FORESTRY QUARTERLY

VOLUME VIII

PUBLISHED UNDER THE DIRECTION
OF A
BOARD OF EDITORS

With Four Plates and Four Diagrams

CAMBRIDGE (BOSTON), MASS.
1910

THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

To offer an organ for the publication of technical papers of interest to professional foresters of America.

To keep the profession in touch with the current technical literature and the forestry movement in the United States.

Manuscripts may be sent to the Editor-in-Chief at University of Toronto, Toronto, Canada, or to any of the board of editors.

Subscriptions and other business matters should be addressed to Forestry Quarterly, 396 Harvard Street, Cambridge, Mass.

CONTENTS.

Page.

The Aims and Organization of the Professional Forest School, 1
By Henry S. Graves.

Methods of Instruction in the Forest School, ... 12
By R. T. Fisher.

The Curriculum in Forestry Education, ... 17
By Filibert Roth.

Public Responsibility of the Forest School, ... 26
By B. E. Fernow.

The Ranger, ... 31
By Robert E. Clark.

The Indian Forest Service and the Question of Personnel, ... 33
By Royal Freeman Nash.

Some Features of Forest Working Plans in India and of Forest Regulation in the Coniferous Forests of the Himalyas, ... 41
By Barrington Moore.

Black Jack and Yellow Pine, ... 58
By B. E. I. Terry.

The Dissemination of Junipers by Birds, ... 60
By Frank J. Phillips.

The Cost of Forest Mapping and Estimating in Montana, ... 147
By Karl W. Woodward.

The Effect of Grazing on Forest Conditions in the Caribou National Forest, ... 158
By E. R. Hodson.

Comparison of Large and Small Sawmills on Tahoe National Forest, ... 169
By M. B. Pratt.

Yield Tables of Western Forests, ... 174

Notes on the Wood Structure of the Betulaceae and Fagaceae, ... 178
By Irving W. Bailey, A. B., M. F.

Forestry in the Agricultural Colleges and Experiment Stations, .. 186
By Samuel B. Green.

The Place of Forestry in General Education, ... 191
By Herbert A. Smith.

Notes of a Civil Engineer on a Forester's Education, ... 196
By F. B. Knapp.

Growth of the Forest Service Library, ... 198
By Helen E. Stockbridge.

Some European Forest Notes, ... 201
By Charles E. Bessey.

A Supervisor's Meeting, ... 210

Survey Methods and Costs For a Large Area, ... 287
By Ellwood Wilson.

Logging Operations in the Province of Quebec, ... 294
By B. Winegar.

Woods Surveying, ... 299
By James W. Sewall.

Report of Supervisors' Meeting at Missoula, Montana, ... 302

Some Suggestions on Predicting Growth for Short Periods, ... 326
By J. C. Stetson.

Method of Calculating Yield in Working Plans in India, ... 330
By A. D. Blascheck.

Two New Insect Pests in Nebraska, ... 411
By Lawrence Bruner and Myron H. Swenk.

The Progress of Reconnoissance, ... 415
By A. B. Recknagel.

Determination of Quality of Locality by Fiber Length of Wood, 419
By C. D. Mell.

Exploiting Telegraph Poles in Colorado, ... 423
By Arthur T. Upson.

A Comparison of Maine and Blodgett Log Rules, ... 427
By Irving G. Stetson.

Water Powers in the Northwest, ... 433
By W. E. Herring.

Forestry in Ohio, ... 439
By Edgar C. Hirst.

New Jersey Forests and Forestry, ... 450
By Grace E. Lyon.

Forest and Soils of Caldwell Parish, Louisiana, ... 462
By J. A. Larsen.

Height and Dominance of the Douglas Fir, ... 465
By T. C. Frye.

CURRENT LITERATURE, ...74, 222, 333, 471
Other Current Literature, ...90, 230, 349, 488

PERIODICAL LITERATURE, ...93, 233, 356, 494
Botany and Zoology, ...93, 238, 360, 497
Forest Geography and Description, ...93, 232, 356, 494
Mensuration, Finance and Management, ...105, 248, 377, 518
Politics and Legislation, ...115, 265, 557
Silviculture, Protection and Extension, ...96, 242, 366, 502
Soil, Water and Climate, ...95, 363, 499
Statistics and History, ...113, 263, 392, 549
Utilization, Market and Technology, ...111, 254, 384, 531
Miscellaneous, ...265, 395, 561

Other Periodical Literature, ...116, 266, 562
NEWS AND NOTES, ...123, 270, 395, 565
COMMENT, ...133, 279, 574

REVIEWS:

Ashe, forest conditions, Virginia, ... 348
Ashe, woodlots, Virginia, ... 349
Baden, forest conditions, ... 340
Besley, report, Maryland, ... 222
Besley, plant life of America, ... 484
Bibliography, Forestry, German, ... 88
Blodgett, plant life of America, ... 484
Boisen, commercial hickories, ... 472
Bray, mistletoe pest, ... 80
British Columbia, fires, ... 82
Canada, Commission of Conservation, report, ... 339
Canada, experimental farms, report, ... 83
Canada, forestry report, ... 75
Chrysler, plant life of America, ... 484
Clements, lodgepole burn forests, ... 477

Coats, wholesale prices, Canada, ... 480
Dendrological Society, report, ... 89
Fernow, care of trees, ... 227
Fernow, history of Forestry, ... 335
Germany, smelter damage, ... 224
Haak, seeds treatise, ... 343
Hall & O'Hara, fire protection, ... 82
Heyer, Waldbau, ... 85
Hole, manual of botany, ... 477
Hopkins, soil fertility, ... 486
Japan, forestry, ... 475
McMillan, forest products, Canada, ... 223
Moore, forest influences, ... 74
Nebraska, Club annual, ... 227
New Hampshire, forestry report, ... 81
New Jersey, report, ... 349
New York, fire law, ... 225
Pettis, growing conifers, ... 78
Pettis, New York report, ... 77, 471
Quebec, report, ... 337
Rafn, seed researches, ... 89
Russia, report, ... 228
Schenck, forest protection, ... 84
Sellers, eucalyptus, ... 475
Sherfesee, wood preservation, ... 473
Shreve, plant life of Maryland, ... 484
Taylor, trees of Hudson River Valley, ... 80
Troupe, Andaman marble wood, ... 84
Troupe, Indian woods, ... 83
Vanselow, Spessartstaatswaldungen, ... 87
Vermont, fires, ... 339, 344
Vermont, forestry cards, ... 339
Wappes, Forstwissenschaft, ... 85

INDEX.

Adventitious roots, ... 498
Afforestation, Great Britain, ref, ... 117
Afforestation, Scotland, ref., 267
" Sitka Spruce, ref., ... 118
Agricultural Science Society, report, ref., ... 490
Alaska, forests, ref., ... 489
Alberta, forest conditions, ref., ... 230
Adler disease, ref., ... 564
Alps, checking floods, ref., .. 266
Anatomy, pine, ... 362
Andaman marble wood, ... 84
Appraising damage, ... 520
Arbor Day, Wisconsin, ref., . 491
Arboretum, Ottawa, ... 83
Argentine, timber resources,. 236
Arizona, forest geography,.. 93
Assistance to forest owners, ref.. 231
Association, lost logs, Wisconsin, ... 540
Athletic goods, wood for, ... 388
Australia, timbers, ref., ... 482
" South, report, ... 231
Austria, forest budget, ... 392

Bacteria, soils, ref., ... 268
Baden, forest conditions, ...233, 340
" statistics, ... 553
Bailey, I. W., article, ... 178
Bark, per cent., Spruce, ... 519
Barrels, gum, ... 547
Bavaria, Forestry notes, ref., 118
" statistics, ... 553
Beech, growth studies, ... 380
" teratology, ... 498
" ties, impregnated, ... 553
" versus Spruce, ... 360
" ref., ... 553
Bessey, C. E., article, ... 201
Bibliography, forestry, ...88, 270

Birches, western, ref., ... 121
Bird nesting boxes, ... 362
Birds, as disseminators, ... 60
Black Forest conditions, ... 233
Black Jack, characteristics, . 58
BLASCHECK, A. D., article, .. 332
Blodgett rule, ... 427
Blue stain, ... 543
Bog iron ore, formation, ... 500
Botany, Indian manual, ... 477
Box lumber, ... 386
Branchless trees, ... 238
Brazil, forestry, ... 113
British Columbia, fires, ... 82
" " log rules, .. 539
" " problems, ref., ... 562
" " report, ... 82
" " scaling, ... 539
" " timber situation, ref., 117
Broadcasting, results, ... 313
Brown-tail moth, Canada, ref., ... 562
Brown-tail moth, parasites, ref., ... 488
BRUNER, L., article, ... 411
Brush problem, ...243, 564
Budget regulation, ...106, 107
Budget regulation, India, ... 332
Budworm, spruce, ref., ... 116
Burn forests, lodgepole pine, 477
Butter dishes, ... 545

Cableway system, mill, ... 258
Cahucit, ... 538
California, trees, ref., ... 352
Calipers, Wimmenauer, ... 250
Canada, Commission of Conservation report, 267, 339
" experimental farms report, ...83, 232
" forest products, ... 223
" irrigation, ref., ... 267
" lumber prices, ... 480
" report, ... 75
" lumber trade, ... 556
" report, ... 75
Canadian forestry Association, report, ref., ... 479
Cape of Good Hope, report, ref., ... 480
Caribou national forest, ... 158
Caucasia, forests, ... 494
Cedar, fungus, ref., ... 121
Chestnut blight, ref., ... 488
Chicago, distributing center,. 263
China, forestry, ... 114
Chir pine, silvics, ... 54
" " working plan for,. 47
CLARK, R. E., article, ... 31
Clean logging, ... 243
Coffins, ... 544
Colorado, ecology, ... 365
" pole exploiting, ... 423
Commission of Conservation, Canada, ... 124
Canada, report, ... 339
Commission report, New Jersey, ... 349
Comparison, large and small mills, article, ... 169
Concavity of leaves and light, 94
Conference of forest school, papers read, ..1, 12, 16, 17, 26, 123
Conifer diseases, ... 247
Conservation agencies, ref., . 561
Conservation Association, Spokane, ref., ... 119
Conservation, Canadian Commission, ref., ... 267
Conservation, forests, ref., .. 267
" legal aspects, ref., ... 354
" president's message, ref., .. 354
Continental forests, report, ref., ... 352
Conversion of coppice, ... 242
Coombe plantation, ref., ...562, 563
Coppice, France, ref. 267
Coppice, conversion, ... 242
Cost of growing timber, ref., 92
Cost of mapping and estimating, Montana, article, ... 147
Coyote-proof pasture, ref., .. 231
Creosoting, notes, ref., ... 563
Crown cover, spruce, ...504, 506
Cypress, new, Arizona, ref., . 266

Damage by fumes, ...224, 489, 516
Damage by hail, ref., ... 353
Damage, forest calculation, . 520
Damage, frost, ... 239
Damages, insect, cause of, .. 361
Dendrometer, ... 105
Denmark, reforestation, ref., 561
" statistics, ref., ... 562
Density, spruce, ...504, 506
Deodar, silvics, ... 47
" working plan for, .. 47
Destructive distillation, results, ... 389
Diseases, conifer, ... 247
Distillation, wood, results, .. 389
Dittmar, Der Waldbau, ref., . 351
Douglas Fir, frost hardiness,. 374
" height, ... ~~461~~ 465
" Switzerland, .. 246
Dry rot, ref., ... 562

Düesberg, Der Wald als Erzieher, ref., ... 351
Durability, ties, treated, ... 533

Ebony, ... 84
Ecology, Colorado, ... 365
" Maryland 484
" Scotch Pine, ... 497
" Vermont, ... 241
Education, forestry, 1, 12, 17, 26, 31, 86, 117, 119, 186, 191, 196.
Education, forestry, England, 265
Effect of grazing on forest conditions, article, ... 158
England, forest schools, ... 265
Englmann spruce, ref., ... 478
Estimating stands, ... 518
Eucalyptus, critical revision, ref., ... 232
" growth and utilization, ... 475
European forest notes, article, ... 201
Experimental farms, Canada, report, ref., ...83, 232
Experiment stations, congress, Brussels, ... 571
Explosive, Cahücit, ... 538
Exports, lumber, Russia, ... 262
" " U. S., ... 554
Exports, forest, U. S., ref.,.. 231

Felber, Natur und Kurst im Walde, ref., ... 351
Felling, electrical, ... 538
FERNOW, B. E., article, ... 26
" Care of Trees, ... 227
" history of forestry, 335
Fiber length and site quality, ...419, 576
Finances, Scotch Pine, ref., . 563
Fire association, Washington, ref., ... 119
Fire insurance, ... 517
Fire protection, ref., ... 561
" " forest preserves, Canada, ref.,.. 117
" " forests, ref., 489
" " New York,. 225
" " Oregon, ... 220
" " Quebec, ... 82
Fire, railways, ref., ... 562
Fires, Bavaria, ... 116
" British Columbia, ... 82
" Maryland, ... 222
" national forests, statistics, ... 130
" Nebraska, ... 273
" New Jersey, ... 455
Fires, New York, ... 77
" North Carolina, ref.,. 479
" Oregon, ...245, 491
" Prussia, ... 115
" Vermont, ...339, 344
" Washington, ... 245
" U. S., statistics, ref.,.. 119
Firewood consumption, U. S., ref., ... 489
FISHER, R. T., article, ... 12
Fixation of nitrogen, ref., ... 269
Flooring, uneven, ... 391
Forest Club Annual, Neb., .. 227
Forest conditions, Alberta, ref., 230
" " Baden, ... 233
" " Brazil, ... 113
" " China, ... 114
" " Kansas, ref., 489
" " Phil. Is.,.... 237
" " Prussia, ... 374
" " Russia, ... 114
" " Uruguay, .. 235
" " Virginia, ... 348
Forester, value to Lumbermen, ref., ... 269
Forest finance, history, ... 264
Forest geography, Arizona, . 93
Forest influence on climate, .74, 266
Forest influence on floods, .. 74
Forest influence on floods, Pennsylvania, ... 334
Forest influence on rivers, ref., ...231, 355
Forest influence on temperature, ... 363
Forest influences, ...266, 453
Forest planting, U. S., ... 312
Forest products laboratory, ref., ... 560
Forest products, Canada, ... 223
" " U. S., ref.,. 231
Forest regulation, India, ... 41
Forest reserve funds, ...528, 530
Forestry bibliography, ... 270
Forestry education, 1, 12, 17, 26, 31, 86, 117, 119, 186, 191, 196, 265
Forestry education curriculum, in article, ... 17
Forestry in agricultural colleges and experiment stations, article, ... 186
Forestry in Ohio, article, ... 439
Forestry law, Switzerland, ref., ... 268
Forestry lectures, outline, ref., ... 232
Forestry, Baden, ... 340
" New Jersey, ... 450

Forestry, N. America, notes, ref., 267
" New South Wales, 276
" New Zealand, 276
Forestry practice, lumbermen, 395
Forests, Alaska, ref., 489
" Armenia, 208
" Crimea, 209
" Finland, ref., 118
" Germany, 201
" Hesse, ref., 561, 563
" Louisiana, article, 462
" New Jersey, article, 450
" Poland, 204
" Russia, 205
" U. S., use, ref., 90, 231

Forest school, aims and organization of, article, 1
Forest school, methods of instruction, article, 12
Forest school, public responsibility of, article, 26
Forest schools, England, 265
Forest service, library, 198
" " photography, 561
" " policy, 213

Forest settlements, U. S., policy, 318
Forest types, change, Sweden, 360
Fossil Miocene trees, 241
France, forestry notes, ref., 118
" reforestation, 561
Frost, causes and effects, 515
" damage, theory, 239
FRYE, T. C., article, 465

Gang saws, efficiency, 111
Gases, injury by, 224
Germany, forestry notes, ref., 118
" statistics, 549
Germination of seeds, 101
Germination tests, 372
Gingko, ref., 353
Gleditsia, wood, price, 548
Gold Coast, report, ref., 352
Grades, northern Wisconsin, 542
" oak, 541
GRAVES, H. S., article, 1
Grazing, Australasia, ref., 266
" damage by sheep, 160
" effect on forest conditions, 158
" Caribou national forest, 158
Grazing lands, revegetation, ref., 488
GREELEY, R. B., report, 302
GREEN, S. B., article, 186

Growth, abnormal, 361
" beech, 380
" factors, Douglas Fir, 465
" in Mexico, 381
" Oak, Alsace-Loraine, 248
" forest service, article, 198
" prediction for short periods, 326
" Scotch Pine, Alsace-Loraine, 249
" spruce, 99
Gum barrels, 547
" staves, 547
Gypsy moth, parasites, ref., 488

Hail, injury, ref., 230, 353
Handling hard wood logs, 258
Hardiness, Douglas Fir, 104, 374
Hardwoods, German needs, 396
Heart shake, theory, 239
Heartwood formation, pine, 497
Heck's thinnings, results, 511
Height of Douglas Fir, article, 465
Hemlock, western, lumber, 387
HERRING, W. E., article, 433
Hickories, commercial, 472
HIRST, E. C., article, 439
History of forest finance, 264
" " forestry, Fernow, 335
HODSON, E. R., article, 158
Humus, effect of lime on, 365
Hunting, Prussia, 560

Importance of White Mountain Forests, ref., 231
Imports, forest, U. S., ref., 231
Increasing forest productivity, ref., 231
Increment per cent., 377
Increment, spruce, 99
Index numbers, 480
India, forest service, article, 33
" forestry, 578
" injurious insects, ref., 492
" match industry, ref., 492
" various reports, ref., 352, 353, 491, 492
" working plans, 41
Indian woods, fissibility, ref., 492
" woods, uses, 83, 354
Indiana, report, ref., 354
Indo-Malayan woods, ref., 121
Ingrowing trees, 361
Injury by fumes, 224, 489
Irrigation, Canada, ref., 267
" Colorado, ref., 483

Irrigation, Congress, Washington, ref., ... 483
" use of windmills, ref., ... 483
Irritant woods, ref., ... 117
Insect damages, cause of, ... 361
" pests, ref., ...90, 267
" " India, ref., ...91, 354
" " new, Nebraska, article, ... 411
Insects affecting maple, ref.,. 120
Insurance, forest fires, ... 517
Italy, forestry, ref., ... 268
Ivory palms, relationships, ref., ... 481

Jack Pine, planting, ... 103
Japan, forest resources, ... 356
" forestry, ... 475
Junipers, dissemination by birds, ... 60

Kansas, forest conditions, ref., ... 489
Kansas, planting, ref., ... 231
Kattemeier, Das Holz, ref.,.. 351
Kentucky, trees, ref., ... 352
Kiln drying, ... 541
KNAPP, F. B., article, ... 196

Larch Sawfly, England, ref., 268, 275, 562.
LARSEN, J. A., article, ... 462
Leaf concavity and light, ... 94
Lectures, forestry, outline, ref., ... 232
Legislation, Switzerland, .. 115
Library, forest service, ... 198
Lignin, determination, ref.,. 563
Lime, effect on humus, ... 365
Literature, botany, Philippines, ref., ... 268
Lodgepole pine burn forests, 477
" " silvics, ... 479
Loggers' association, Pacific, ... 569
Logging, clean, ... 243
Logging operations, Quebec, 294
Logging railroads, U. S., .. 262
Logging telegraph poles, ... 423
Log handling at mill, ... 258
Log rafts, Pacific, ... 540
Log rules comparison, article, ... 427
Log rule, standard, ... 382
" " Maine, ... 427
Log table, ref., ... 353

Louisiana, forest conditions, 358, 495
" forest law, ... 559
" forests and soils, 462
Lumber cut, U. S., ... 394
Lumbering, Paraguay, ... 236
" Texas, ... 494
Lumbermen, forestry practice, ... 395
Lumber prices, Canada, ... 480
" " record, ref., 483
" " U. S., ref., . 232
Lumber weights, ... 390
LYON, G. E., article, ... 450

Machines, soil preparation, .. 246
Mahogany supplies, ... 258
MAIDEN, J. H., Eucalyptus, ref., ... 232
Maine decision, ref., ... 562
Maine rule, ... 427
Management and silviculture, ... 106
Mangrove, tanning, ... 260
Maps, water-proof, ... 254
Maryland, conservation commission, ref., .. 483
" forest resources, ref., ... 230
" report, ... 222
" plant life, ... 484
" timber supply, ref., ... 480
" wood-using industries, ref., .. 490
Massachusetts, report, ref.,. 478
" wood - using industries, ref, ... 488
Medullary rays, ...178, 268
MELL, C. D., article, ... 419
Metal ties, ...111, 263, 530
" " Prussia, ... 531
Melted wood, ... 112
Mexico, tree growth, ... 381
Mine timbers, protection, ref., ... 268
Mining and forestry, ref.,.. 119
Mining, Germany, relation to forestry, ... 259
Minnesota, forest conditions, 357
" forestry, ref., .. 268
" report, ref., ... 479
Miocene trees, Rockies, ... 241
Mistletoe pest, ... 80
MOORE, B., article, ... 41
Moorland reclamation, ref., . 563
Mycorhiza, ref., ... 121

NASH, R. F., article, ... 33
National Lumberman's Association, report, ref., ... 483
Natural reforestation, Vermont, ... 241
Nebraska Forest Club Annual, ... 227
Nebraska, insect pests, ... 411
Newfoundland, resources, ref., ... 120
New Hampshire, forest conference, ref., ... 351
" " log rule, . 427
" " policy, ... 81
" " report, ... 81
New Jersey, Commission report, ... 349
" " forests and forestry, art., 450
" " report, ref., ... 481
New York, nurseries, ...78, 557
" " report, 77, 225, 471, 490
New South Wales forestry,. 276
" " " report, .91, 482
New Zealand forestry, ... 276
Nitrogen, fixation, ref., ... 269
North American conservation conference, ref., ... 117
Norway Spruce, branchless,. 238
Notes of engineer on forester's education, ... 196
Nurseries, New York, ...78, 557
Nursery practice, Massachusetts, ref., ... 478
Nyssa, ref., ... 121

Oak, Alsace-Loraine, gr'th, 248
" flooring, ... 546
" grades, ... 541
" ray, origin, ref., ... 268
" structure, ... 181

Obituary, L. C. Miller, ... 404
" S. B. Green, ... 403
Odd lengths, arguments and objections, . 254
" " saving by ref., ...120, 488
Ohio, conifers, ref., ... 120
" forestry, article, ... 439
Ontario, entomological report, ref., ... 490
" game and fish commission, ref., ... 564
" tree species used, .. 257
Orange River colony, report, ref., ... 353
Oregon, conservation committee, ref., ... 491
" fires, ...245, 491

Padouk, ref., ... 492
Paper, fibres for, ref., ... 267
Paper making, Wisconsin, .. 557
Paraguay, lumbering, ... 236
Paving blocks, ... 544
" " yellow pine, ref., ... 483
Peat bogs, ref., ... 121
Pencils, juniper, ... 574
Pennsylvania, foresters' convention, ref., ... 351
Pennsylvania Railroad, planting, 127
" " preservation plant, 399
" " pruning, 271
Petwin wood, ref., ... 492
Phenological record, Pennsylvania, ... 334
Philippines, botanical literature, ref., ... 268
" bureau work, ref., ... 561
" forests, ref., ... 268
" forest conditions, ... 237
" report, ...232, 353
" problems, ref., . 266
PHILLIPS, F. J., article, ... 60
Photography, U. S. F. S., ... 561
Pinchot, fight for conservation, ref., ... 480
Pine seed extraction, ... 515
Pine-Tip Moth, ... 407
Place of forestry in general education, ... 191
Planting, Banksian Pine, ... 103
" co-operative, ... 449
" good vs. poor, ... 504
" leaflet, shortleaf pine, ref., ... 489
" leaflet, loblolly pine, ref., ... 489
" statistics, ... 313
" western Kansas, ref., ... 231
Plow, forest, ... 246
Policy, Canada, ... 274
" New York, ref., ... 119
" Ontario, ... 129
" Prussia, ... 558
Populus, ref., ... 121
Prairies, ...121, 469

PRATT, M. B., article, ... 169
Preservation, farm timbers, ref., ... 354
" wood, ... 473
" notes, ref., ... 564
Preservatives, used in U S., 535
Prices, lumber, U. S., ref., .. 232
" ties, U. S., ... 261
" timber land, B. C., ref., ... 119
" wood, Germany, ... 112
Private forestry, ... 215
Productivity, method of increasing, ref., ... 231
Progress of reconnaissance, article, ... 415
Pruning, ... 373
Prussia, department budget, 393, 552
" forest conditions, .. 374
" hunting, ... 560
" metal ties, ... 531
" policy, ... 558
Pulp industry, Canada ref., 119, 120
" " Sweden, ref., 561
Pulpwood export, prohibition, ref., ... 267
Pulpwood, U. S. statistics, .. 556

Quality and growth conditions, ... 535
Quality, wood site influence on, ... 261
Quebec, report, ...232, 337, 354
" logging operations, . 294

Railroad ties, beech, ... 384
" " Imports, Orient, ... 261
" " metal, ... 263
" " price U. S., ... 261
Railway damage suit, ...567, 568
Rainfall distribution, ... 95
Range problems, ... 217
Ranger, forest, article, ... 31
Ration list, ... 150
Ray tracheids, origin, ref., .. 564
Reboisement, Alps, ref., ... 266
" Switzerland, .. 356
RECKNAGEL, A. B., article, .. 415
Reclamation service, U. S., report, ref., ... 483
Reconnaissance, progress U. S., article, ... 415
Recording calipers, Wimmenauer, ... 250
Reforestation, France, ... 561
" Massachusetts, ref., . 478
" New York, . 78
Report, Am. Soc. Testing Materials, ref., .. 91
" Continental forests, 352
" Germ, Dendrol Soc., 89
" Miss. Bot. Gard., ref., ... 90
" Supervisor's Mtg., . 302
Reports, forestry (see various countries)
Reproduction, western yellow pine, ref., ... 231
Reserve funds, ...528, 530
Resin canals, White Fir, ref., 560
Resin yield, factors influencing, ref., ... 561
Rhode Island, report, ref., .. 232
" " soils, ... 230
Ring shake, theory, ... 239
Rocky Mountain, forest reserve, ref., ... 562
" " yield tables, ... 174
Rotation, determination, Scotch Pine, ... 522
" Scotch Pine, ... 110
ROTH, F., article, ... 17
Royal Commission, Great Britain, ref., ... 117
Rubber, synthetic, ref., ... 561
Rubber tree, Brazil ref., ... 267
Russia, forestry, ... 114
" report, ... 228
" lumber exports, ... 262

Sales, practice, ... 525
Sand plains, reforestation, .. 241
Sap pressure, birch, ... 94
Sawdust, nuisance, ... 402
Sawmills, large and small compared, article, ... 169
Scotch Pine, Alsace-Loraine, 249
" " ecology, ... 407
Scotland, afforestation, ref., 267
Seed dissemination, ... 60
Seed, extraction, pine, ... 515
" germination tests, ... 101
" quality, ... 343
" researches, ... 89
" storing, ... 244
" supply, ... 245
" tests, ... 372
Sewall, J. W., article, ... 209
Shade tree laws, Massachusetts, ref., ... 470
Sheep handling on range, ref., ... 478
Ship knees, wood for, ... 388

Silviculture, methods, Black Forest, ... 233
" spruce, ... 504
Site quality determined by fibre length, article, ... 412
Smelters, damage, ...224, 489, 516
SMITH, H. A., article, ... 191
Smoke damage, Douglas Fir, 376
Society, American foresters, proc. ref., ... 490
Society, Testing Material, report, ref., ... 490
" Prom. Agr. Sci., report, ref., ... 490
Soil fertility, ... 486
Soil preparation, machines, . 246
Soils, bacterial factor, ref., .. 268
" classification, ... 499
" harmful constituent, ref., ... 490 ~~480~~
" influence of species, .. 364
" Rhode Island, ref., .. 230
" U. S., ref., ... 91
Soudan, forest, ref., ... 481
South Australia, report, ref., 231
Southern pine, cut, ... 555
Southern pine, sawyer, ref., 90
Sowing versus planting, ... 368
Space number, ... 518
Species used, Ontario, ... 257
Spessart, forests, statistics, .. 87
Spruce, budworm, ref., ...116, 562
Spruce, cone variation, ... 513
Spruce, growth, ... 99
" silviculture, ... 504
" underplanting, ... 96
" variability, ... 361
Stain and enzymes, ref., ... 564
State regulation, doctrine, ref., ... 562
Statistics, Baden, ... 553
" Bavaria, ... 553
" Canada, trade, ... 556
" cost, logging, ... 425
" " growing timber, ref., .. 92
" " mapping and estimating, 147
" " nursery, ... 79
" " survey, ... 417
" finance, Austria, .. 392
" " Prussia, .. 393
" fire, Br. Columbia, 82
" " U. S., ref., .. 119
" " Western States, ... 245
" firewood, U. S., ref., ... 478
" forests, Canada, .. 223
" " Louisiana, 358
Statistics, forests, Minnesota, 257
" " Russia, .. 228
" " U. S., ref., 231
" " Virginia, . 357
" forest products, U. S., ref., ... 120
" Germany, ... 549
" logging railroads, 262
" lumber, Canada, .. 480
" " U. S., ... 554
" Japan, ... 475
" pulpwod, U. S., .. 556
" Prussia, ...549, 552
" southern pine cut, 555
" stumpage, ... 496
" survey, ... 291
" Switzerland, ref., . 483
" teak, Siam, ... 548
" Texas, ... 494
" timber, U. S., ref., 90
" wood prices, Germany, ... 112
Staves, gum, ... 547
Stetson, J. G., article, ...326, 420
STOCKBRIDGE, H. E., article, . 198
Storing seeds, ... 244
Stream flow and surface conditions, ref., ... 231
Street tree, planting, Detroit, ref., ... 352
" " care of, ... 227
" " ref., ... 354
Strength and site conditions, 535
Strip selection system, Wagner, ... 366
Structural timber specifications, ... 537
Sulphite pulp, ref., ... 563
Sulphite waste injury, ... 542
Supervisor's meeting, ... 210
Supervisors' meeting, report, 302
Survey, Nova Scotia, ref., ... 116
" instructions for making, ref., ... 353
" methods and cost, article, ... 287
" topographical, ref., ... 120
" woods, ... 299
Sustained yield, Württemberg, ... 250
Switzerland, Douglas Fir, ... 246
" forestry, ...263, 268
" forestry, law, ref., ... 268
" forestry, ref., . 268
" legislation, ... 115
" reboisement, .. 356
Tahoe national forest, ... 169
Tanning, Mangrove, use, ... 260

Taxation, ref., ...118, 351
Teak, Siam, exports, ... 548
Teak, Siam, exports, ... 547
Telegraph poles, exploiting, Colorado, article, ... 415
Temperature, forest influence on, ... 363
Teredo, counteracting, ...544, 565
TERRY, B. E. I., articles, ...58, 174
Texas, mistletoe pest, ... 80
" trees, ref., ...230, 231
Theodolite as dendrometer, . 105
Thinnings, Heck, results, ... 511
" Massachusetts
" woodlots, ref., .. 478
Ties, beech, ... 384
" durability, German, ... 523
" metal, ...111, 263
" price, U. S., ... 261
Timber, licenses, Canada, ... 274
Timber physics work, Austria, ... 385
Timber resources, Argentine, 236
" sales policy, U. S., . 302
" supply, species, ref., 267
" supply, tropics, ... 358
Trametes Pini, ...247, 497, 563
Tree culture, Oklahoma, ref., 352
Tree distribution, Canada, .. 76
Trees, forest and ornamental,
" Texas, ref., ...230, 231
" Hudson River Valley, 80
" Kentucky, ref., ... 352
" ornamental, California, ref., ... 352
Tree studies, ref., ...353, 354
Tropical timber supply, ... 358
Turf planting, ref., ... 565
Turpentine, ref., ... 479
Turpentine, substitute, ref., . 562

Underplanting, spruce, ... 96
UPSON, A. T., article, ... 423
Uruguay, forest conditions, . 235
United States, forests, use ref., ... 231
" " lumber cut, 394
Utilization, German knowledge, ... 392

Variability, spruce, ...238, 361
Variation, white fir, ... 239
Veneers, making, ... 387
Vermont, fires, ...339, 344
" forestry cards, ... 339
" forestry, ref., ... 266
" natural reforestation, ... 241
Virgin forest, Austria, ... 502
Virginia, forest conditions, 348, 357
" woodlots, ... 349
Volume table, western pine, . 177

Wagner, strip selection system, ... 366
Walnut uses, ... 386
Washington, fires, ... 245
" Forest Fire Association, ref., 119
Waste land planting, ... 503
Waste paper treatment, ref., 120
Waste, sulphite, injury, ... 542
Waste, wood, percentage, ... 542
Water powers, ... 210
Water powers in northwest, article, ... 433
Water-proof maps, ... 254
Week's bill, ref., ... 232
Weight of lumber, ... 390
Western hemlock lumber, ... 387
Western yellow pine, reproduction, ref., ... 231
White ants, protection, ref., 563
White fir, branchless, ... 239
White Mountain forests, importance, ref., ... 231
Willow cultivation, ref., ... 563
Willow reproduction by seed, 513
WILSON, E., article, ... 287
Wimmenauer calipers, ... 250
WINEGAR, B., article, ... 294
Wisconsin, wood-using industry, ref., ... 479
Witches' broom, ref., ... 564
Wood distillation, ref., ... 268
Wooden vs. metal ties, ... 531
Woodflour, Norway, ... 129
Woodlot, care, ... 447
" improvements, ref., ... 564
" Virginia, ... 349
Wood paving, ... 544
Wood preservation, ... 473
Wood preservers' association, ref., ... 354
Wood quality and locality, .. 261
Wood sales, practice, ... 525
Wood structure of the Betulaceae and Fagaceae, article, ... 178
Wood structure, pine, ... 362
Wood using industry, Massachusetts, 488
" " " Wisconsin, ref, .. 489
WOODWARD, K. W., article, .. 147
Wood waste, percentage, ... 542

Working plans, Himalaya conifers, ... 41
" " India, article, 41, 332
" " olden times, . 252
" " U. S., ... 307
Württemberg reserve fund, 528, 530
" sustained yield, 250

Yew woods, Bavaria, ... 131
Yellow pine, characteristics, 58
Yield calculations, India, ... 332
Yield tables Douglas Fir, ... 176
" " Scotch Pine, ... 519
" " western forest, article, ... 174
" " western larch, .. 175
" " western yellow pine, ... 174

Zebra wood, ... 84

RED CEDAR DISSEMINATED BY BIRDS ALONG ROADSIDE.

Near G[illegible], New Jersey

Very limited bird dissemination of Red Cedar in [illegible] woodlot.

Red Cedar under a poplar and an apple. Berries obtained by birds from a single old tree in immediate locality.

FORESTRY QUARTERLY

VOL. VIII] MARCH, 1910. [NO. 1.

THE AIMS AND ORGANIZATION OF THE PROFESSIONAL FOREST SCHOOL.*

HENRY S. GRAVES.

One of the most significant indications of the progress of forestry in this country is the fact that there are a large number of young men preparing to take up the profession as a life work. This is clear evidence that there is a demand for men with a technical training in forestry. Our educational institutions are responding to this demand in a progressive manner, and there are already over 20 institutions in this country and Canada which give instruction in forestry, and most of them aim now or in the near future to give a full training for professional work. We may fairly claim that forestry is now recognized as a profession and that there is a place for the professional forest school, a fact only recently given recognition, even in educational circles.

There are to-day probably 400 to 500 men engaged in work which requires a measure of knowledge of technical forestry. If the opinions of all these men were known there would be a great divergence of ideas as to the requisite training for a forester, and in fact as to what really constitutes a trained or professional forester. We have as yet no adequate standard of our profession, as is evidenced by the wide difference in scope of the forest schools and by the great diversity in attainments of those calling themselves professional foresters. Heretofore the Civil Service examination has in a measure served as a professional standard, but an examination designed to secure an eligible list for the Federal service, which only a part of the foresters undertake, can not in the long run answer our purpose. We shall attain a pro-

---

*Read at the Conference of Forest Schools, Washington, D. C., December 30, 1909.

fessional standard just as soon as our schools are standardized, as soon as a degree from a forest school means that its graduates have actually received a full training in forestry.

In my opinion the great opportunity of this conference is to take the first steps in an agreement among the schools as to the minimum technical training required by a professional forester.

There are, in general, three classes of instruction which must be provided in this country:

1. The full technical training for the higher administration positions.

2. That required by forest rangers or woods superintendents.

3. Special or elective instruction, for owners of woodlands, lumbermen, and others who desire work in special lines or desire only a superficial knowledge of technical forestry.

These three lines of educational work must be clearly distinguished. One danger in the multiplication of forest schools which has just commenced is that some institutions may be misled in the belief that they are giving instruction of the highest grade when really they are giving that of the special or even the ranger grade and that students will believe that they are receiving a training of full professional character when they are not.

The problems of education in forestry differ somewhat from those in professions fully established, like engineering, medicine, etc. So far only the first steps in forestry have been taken. The science itself as related to our forests is still undeveloped. The principal work of establishing stable policies of Federal and State forestry, the work of initiating the practice of forestry on State and private lands, the actual practical organization of the forests, and the first and most difficult work of constructive administration remain still ahead of us. For this work men are required who are trained not only to manage forests but to do the work necessary to bring about their management.

Most work which the forester to-day has to do is in connection with the preparation for the practice of forestry. State foresters are chiefly engaged in developing policies and educating the public to adopt them. Federal forest officers in charge of the National Forests are largely occupied in preliminary organization, reconnaissance, boundary work, surveys, cruising, land classification, settlements, construction work, protection, etc. The first work of the private forester is often confined to forest surveying, cruising, forest protection, or straight lumbering. Very commonly the forester is doing work which it seems to him and to others could be equally and perhaps better done by a man who had not received a so-called professional training, or which he himself could do better if he had had a different training from that provided by the professional schools. This feeling is particularly apt to come to one when he is organizing a large undeveloped forest where markets are poor and logging conditions are difficult and he sees that it will be a long time before there can be much silviculture or thorough-going regulation. It comes also to the State forester or other administrative officer who sees the great amount of educational work and perhaps hard fights in Congress or Legislature which must come before the practice of forestry.

This preparatory period of laying the foundations for the practice of forestry is not a temporary one. It will be a long time before the creative work of forestry is completed. Perhaps the realization of that has led to the opinion held by a considerable number of foresters that the work of real forestry will be so long deferred that at present it differs little from lumbering and that the training of a forester should be lumbering with a modicum of the science of forestry. This is the reason that lumbermen often claim that forestry is nothing but lumbering with a little fire protection and provision for seed trees. Many lumbermen hold this view because they have been educated to it by foresters. Their conclusion from this premise is perfectly logical; that the development of forestry should be turned over to the lumbermen, for they best know the woods and the science of lumbering, and the necessary forestry is soon acquired by a little reading and intelligent reasoning.

There is danger, as I see it, that some forest schools may too much restrict their training to what the forester has to do to-day. There is great pressure upon the schools from many quarters to teach the practical application of forestry without the so-called theory, and particularly to omit those auxiliary sciences which many of us believe to be a necessary foundation for the forester. It is absolutely essential that the forest schools prepare their students to meet the practical problems of lumbering, cruising, boundary work, construction work, etc., which the graduates encounter in their first work. They must give a better training than in the past. I believe that every school appreciates this.

On the other hand, a professional school must look beyond the work of to-day. The schools are not merely giving a training which will enable their graduates to secure positions. They are creating and building up a profession. They must provide men who can develop the science and get it into practice. They are preparing men for work not now being done at all, for positions not now in existence, for a class of forestry practice hardly represented in this country.

The forest supervisor who is not trained beyond the needs of the moment will not be able to develop his forest as well as the trained man of equal administrative capacity. The reason why trained supervisors should ultimately be in charge of the forests, is not that they can get the business of selling timber and carrying out the contracts done better than untrained men, but that they will organize and administer the forests with a constant view to their development in the future. As soon as possible there must be developed policies of silvicultural treatment, having reference not only to methods of reproduction but also to the rapidity of cutting and location of cuttings, just as there must be policies of development of roads and trails, telephone lines, ranger stations, etc. The condition of the forest in the future with reference not only to production but also to actual management will be very much influenced by the organization and the operations to-day. The local forest officers have the task of working out these policies and they can do it only if they understand thoroughly the principles of forest production, of silvics, of silviculture, of forest management, and of administration, as well as of lumbering. It is the man who knows what to aim toward who will make progress and who will get the best results now and who will place his forest in the best condition for the application of more intensive treatment as soon as conditions over which he has no control permit.

What I have said about a forest supervisor applies equally well to those in other responsible positions. The untrained State Forester who has the right personality, good judgment, and vigor may at first fully meet the requirements of his office so long as these concern the creation of general interest in forestry in the State. Just as soon, however, as a point is reached of developing a thorough-going State policy involving such problems as the establishment of forest reserves and the development of a silvicultural policy for those reserves, the regulation of private forests, etc., the man with the inadequate knowledge of forestry is apt to fail.

The American forester has many perplexing problems to work out in any line which he may take up. He can not be told in advance at a school how to work them out. The school must prepare him to solve these problems himself. He needs the best training we can give him. Let us not, therefore, be short-sighted in this country and sacrifice fundamental educational work because it may not seem to count in a forester's first work after graduating from school.

There is one phase of the problem of a professional school which it may seem superfluous to mention, yet we must all have some feeling about it. Forestry is not, in a sense, a commercial profession. Forestry is a movement which will affect the permanent welfare of the country very profoundly. Most foresters, whether publicly or privately employed, will participate in the promotion of the movement. It is gratifying to me to see how to-day the private foresters are doing everything in their power to interest people in forestry, promote legislation, and other educational work which has no bearing on their own business. The development of a spirit of public service should be prominent in the aims of a professional forest school. We need men of character who have a sense of public service in entering the profession. There are going to be many hard fights ahead of us and things may not always progress as smoothly as in the past. There may be in our public service reactions and temporary setbacks. We want men who are going to stand by the profession in foul weather as well as in fair.

In organizing a forest school a first inquiry should be what grade of school is best adapted to meet the requirements of the profession. In my opinion the professional forest school should be at least of collegiate grade. I do not believe that the average high school graduate can in a year or two secure an adequate training for professional forestry. The question whether a school should be on a postgraduate or an undergraduate basis is a matter which must be worked out locally at each institution. Theoretically each has its advantages. Personally I do not think that it is necessary that every forest school should be a postgraduate school. The fact that in order to carry out the particular aims which we have at Yale we regard the postgraduate method as the proper one does not mean that we think that every other institution should organize its school on the same basis.

Another question of the organization of a professional school is whether it should be attached to a University or should be a separate institution or academy. This is a question which has been discussed for many years in Europe. To-day one of the best schools in Germany is a forest academy, Eberswalde, while other schools are at Universities, as for example, Munich. As far as the ultimate training is concerned, the graduates of Eberswalde are thoroughly well educated and so are the graduates of the University schools. The question of whether a school should be at a University or a separate academy is largely an academic one, provided they give equally good instruction and cover the same ground. The advantage of school at a University is that there are already established departments of Engineering, Botany, Geology, Chemistry, etc., where a student can get the full advantage of the best experts in these sciences. The danger is that the academy can not afford to employ separate instructors in these subjects and that all the auxiliary work would suffer. The tendency of the academy is to devote its attention almost entirely to the technique of forestry and not to give the right foundation.

There has been a good deal of discussion as to the proper location of a forest school. It has been said by many that the attachment of a forest school to a University usually necessitates a location in a town and not readily accessible to a demonstration forest. If it is the case that the location in a town prevents field work, it is a poor place for a forest school. The school must be so situated that it is possible to take frequent excursions throughout the year to the woods and to carry on practical work in the field. On the other hand, it does not at all follow that the best place for the location of a forest school is in the heart of a forest and particularly of the lumber woods. The curriculum must be so arranged that the classes can be taken to the lumber woods for a portion of the course where practical instruction in lumbering, cruising, scaling, etc., may be given. Without in any way failing to appreciate the value of a location which would enable the class to get into the heart of the deep woods at any time the question of accessibility to more than one forest region, the ability to reach places of interest where forestry has been practiced, and the ability to secure lecturers engaged in the lumber business and the profession of forestry must be taken into consideration. As a matter of fact there are relatively few collegiate institutions in this country which are unfitted for teaching forestry from the standpoint of location.

In a properly conducted forest school there should be a great deal of field work. The forest must be the working laboratory for a great many courses. It is essential, therefore, that there should be connected with every school a forest suitable for this field work.

One of the disadvantages under which American foresters labor—and must for some time to come—is the lack of illustrations of silviculture. Students may be taken into a forest and shown how trees in that particular forest should be cut to carry out definite policies of silviculture. But the work of instruction can never be satisfactory until there are actual demonstrations of the results of silviculture, demonstrations of what the forest looks like before and after cutting, demonstrations of tree planting under different conditions, etc. Sometimes a school may be located in a region in which there has been a great deal of work done by private owners which the classes can visit. It is a much better plan, however, for the school to have a demonstration forest over which it has a definite control and one large enough to show the operations on a considerable scale. In the demonstration forest there must be illustrations of intensive as well as extensive forestry. We have reached a point in many parts of the country where we can practice silviculture with relative intensity and in some cases almost as well as in Europe. Every student should have the opportunity to study intensive work, to give him a view of what may be accomplished under good market conditions and an outlook for the development of silvicultural policies when he is organizing under extensive conditions.

In addition to studying in the demonstration forest which is under the management of the school, the students should work in the forest where lumbering is in progress. There would be certain advantages in a school owning a large lumber tract where all the work of lumbering is constantly in progress. The main difficulty with this plan is that the average school does not own such a tract and even if it did, is not in a position to run a great lumber operation. The simplest plan, and a very effective one, is to spend a certain part of the course in the lumber woods where all the facilities of modern logging and milling are available for study.

In some institutions the forest school is a separate department, in others a branch of an undergraduate or graduate department. Whatever the exact organization in a particular school there should be sufficient independence to enable the arrangement of a suitable curriculum. There must be provided time to take the students into the demonstration forest during the course and there must be a separate period or periods when the class may be taken into the deep woods for that field instruction and practice which can not be obtained elsewhere. As probably most of the men here have found, it is a difficult thing to develop a course of study which makes use of established University courses whose hours are fixed, and at the same time find time for the field instruction. The ideal method is to have special courses given to the forest students by instructors in other departments. Thus at Yale, we have found that the best results in the foundation work of Surveying have been secured by having a special course given to the forest students by the regular engineers. The specialized forest surveying has been given by the members of the staff of the forestry faculty. This involves increased expense in instruction but the results justify it if the money is available.

Instruction in technical subjects is always expensive. There is a great deal of work requiring small divisions and personal attention to individual students. If a forest school has only a few students the problem of instruction is exceedingly simple. One instructor can handle a small class of half a dozen students in a number of subjects and secure a maximum of efficiency in all. With the increase in the number of students there is necessity for a closer organization, an increase in the number of instructors and greater difficulty in conducting various branches of instruction. In establishing a forest school an institution must take very carefully into consideration the probable ultimate faculty and cost of instruction. I am forced to the opinion that some institutions have undertaken to give a full course in technical forestry without appreciating what the expenses of such a course properly conducted will ultimately be.

The fear has frequently been expressed that there is danger of multiplying the professional forest schools and that there is no need or justification for more than a few institutions of the highest grade. This brings up immediately the question of opportunities for professional work in forestry in this country and whether there are now or will be in the future a demand for more than a limited number of men with a complete technical training in forestry. So far, the chief demand has been in the Government service. The Forest Service has been able to take on each year all the men who pass the Civil Service examination. This number has varied from 35 to 60, if I am correctly informed. While there have been a good many graduates of forest schools entering State and private service without taking this examination, the majority—probably three-quarters of the graduates of the schools—have each year taken the examination. I have not the statistics of the number of students in the various forest schools which are preparing men for the high grade positions. I presume, however, that in the schools which are completely equipped there will be graduated this year 100 to 150 students and within a few years there will be between 300 and 400. Assuming such an increased efficiency on the part of every school that practically all the graduates are fitted to pass the Civil Service examination, very soon there will be more men on the eligible list than can be used. The National Forests are to-day very much undermanned. From the standpoint of the need of foresters the Government could probably take all of the technical men whom the various schools could furnish for a considerable length of time. On the other hand, from the standpoint of the probable rate of increase of appropriations and the most effective work with the money available, the greatest need, to my mind, is a much more rapid increase of the subordinate than of the technical force. The meaning of this is that the forest schools—multiplying as they are in number and each with a stimulated attendance—must look outside of the Government Service to place an increasing proportion of their graduates.

At the present time our profession is exceedingly small and I do not look for a real overcrowding of it for a considerable length of time. I base this judgment, not on the number of positions which I could find for my graduates to-day, but on my belief that the demand for trained foresters is going to increase rapidly in the future.

On the other hand, it must be recognized that forestry will never be an unlimited profession. The requirements for foresters will not be based so much on population as on forest area. There is a certain amount of work to be done, based on the amount of the forests which we have and the time will come when our profession will be in much the same condition that it is in European countries, where each forester must pass through a long apprenticeship before he can expect a position of responsibility.

My feeling about the increase in technical forest schools is that, from the standpoint of the progress of the profession, the more schools the better, provided they are thorough, for this means more technical foresters, more forest work done, and a corresponding increase of the demand for forest work. From the standpoint of the student there will be a progressively smaller number of responsible positions which he can enter almost immediately upon graduation. There will be an increased competition for the best places. This competition will necessitate progressively a better training. The poor student, the inapt forester, and the poorly trained man will have an increasing difficulty in finding a place.

As positions become harder to get, the number of students in attendance at the schools will be checked. I can see no reason why any first class institution should not start a forest school if it desires, provided the forest school is a good one. The only danger in the increase of forest schools is that there will be some which will call themselves technical forest schools and give a degree without giving a complete training. I believe that the tendency in the future will be to give some instruction in forestry in most institutions—and in practically all agricultural colleges—but that there will in the long run be only a few institutions with sufficient funds to carry on a forest school which will meet the needs of our profession.

Personally, I should like to see a much greater attention paid to the Ranger School. There are many institutions which are so located that instruction suitable for rangers could be very well given and perhaps in many cases given better than at the higher grade schools.

At the beginning of this discourse I said that I considered it a great opportunity for this body to set a standard of forest education which would result in standardizing the profession. I think that the various institutions giving instruction in forestry should organize themselves into an association of forest schools which should meet at stated periods for the discussion of educational problems. I think that there should be organized in this association a committee charged with the formulation of a standard of training for the profession. The principle of formulating a standard should not be an effort to make all schools alike in organization or in the minor details of instruction. There are, however, certain principles of education which could be determined, as the grade of the schools, the training in the subjects required as a basis, and the main technical courses which should be given. One of the chief difficulties would be to determine upon the amount of instruction required in a given course. This could most easily be reached by fixing a minimum of time to be devoted to each course. It is entirely practical, for example, to establish a certain number of hours which must be devoted to surveying proportioned to class work and field work, and in the same way the number of hours of actual field and class instruction required in silviculture and other technical courses.

The test of the work of this committee would be the acceptance by the various institutions of the work done at other institutions. The immediate result would be an arrangement for the interchange of credits so that a student having completed a given course in one institution which met the requirements of the committee's standard would be given full credit for that course in another institution.

My discussion of the aims and organization of a professional school has necessarily been general in character. I feel certain that many points touching upon this subject will be treated in detail by the other papers which follow.

METHODS OF INSTRUCTION IN THE FOREST SCHOOL.*

By R. T. Fisher.

The work of the American forester is (and will be) primarily concerned with the management of commercial timberland. There are many problems not directly commercial which are also properly within his field, but it is clear that the successful development of forestry in this country turns on the ability of foresters (or whoever handles the forests) to perpetuate the forest industries. Lumbering has got sooner or later to become forestry, but its progress toward that end is fundamentally controlled by economic limitations.

These facts, though commonplace enough, underlie the determination of methods of instruction in the Forest School, and indicate one of the prime needs of the forest student. Any one who has had a few years experience of forest work in a particular region cannot fail to have realized that the successful lumbermen owe their success largely to a knowledge of executive and mechanical detail, from the efficiency of labor to the varieties of saw practice, that has taken years to acquire, and which has crystallized into a large and complicated organization. It is businesses of this character that the forester is expected to prescribe for, to improve, and sooner or later, as conditions change, to reorganize. How, then, should the Forest School prepare him for his work? It should plan its teaching on the assumption that just as medical practice is based on the anatomy and physiology of the body, so forestry must be based on a no less through grasp of the lumber business, that is, the mechanical and administrative principles which are involved in the harvesting of timber. Whatever degree of sustained productiveness a forest may attain, its manager will still have to make roads, organize crews, and get logs to market—in other words, control the machinery by which forestry is to be carried on.

In planning the training for this purpose, it is apparent that

* Read before the Conference of Forest Schools, Washington, D. C., December 30, 1909.

within the usual limits of a forest curriculum not all American lumbering can be effectively studied. The best scheme would seem to be thorough instruction in the methods and conditions of some one typical region, with a more general consideration of the business over the rest of the country. This involves on the part of the Forest School the possession or control of a large tract of forest land in which lumbering operations on a scale typical for the region can be annually carried on. If possible the forest ought to be so situated, with regard both to composition and value, as to make a high degree of intensiveness in management possible. In that case it can be organized under a working plan, the operation of which may involve and exemplify a variety of scientific methods. The forest then becomes, as far as its business development will permit, the backbone and background of professional instruction, and the key to the understanding of problems in other fields and regions. In its relation to the school it has the following functions: First, it offers a field for thorough grounding and practical experience in a representative lumber business. Second, it furnishes the laboratory for training in technical forestry. Third, through the accumulation of records, both those connected with the operations and those arising from research, it becomes an instructive experiment station.

With the demonstration-forest in its possession, the school ought then to correlate the various courses and organize its teaching so that lumbering on the one hand and technical forestry on the other, while developed in their elements and principles separately, should enlarge and illustrate each other. In other words, the science of forestry as developed in practical instruction should be under constant test of applicability, first to the particular business in question, and later to those typical of other regions. This is not in any way to limit or narrow the highest technical training or the inculcation of the broadest ideals of forestry, but rather to aid the student in remembering by connecting principles with their uses. The arrangement and sequence of courses, while admitting of a good deal of variation, fall naturally into a number of parallel lines, each including, in logical order, those subjects which grow out of each other. The main and central line would be lumbering,—logging, transportation, sawmilling, market, and manufacturing, in detail for the home operations, more generally for the business elsewhere. The other lines of development, based whenever possible on forest work itself, are (1) Dendrology, Silviculture and Protection, (2) Forest Survey and Mensuration, Management, Administration, and Policy, and (3) Wood Structure, Technology and Products. As a means of instruction the order here indicated ought, at least roughly, to be followed.

When it comes to the actual teaching and how to do it, there may conceivably be as many ways as there are good teachers. Yet leaving aside the personal gift, and assuming a complete and logically arranged curriculum, it is possible to indicate a method of developing subjects, imparting information, and accomplishing training which is more or less applicable to all parts of an education in forestry, and which is already proved and established in other professional schools, such as those of medicine or mining. This is a method resembling both the "case system" in use at many law schools and the clinical system in medicine. It has been the experience at Harvard (and it has strenghtened our belief in graduate instruction for the scientific professions) that the professional attitude of mind can be awakened best by requiring some initiative on the part of the student, making him do some of the teaching himself. Thus, in many professional courses, the work consists primarily of a series of cases or problems from which the student is expected, in some degree, to derive the principles himself, and on which the instructor's lectures may be as much quiz and comment as regular exposition.

In adopting such means in the teaching of forestry judgment must of course be exercised in fitting them to the subject in hand. Such necessary modifications would naturally occur to any instructor who was well grounded in his subject. So far as the method is applicable to forest education in general, it consists, first, of lectures so given as to develop the subject logically and make the student himself think and assimilate; second, regularly assigned exercises or problems, arranged so as to follow the evolution of the course, and the results of which, especially the principles involved, have to be embodied in reports; and third, as far as it exists, both text-book and collateral reading. A few examples will show how the scheme works out in particular cases. In silviculture, for example, general lectures on the factors governing forest distribution and the association of species, supplemented by reading, are accompanied by connected field exercises as follows: Topography over an extensive area and classification into distinct features or sites; soils, identification and physical analysis as related to formation and site; local forest distribution as related to soil and site and separation into types; the single type, its composition in detail; the silvics of the species as indicated by the life history and form of the stand; and so on through a more or less coherent series of assignments leading up to extended practical work, such as marking for various kinds of cuttings, and independent silvical studies. In a similar way instruction in lumbering is developed. The class is put to work in each part of the operation as it occurs, divided up among the regular crew, beginning with felling and ending with mill work. In each process the aim is to make the student find out by sufficient experience not merely average costs (which are misleading at best), but the actual factors which affect efficiency, economy, and cost. Thus, to illustrate by the work in felling, he is expected to learn and to set down in his report, not only the ordinary mechanics of cutting down a tree and the capacity of a standard crew per day, but such points as the relative loss or gain, in money and per cent. of volume, depending on the angle of the undercut, the position of the saw cut, and the height of the stump. Forestry, in its execution, can not differ essentially from other woods work in being largely a matter of good organization and small economies; and it is points like these that train a man's executive judgment and open his eyes to the needs and chances for better and better methods. With a knowledge of such details and the principles underlying them, the professional student has, for one type of business, something resembling the practical lumberman's hard-won insight. This should serve both as the groundwork of later instruction in general lumbering and forest engineering, and as a guide and help to the prompt understanding of essentials in any new region. If throughout the whole of his technical education, no less in silviculture than in logging, the student is thus made to deal with facts and cases, to derive principles, and to show his own results, he will have acquired some of the capacities which his future work will demand.

As far as instruction and training will suffice, the Forest School should have trained a man upon graduation to the possession of certain definite and necessary qualities or abilities. In the first place, he must like and understand how to live rough a fair share of the time. Forestry is not a refuge for the unfit, and for their own sakes as well as that of the profession, such men should be weeded out early in their course. In the second place, he should have executive understanding of the organization of all important branches of woods work. Many lumbermen of no technical training are already making some of the very improvements in method that forestry should be able to furnish, and if the forester is to win his place in such work, he must first know the business in question, and have some idea how it is controlled. Third, he must be able to make investigations of scientific value, whether on the business or the technical sides of his work. Involved in this are the power of quick and accurate observations, and of being able to record them in clear and workmanlike reports. The command of writing constitutes almost the only advantage of the forester over many experienced cruisers, who are often able to estimate timber more cheaply than he can, but lack the training to make an intelligent statement of facts. Finally, he should have the broadest outlook on the relation of forests to national economy that the fullest technical training can give him. It should not be enough that he should prove useful in some of the immediate problems of present day lumbering, although that will often be the test of his success: he must be equipped for a scientific development of forestry which, though it may be difficult to forecast in detail, is none the less certain to come.

THE CURRICULUM IN FORESTRY EDUCATION.*

By Filibert Roth.

The curriclum is a course of study; it can be long or short; good or bad; of few topics or many; it has extent, quality and composition.

The curriculum of any professional school depends in its character or general composition on the use to be made of the studies; in its quality or detail make-up largely on the existing knowledge of the subject; and it depends in its quantity or extent on the time given to the study or the willingness of students and parents to spend their time and money.

To a lesser extent, pedagogy and custom or fashion assert their influence. We believe that mathematics cultivates the mind and we desire to produce men of culture.

But while these two considerations are still very potent in shaping the general form of higher education, it is the first three mentioned above which have dominated in the past, and are to-day foremost in shaping the curriculum of the professional school. The course in law is for lawyers; the curriculum is law and law only, and the time spent has, certainly, been dominated entirely by the attitude of the students so that while the course for B. A. was a four year course, our course in law was only half as long. This same influence appears in medicine and still more in dentistry and pharmacy and has always been evident in engineering.

The study of agriculture involves a wide range of knowledge, but the curriculum of the Agricultural College is still quite limited, especially in quality, simply because we have not the students willing to spend many years and much money in studying this science.

This limitation of the curriculum even reaches back of the college, so that the preparation for college is affected in exactly the same way and much to the same degree.

The curriculum of the forest school has shared with that of

---

*Read before the Conference of Forest Schools, Washington, D. C., December 30, 1909.

other professional schools. In its general character it is determined by the use which the forester makes of his knowledge. Centrally it is the study of the forest as an aggregate of living plants with all their biological peculiarities, demands and possibilities; the forest as a crop to be raised and cared for; to be harvested and used economically; and finally, the forest as a large property to be arranged and managed according to the methods of business adapted to the forest itself. Around this central or principal study, there have been grouped others, more or less related, but on the whole the curriculum of the forest school much like that of other technical schools, has been limited to the useful, even to the necessary.

This limit is largely set by the student himself. It is his ability or willingness, or both, which determines the length of the college course in forestry.

The young man is and should be anxious to become a useful, self-maintaining member of society as early as possible. Often he is limited in his means and in all cases he and his parents will compare the investment and its returns. And it is here where the employer, the owner of the forest, the value of whose property so largely depends on the work of the forester, can and should enter and exercise a beneficial influence.

Opposed to this limitation of study, stands the rapidly broadening science itself. Over a hundred years ago, the old empirics of forestry as a trade, welded together and improved, took on the form of a science. Since that time, the fundamental sciences, physics and chemistry, botany and geology, even mathematics itself, have all gone through a period of rapid development and extension, and with this has come an area of similar development for forestry. Study, comparison, compilation, and controversy have all shared in enlarging, shaping, clarifying the science of forestry. And this broadened and strengthened science, conscious of its great economic importance has rapped at the door of the forestry school for over half a century, clamoring for better preparation of those who are to devote themselves to its support, extension and application.

In its development, the curriculum of the forest school like that of the agricultural college and even the engineering school inherited a large amount of empiric knowledge. This empiric knowledge was old; it was the result of centuries of growth; it was considerable in amount and in usefulness. In fact, it quite sufficed to make some good foresters and good forests. Such men as von Zanthier, and von Langen whose education consisted largely of this rather empiric knowledge of two centuries ago, amplified by observation and experience, fully demonstrated the values of this older form of knowledge in our profession.

This older empiric knowledge was extensively amplified, sifted and compiled during the 18th century so that when the "Meisterschule" gave way to the regular forest school, the curriculum, at least in its general composition at once took on its present form. This is well seen in a comparison of Cotta's "Grundriss" and the present curriculum of the Academy Tharandt.

This comparison also brings out the influence of the use to be made of the knowledge in shaping our curriculum. It was just as clear to Cotta, one hundred years ago and Reaumur a hundred years earlier that mathematics and the study of natural history were as useful and necessary in the forester's school program as the instruction in seeding and planting.

As soon as the formative period of forest school organization was over, say about 1840, the struggle for more education, for a longer and better curriculum began. Schooling had led to knowledge and knowledge called for more schooling. Accordingly, the simple condensed curriculum of the private school of 100 years ago gave way to a regular two year course at an academy; this, in Prussia, for instance, to a mixed course of two years at the academy and one year at the university, and finally developed into a full fledged four year course of scientific study with every indication of further improvement. For the overwhelming defeat of the advocates of the academy by those demanding thorough university training, witnessed two years ago at Strassburg is simply a victory of the rapidly broadening science over the old standards set by use and pay.

At present the Prussian or Saxon "Oberförster," perhaps the type of a well prepared forester of our times, passes through the following course of training. After finishing high school (Gymnasium or Oberrealschule) and a three or four months apprenticeship or better "Vorlehre" he enters the academy. Here he spends three years and then he studies for one year at a university to finish up especially in political economy and law. He then passes a state examination and enters the real practice, spending two or more years at a prescribed variety of work and finally presents himself for the final examination which makes him eligible for a position.

In our own country we started with a four year university course at Cornell, a six year course at Yale and Harvard, five and six at Michigan, four at Toronto, Nebraska, Washington and a number of agricultural and other colleges.

From this it appears as if the American student receives a more thorough training than his European brother. This is not generally true since the high school preparation is usually less thorough, sometimes wanting and always more variable with us, and the probation period after school fully offsets any difference that might exist.

In keeping with the unformity in the work of foresters we find the general plan of the curriculum of all forest schools very much alike. In this respect it resembles that of medicine and law rather than that of engineering, where nearly every school has certain specialties. Not only is the curriculum of the academies and higher schools much the same but even the middle schools and ranger schools use a plan which in its general composition just like the curriculum of a hundred years ago, resembles that of the academy of to-day. This is illustrated by the textbooks such as the Neudammer Förster Lehrbuch. What difference we do find in the curriculum of the higher forest schools is usually due to efforts of local adaptation, or else is based on temporary influences such as personal views of teachers.

The composition of the curriculum of an efficient forestry school may be illustrated by the program of studies used at Tharandt. The program covers three years at the academy and one year at the university. The curriculum includes:

I. Pure Science, Mathematics and Natural History.
  a. Mathematics to Differential Calculus.
  b. Physics, Mechanics, Meteorology.
  c. Chemistry, inorganic and organic.
  d. Botany, Systematic, Morphology, Anatomy and Physiology.
  e. Geology, Mineralogy, Petrography.
  f. Zoology.

II. Forestry, Applied Mathematics, and Natural History.

- a. Introductory Course in Forestry.
- b. Forest botany, plant pathology.
- c. Forest Zoology, Vertebrates and Insects.
- d. Forest protection.
- e. Soil and Site in Forestry.
- f. Silviculture.
- g. Forest Utilization.
- h. Forest Technology, chiefly chemical.
- i. Road construction.
- j. Survey and map-drawing.
- k. Forest mathematics, Mensuration and Valuation.
- l. Forest Regulations.
- m. Forest adminstration.
- n. Forest policy.
- o. Forest history.

III. Other Sciences.

- a. Political Economy.
- b. Law.
- c. Agriculture.
- d. Game and fish.

Every other year a course on Hygiene.

Conspicuous in this program is particularly the absence of all that might be termed purely cultural studies.

In its quality, the curriculum depends primarily on the topics and their arrangement, and the length of time devoted to their study. But it also depends on the environment, on equipment, and on the mental attitude of teacher and student toward the different parts of the curriculum. Accordingly we find both here and in Europe, the question of location of school. Should we locate at the university with its larger number of students, its many departments, its extensive equipment and larger staff of teachers or should we place forestry at the agricultural school, or teach it at special academies? In this very question of location, the quality of instruction, the maturity of the student, the broadening influence of larger schools, all are involved. The attitude of teacher and student toward the curriculum is important. Though the composition and even the balancing of the curriculum in the catalogue remain constant, the teacher who sees in forestry only a matter of horticultural subjects on the one hand or of timber estimating and logging on the other is bound to influence the quality and the real character of the curriculum. Similarly, if the student gets it into his head that artificial reproduction is German nonsense, or that regulation and valuation are "theoretic stuff" he puts himself in a mental attitude with regard to these subjects which makes their teaching useless, and the course of study a failure.

In these subtler matters of interpretation and treatment of curriculum, different schools must always differ. And as long as opinions in forestry have the tendency to move in extremes, forestry education is affected more seriously than technical education in other branches.

But aside from this appreciation and interpretation of different topics of the curriculum there is also in the forest school, as in all others, the finer interpretation of teaching itself. And while this is much a matter of teacher and student, it is not a matter of method of teaching but is truly a part of the curriculum. Whether the teacher or student body favor the mere learning of methods in silviculture or whether they try to get the principles on which silviculture rests, depends on this interpretation. Similarly, it is really a part of the course of study and not so much a matter of methods of teaching whether the course teaches to think and work out a problem rather than to memorize facts and fix methods. That these parts of the curriculum are not guaranteed by the printed circular, and its usual phrases but are the essentials which the name of the school and its teachers must vouch for, goes without saying. Generally, then, length of course and proper arrangement of subjects form the first criterion, but the school, the teacher and student remain the most important factor in the quality of the course of study.

The value of the several studies is generally recognized and little need be said. The necessity of the fundamentals, such as mathematics, physics, chemistry, geology, botany, zoology, and surveying is patent to everyone. The value of political economy and law to the forester is clear when one considers that the very use of wood itself is an unsettled condition and that forest legislation in our country is just beginning to receive attention. In the estimate of the forestry topics proper, the mental attitude of student and teacher is still apparent. Influenced by the tenets of a vandalistic business, we have ridiculed planting in silviculture and neglected regulation in management. In the old world, they have passed this point, but the extremes of "forestry for the highest interest on investment" stands firmly opposed to "forestry for the best possible crop," and other dogmas still disturb the uniformity and quality of their course of study.

In the balancing of the curriculum the use of the knowledge and the time at our disposal have acted as regulators. This together with the fact that every new circular or printed curriculum is patterned after some older one and that thus our American curriculum is a copy of the slowly developed, long tried one of Europe has brought the general balancing into a surprisingly uniform condition. Thus about 30 per cent. of the entire time in the forest school is devoted to forestry proper. This is as true approximately of Hanover, Munden and Munich, as of Yale, and Michigan. In the proportioning in details, considerable variety appears. Europe runs to political economy and law and lays great stress on forest valuation and regulation. In our country we have favored the natural history sciences and surveying in the fundamentals and laid stress on mensuration and utilization in forestry. Generally it is feasible to set definite satisfactory limits for the mathematical studies, such as physics surveying, mensuration, and valuation. Some studies like botany and silviculture, we are forced to give all the time we can possibly spare, while a number of others, like regulations, administration, political economy and law, receive what is left, or are "cut to fit the cloth."

What is the outlook? Have we reached the maximum in time and expense? This will depend largely on the young foresters themselves. A well trained body of men will make for a strong and respected profession, such as President Roosevelt called for in this very room. Such a profession will stand for good schooling and a broad, well-balanced curriculum.

But the employers, too, will exercise their influence. With an abundance of small, cheap jobs will come a demand for cheaper men and short courses to prepare them. On the other hand, if the Government and the large employers will demand a certain minimum of preparation, they will, here as in the Old World, help to build up the schools and the profession and thus assure themselves of a supply of satisfactory men.

A consideration of the curriculum is incomplete without considering the so-called pratice courses. In the majority of European States a short apprenticeship with a forester precedes the regular college course. This three to twelve months apprenticeship is intended to give the student a taste of the woods, familiarity with the woods language, work and people and thus prepare him for his study. The value of this apprenticeship is often overrated, often disputed, and it is generally conceded that too much depends on the master forester and that in many cases it is largely a waste of time.

After the college course and the examinations comes another period of practice. This is an entirely different part of the program and is an important part of the curriculum of an "Oberforster" education. This is real practice and real man's work. While the school is intended to make a student, this two or more years pratice now makes a forester.

The question naturally comes up: "What should we do to supply the practice in our own country, under our conditions and in our new schools?" This may be debated but opinions will continue to differ. Generally it may be set down as fact that the school never makes an artisan; it teaches how to do, but it does not teach to do. It presents facts, teaches principles, and develops judgment but the ability of applying this knowledge requires more than a few excursions or a few weeks in the woods.

On the other hand a few months work at surveying, mensuration, etc., in the woods, gives the student some confidence in applying what he knows. How much this is worth, and whether it justifies men leaving the university for months at a time is a matter which falls to the discussion of methods.

Reviewing the situation, we find general agreement in the demand for a good program of study to prepare our men for the extraordinary task before them. But we find here, as in the Old World, considerable difference of opinion which may be summed up in the following points:

1. Should the course be given at a university or a technical college?
2. What should be the length of the course?

3. Preparation, high school or eighth grade?
4. What proportion of time should be devoted to forestry studies?
5. Amount of accessory studies such as botany, zoology, chemistry, physics, etc.
6. Balancing of forestry, studies proper, i. e., how much time should be given to silviculture, management, utilization, etc.
7. How much practice or field work is necessary or desirable, when shall it be given and where?
8. How should the curriculum be represented in the examinations for positions?
9. Should a certain minimum program of studies be made part of the requirements for admission to the examination?

PUBLIC RESPONSIBILITY OF THE FOREST SCHOOL.*

By B. E. Fernow.

The subject assigned to me to open for discussion is one on which I do not feel well qualified to speak, for, prior to this assignment, I had given little thought to it, and when I did think on it, I found that I had views, which are probably heterodox and antagonistic to the idea undoubtedly implied in the title—and which make me an unworthy spokesman.

Perhaps my actions have belied my opinions. I may have misled those who selected the topic for me as regards my attitude by my behavior, having assumed implied duties without being convinced of their propriety.

As foresters we are all, I suppose, agreed that to a given site corresponds a given limited growth energy, which it is our task to direct into the production of the largest amount of wood of the most valuable description in the shortest time.

Can we formulate any better prescription for the task of a forest school, than that it is to produce foresters of the most valuable description in the shortest time? And we may question whether this is attainable, if the energy of its teachers is dissipated on entirely different tasks.

My view of the responsibility to the community of any educational institution and especially of a professional school, is plainly and simply that it is to bend primarily all energies upon the task for which it is instituted, namely, to provide the best education possible in the subjects which it professes to teach to those who are its inscribed students and to turn out well prepared citizens. If this primary function is well performed, I consider the school has done its full duty to the community, and nothing more should be expected of it.

Of late, the so-called university extension movement has apparently enlarged the functions of the higher institutions of learning, namely, in the direction of educating the outside public.

I admit that, especially in a democracy whose progress depends

---

* Read before the Conference of Forest Schools, Washington, D. C., December 30, 1909.

largely on enlightened public opinion, any movement towards the enlightenment of public opinion is to be applauded.

Democracy implies education of the masses. If we must rely upon the nondescript force, public opinion, to direct our government, surely, we must see to it, that it be as enlightened as it is possible to make it.

Far be it, therefore, from me to find fault with the universities who seek to spread their influence among the rank and file of the people. The fault I have to find is not in the aim but in the method which I suppose to be implied in the title of my topic, namely, that the teachers of the school should also become the teachers of the public.

The old proverb that you cannot serve two masters holds good here, especially if they are of different dispositions and have different needs. Few people can do two heterogeneous things equally well, or indeed, well at all. Either the one or the other may be well done at the expense of the other, but in most cases, neither will be done as well as if the other were not attempted.

Now to teach the technicalities of a profession and to popularize a subject require quite different talents and different methods. There are very few who possess talent in both directions or can shift from one method to the other.

Teachers like poets are born, not made, or if, as unfortunately is often the case, they are made, the product is second rate.

From what I have seen of school education in the States and Canada, I have come to the conclusion that there are not many born teachers employed in the preparatory schools. The more need to reserve such places in the higher grade, technical and professional schools, the universities, for men specially fitted for the task. Such men must have the ability not only to present principles clearly, but to infuse a desire for investigation into their students, being themselves investigators and accurate reasoners.

Such men cannot afford to waste their energies on the popularization of their subject, and for the most part would lack that ability of superficial generalization, which seems to be the need of a popularizer. Being concerned with details which popular audiences do not appreciate the good university teacher is apt to make a failure of his popularizing efforts.

From my own experience, having tried to serve both masters, the professional student and the community at large, I can say I am lacking ability in the one direction and have my attention detrimentally diverted from the other.

The superficiality which satisfies the one task is apt to translate itself into the other task.

If there are to be good results secured from the university extension movement, it should be put into the hands of men specially competent and versed in the art of popularization.

On the whole, I am not sure, whether this policy of diffusion, this attempt to bring the university to the people and fill them with half-knowledge and heterogeneous information, does not do as much harm as good, whether or not the morsels of half-cooked food, which are usually presented to popular audiences in the single popular lecture do not threaten to produce a mental dyspepsia which is worse than mere simple honorable ignorance.

What will be the result in the limited mental pot of the common man, which an hour's lecture on botany this week, on astronomy next week, on geology the next, on forestry next, and so on, will produce?

Lack of thoroughness which has become the besetting sin of our educational effort, even in the schools, is fostered by this procedure among the whole people.

While the occasional lecture on a large subject, circumspectly constructed may have a value in stimulating the hearers to take interest in it, and to do subsequent reading on the subject, a real educational value that is worth while, can only come from a connected series of lectures, prepared with the greatest care by the most competent teachers fitted for this purpose.

These men to be sure the university should furnish, and it should by all means take intense interest in the movement, not holding itself aloof but entering into its spirit and lending its facilities and countenance.

But let it be understood that this work must be a special department and not merely an odd job given to an already overworked staff of university teachers.

The creating of a sane public opinion on certain large and vital questions affecting the community stands on a somewhat different plane from the more general education which the university extension movement attempts.

Here the citizenship of the individual is called into play to exert itself, according to opportunity and ability, in moulding public opinion.

But let it be understood that the responsibility for this exercise of the duties of citizenship on the part of the university man is individual and cannot be charged to the institution and construed as a part of the school duties.

It is not the school, but the individual members in their individual capacity that may assume this public responsibility.

The subject of forestry in particular we may admit, is one that is still in need of wide spread propaganda, for more than any other it calls for the exercise of the providential function of governments, and hence an intelligent public opinion is a necessity.

But, in this educational effort too, specialization would be more effective than the odd-job method.

Expediency rather than good principle has hitherto made it necessary in the absence of special agencies for directing the public to call upon the representatives of forest schools to appear as leaders of public opinion; but, I daresay that in proportion as they have devoted themselves to that task they have probably neglected their academic duties. Now, however, special agencies exist created for the very purpose, namely, that of the education of the public opinion, and to these can, therefore, now be relegated these functions and responsibilities, relieving the technical men from the more than incidental exercise of their civic duty in this respect.

I refer to the forestry associations, who should much more actively push the work of propaganda through special lecturers and pamphleteers, devoted to the purpose, who of course may be educated in the forest schools.

By thus pleading for segregation of the technical and popular education at least as far as the men engaged in these different callings are concerned, I do not want to be understood as desiring separation of academic from practical life or of narrowing the sphere of usefulness of the school.

Like any other modern institution of learning the forest school is not only to impart information and develop technical ability and judgment, making the mind a useful tool, but indirectly at least it must encourage the development of the heart and soul and produce a realization of civic duty and responsibility among its students so that from its ranks will arise apostles of right thinking and correct public attitude—desirable citizens. For *such* result the school as a whole is or ought to be responsible. But I insist that the public responsibility of the forest school begins and ends with its students.

THE RANGER.

By Robert E. Clark.

Various changes have taken place, of late, in the method of procedure in Forest Service matters, the idea of which has been to distribute the work in such a manner as to put considerable responsibility upon the members of the Service situated in the field. A large amount of supervision has been turned over to the Supervisor's office which had heretofore been dealt with in both the Washington and various district offices. The result of this transfer is, and will be in increased measure to transfer some of the work which was before dealt with only in the Supervisor's office, to the Ranger force. This will, of course, put more responsibility upon the Rangers and will require them to do considerable more work of both office and technical character. This will necessitate a certain degree of knowledge on forest subjects that most of the present force are lacking.

The Service has already seen this need of instruction and has in many instances established schools fitted to instruct the rangers in both practical and technical subjects, chiefly the latter. Various articles have appeared favoring this system and all have been highly approved as well as appreciated by the men who will derive advantages from such institutions that these articles have been the means of establishing.

Although the Forest Service has established various schools for the tuition of its Ranger force and will benefit scores of men yearly, it has not the time to allow more than one or two men from a Forest to attend the course for a year. It is this fact that brings up the question: How are we to benefit those men who are unable to attend this course this year or next year and who this year need some form of tuition to enable them to carry on their work in a satisfactory manner.

In past years circulating libraries were in force, but under this system a book was sent out to a man which book was very often of such a technical character that it would even tend to puzzle our technically trained men. The Ranger received it in good faith, glanced at the contents and said, "It's too deep for me" and nine cases out of ten the book was carefully tucked away and remained so until called for by the office.

Suggestions have been forwarded that a digest be made of our principal library books and that such a digest be forwarded with the book. Furthermore, the Ranger was to use this digest and prepare himself for an oral examination on the subject whenever one of the office men dropped in on him. This idea is an excellent one and would be of great help to the men. Its only disadvantage, to my mind, is that the majority of the time all rangers would be at work on different subjects and very often on one entirely foreign to his line of work or needs. Scarcity of books would be the cause of this disadvantage. My idea is to instruct the Rangers in the subject they need most which can be determined as their work progresses, and demands. Again, such information should be given out simultaneously so that interdiscussions could be held between the men and ideas handed back and forth. Such an arrangement as follows might be carried out with considerable success.

A periodical publication, in the form of a lecture, could be issued from the office of the Supervisor containing extracts from books on a certain subject, such extracts leading up from a simple introduction of the subject to a point where valuable facts could be published in such a form that the men could thoroughly understand them. Such a publication could well be issued in connection with the monthly bulletin which is now being issued on many of our Forests. It would be simple and short and would be of such a nature that it would be kept continually on the Rangers' files and could be referred to at any time.

Again, our Technical Assistants come into the field fresh with knowledge of a character derived from years of college training, and in nine cases out of ten, are entirely ignorant of any of the practical knowledge derived from years of field work. Such technical men meet our rangers who are superbly trained on the practical side. Why not have them coöperate? Surely they both need each other's knowledge in the subjects that each are well versed in. It is this fact, of coöperation between the technical man that is assigned to a Forest and the practical men with whom he associates, that has proven, by experience, to be the best for both men.

I, therefore, appeal to both the technical man and the practical man to combine their forces and by so doing the battle will be won.

THE INDIAN FOREST SERVICE AND THE QUESTION OF PERSONNEL.*

By Royal Freeman Nash.

We are here in conference to give each other the mutual benefit of the experience accumulated in our several lines of activity. Think how much greater a fund of experience would be open to us were we sitting to-day in Singapore in conference with the forest officers of Java and India and the Straits! Americans have been frequently criticised for their disregard of the tremendous work done in the tropics by the English and the French and the Dutch, for our attitude that Philippine administration, because conceived in a different spirit than the governments of European dependencies, has little to learn from them. From the meagre literature on the forest services of India and Java in our Manila libraries, I deem the criticism well founded as regards forestry.

It is somewhat over a half century since Dietrich Brandis came out from Germany to administer the government teak forests in Burma,—one lone missionary forester in as heathen a "bosque" as existed on the globe. He found a property devastated by shifting cultivation and the teak in Pegu in a fair way toward destruction by the timber merchants who had free run of the government forests. They soon knew that they dealt with a master,—scientist, forester, and administrator in one. He introduced right from the outset the system of native contractors which enabled him to take the exploitation into his own hands, or at least to enforce suitable conditions and prices from private timber firms. The fight he made against these entrenched lumber despoilers in Burma and his work in organizing administration in other provinces, showed the calibre of the man, and in 1864, after eight years of service, the government of India saw fit to make Dietrich Brandis the first Inspector-General of Forests. I want to review the development of the service so begun as

*An address delivered before the Fourth Annual Conference of the Philippine Forest Service.

regards the selection and education of their men, their organization, and their pay.

In the beginning, Brandis had to officer the new department with gentlemen of no previous special training; but two years later he was permitted to bring out two young foresters trained for the German service, men known to you as the second and third Inspectors-General, Schlich and Ribbentrop. At the same time arrangements were made for the training of Englishmen in the forest schools of France and Germany.

In 1875, the professional education was entirely transferred to Nancy, the school where Mr. Pinchot received the major part of his forestry training. Ten years later politics determined England to abandon her training grounds on the continent, and Schlich was called from the Inspector-Generalship to organize the forest school in the Royal Engineering College at Coopers Hill. There the training was carried on until four years ago, when the forest branch of Coopers Hill was closed, and the education of the probationers for the Indian Forest Service made a monopoly of Oxford University.

The 1909 regulations governing these probationers provide that preferred candidates must have taken a degree, with honors, in some branch of science at a British University, or hold a British diploma in forestry. Only natural-born Britishers under twenty-three years of age, unmarried, and of sound physique are eligible. Their period of probation is two years at Oxford with vacations in continental forests, but students who already hold a diploma in forestry are given special consideration and may be granted the Oxford diploma in less than two years. Twelve appointments are to be made in July 1909, and in case a sufficient number of preferred candidates are not forthcoming, an inferior class of probationers who are not less than nineteen years of age and possessed of an education about equivalent to the requirements for university matriculation, may be appointed. These will obtain the Oxford diploma in three years. The government makes an allowance to preferred probationers of $50.00 a month, besides fees payable to local forest officers on the continent. The inferior probationers receive the same total of $1,200 distributed over their three years.

The crucial point that we are interested in, however, is what Oxford's diploma of forestry represents. In brief, the curriculum at Oxford as at Yale, for instance, is designed to insure a grounding in the underlying and engineering sciences and a thorough survey of forestry, with extensive field work in the forest. In both institutions lack of properly prepared material has heretofore necessitated including elementary subjects which any scientifically trained college graduate should know. Yale has just announced that after 1911 the entrance requirements will insist on a thorough grounding in natural science, mathematics, and elementary engineering before students will be admitted to the work of the forest school.

The Britishers have courses in the botany of Indian trees and the geology of India and are better prepared than Philippine foresters to the precise value of those two courses. Their opportunities to become acquainted with the results of forestry in Germany and France give them a priceless ideal toward which to work. Philippine foresters must put in some years before the leisure is gained to study in Europe. On the other hand, American trained foresters certainly have a much greater opportunity to become acquainted with colossal lumbering operations, and the technique of utilization applicable in an undeveloped tropical region like the Philippines. And by no means to be overlooked is America's advantage in being able to send to her forest schools woodsmen, men thoroughly at home in and with a love for the forest, as many of her best forest students are. Balancing differences, it would seem that the probationers who go from Oxford as Assistant Conservators and the graduates of our best American schools of forestry who enter the Philippine service as Foresters directly from college are equipped pretty much the same. Both have everything to learn of tropical conditions after their work begins. (In this connection Professor Graves, the Director of the Yale Forest School, has suggested that it would be a measure of economy for us to give our appointees six months training in India at government expense on the way out here.) But as it is to-day, so far as her Imperial Service is concerned, India's sole advantage is in sending out men who have trained for and go to an assured life-long career.

Quite different, however, and certainly of not less importance is the training of the subordinate Forest Service,—rangers, foresters, and guards. Mr. Brandis as early as 1869 drew attention to the necessity of providing technical education for natives of

India. They began, as we are doing in the Philippines, by placing selected natives under officers who were considered especially qualified to instruct them. The next experiment was to apprentice a number of young men to forest divisions in their own province for a year or two, and thence to send them for a year to some engineering college. But the apprentices received practically no instruction in forestry. They were used as welcome additions to a staff short of men, and put to such mechanical work as they could perform, and at college they learned neither silviculture nor natural science. Unable to do the work with the draughtsmen turned out by this training, the Imperial Forest School at Dehra Dun was established in 1878.

The forests about Dehra, comprising a great variety of forest vegetation, have been set apart as training grounds and formed into a separate circle under the control of the Director, and the school is throughly equipped. It is under the administrative control of the Inspector-General, assisted by the Director of Public Instruction, the Director of the School, and three Conservators.

To the course for Rangers in English are admitted three classes of students: private students without appointment in any forest service, students deputed by native states, and Rangers already in government service. The first two must be between eighteen and twenty-five years of age, recommended by the Conservator or Durbar, and must pass an entrance examination in mathematics and English. Rangers of any age are admitted without exmination, provided the Conservator under whom they are serving thinks their general education and knowledge of English sufficient to enable them to profit by the course. Deputy Rangers who have been in the service not less than two years and are under twenty-five years of age are admitted upon passing the entrance examinations and agreeing to serve five years after graduation. These Rangers and Deputy Rangers draw the full pay of their posts and travelling allowances while at the school.

The course for Rangers at Dehra Dun reads almost identically with the curriculum at Oxford. Necessarily it must be somewhat more elementary, because the students have not had the advantage of preparing at a British University. Thirteen out of the twenty-four months are spent in the forest. But the finished product is a man fully competent to take over all the executive work.

The Dehra Dun Rangers in India are satisfactorily performing the greater part of the functions that the Philippine Foresters are to-day, with the exception of the splendid scientific work of the Division of Investigation.

For Deputy Rangers and Foresters a two years' course is given in Hindustani at Dehra Dun, a similar course in Burmese at Tharrawaddy, and a one year's course at the Madras school in English. Thus, the forest guard is the only man in the service of India whose training is unprovided for. Since 1902 plans have been constantly agitated for his education; the dictum is accepted that the Forest Guard can no longer remain the untutored man of the woods if he is to be of any real use, and the next year or two will see India equipped with a forest service in which there is no man, from patrol to Inspector-General who has not received a forestry training suited to his needs and intelligence.

At the head of this Imperial Forest Service of India is the Inspector-General, professional adviser to the governments of India and controlling Dehra Dun, the forest surveys, and working plans, on a salary of $10,175 per annum, at the present value of the rupee.

Below him are twenty Conservators, who hold the most responsible positions in the service. Within their province or circle they are sovereign administrators so long as they keep to the working plan laid down. The Inspector-General may not address them on matters which involve any administrative or general policy. These posts pay from $5,760 to $8,255 and are filled by selection from anywhere in the service, seniority alone counting nothing. The post of Conservator corresponds more nearly with that of our Director of Forestry than does the Inspector-Generalship.

A Conservatorship is divided into a number of Divisions, the most important of which are in charge of officers of the Imperial Service, the minor ones in charge of officers of the Provincial Service, as they call the Dehra Dun graduates who rise from the Ranger class by promotion. Pay in these Imperial ranks depends upon length of service. A man fresh from Oxford starts in as Assistant Conservator at a salary of $1,460. For the first nine years he gets an annual increase of $153, providing he passes an examination in the provincial vernacular at the end of three years, and subject to the provision that Local Government can at any time stop his incremental rise in pay if his work is unsatisfactory. From the sixth year on he is styled Deputy Conservator, and after the ninth year draws an annual increase of $192.00 so that a man in his twentieth year draws $4,800.00, even if he does not attain to a Conservatorship.

The Divisions are again divided into Ranges, which form the unit of administration. The Ranger is for the most part, as I have said, a man thoroughly trained at Dehra Dun or Tharrawaddy. He is the executive officer of the tract under his charge, responsible to the Divisional Officer for the protection and working of the forest in every detail. In special works he is assisted by Foresters and for protective purposes his range is divided into a number of beats in charge of Forest Guards. The latter are appointed straight from the jungle and the best of them promoted to the Forester class.

So much for their organization, but, before I quit the subject of pay, I want to mention certain allowances in addition, which the Philippine government must consider if she is to have a permanent and efficient force of forest officers. England considers that the most expensive investment she can make is to train up an officer to a point of efficiency and then break his health by exposure in the jungle. She also recognizes that a man's official status in a community depends to a large degree upon his social relations with that community. There, as here, a forest officer is on tour most of the year, but there is a noticeable difference in the comfort inherent in the two undertakings.

A Conservator or Divisional Officer proceeding on a tour of inspection sanctions an advance to himself sufficient to cover the travelling expenses of himself and subordinates for one month, subject to adjustment on the next issue of pay. In the Philippines, the Forester is required to advance the government, without interest, the entire field expenses of his party, subject to reimbursement at the whim of an auditing clerk and the delays of communication, delays which sometimes mean that a Forester carries a party of ten or twelve men for three months during which time no man receives either salary or field expenses from his employer.

Two or three elephants bear the cargo of the Britisher through the forest, laden with tents that the government provides, or if he has his own camp equipment, government gives him a tentage allowance. At intervals for his necessary office work he stops at a splendid rest house, erected by government in sightly locations, for which no rent is charged. There he transacts his local business with the citizens of his district, surrounded by the decent necessities and able to extend the little hospitalities that breed respect and mutual understanding between man and man. The Philippine Forester,—outfitting his party himself, hiking around at the mercy of transient packers, reeking with sweat in the midday sun and at night over the chickens or on the ground, with rice and fish for a constant food,—it is not a joyous comparison.

The Indian Forest Service has a provident fund in which an officer can put ten per cent. of his salary and receive from the government compounded interest at 4 per cent. If he wishes to build him a house, government advances him up to six months salary and takes it out in twenty-four installments from his pay. Furlough is allowed to the amount of one-fourth active service, and after twenty years the Imperial Forest Officer may retire on a pension of $1,280 for life.

I have touched on but these phases of the Indian Service because unwilling to take more of your time. The one essential point I want to strongly emphasize is this: There is no problem that we are likely to confront which India has not worked out in one way or another. Every bit of their experience should be on record here and at our fingers' tips. The habit of accumulating and using the knowledge of past generations spells the whole difference between savage culture and progressive civilization. If we must go through the entire painful series of experimental errors that other foresters have gone through, I see small hope for the rapid control over nature at which we should aim.

So much for the Indian Service. But before I conclude, I want to say a word on the fundamental question of personnel in this service.

The forest wealth of these Islands has been turned over to the guardianship of the Philippine Forest Service, to be administered for the welfare of society, at a time when its utilization is just commencing,—conditions more favorable than shone upon the birth of any other forest department on the globe, with the possible exception of Canada. Before the United States could begin to see that natural resources, like government, are vital to every man's welfare and should be conserved in the interest of all, they had to be brought face to face with a threatened timber famine.

There could be no greater crime against the world than to fail in the social service demanded of this bureau. The measure of our success will depend entirely upon the calibre of the men who do the work. There is immediate need of a school in the Philippines on the comprehensive scale of Dehra Dun, which shall attract the best class of Filipinos and educate for us a large force of rangers able to perform the whole of the executive work which now devolves upon the foresters. In the administrative posts we must have the best men turned out in America. We don't need many; but right now when the great work of organization is commencing, and before the inevitable tide of exploitation sweeps down upon us, we have got to make this service so attractive that each year we can have the pick of the hundred men graduated from American Forest Schools.

Surely, the Philippine people can afford to trust their second greatest asset only to foresters who have a statesman's comprehensive view combined with high ability to organize; to scientists who are not only saturated in the accumulated knowledge of their special field of thought, but filled, too, with the determination to make their science serve human wants. Such men are to be had in the United States. Many well paid positions are open to them there and a broad field of service. We are forced to bid for them in competition with the needs of a great nation just determining to conserve the remnant of her national resources. Our present salaries are certainly no temptation. The matter of pay and allowances and quarters must be made attractive enough so that men of this broad calibre will train and compete for this service, give their best twenty years to tropical forestry, and be able to take a fair bank account home at the end.

So long as the Philippine service is regarded merely as a rest house on tours of the world it will be impossible to do justice to the colossal task laid out for this bureau. Given a permanent force of men of broad understanding, men who can grasp a great economic problem in its entirety, it can be solved to the satisfaction of the generations which shall be our judge.

SOME FEATURES OF FOREST WORKING PLANS IN INDIA, AND OF FOREST REGULATION IN THE CONIFEROUS FORESTS OF THE HIMALAYAS.

By Barrington Moore,

United States Forest Service.

An attempt will be made to give some general idea of the making of working plans in India and of some of the more important provisions of a particular plan for coniferous forests in the Himalayas. The plan in question deals principally with Deodar (*Cedrus deodara*) and Chir Pine (*Pinus longifolia*) which resemble rather strikingly our Douglas Fir and Western Yellow Pine of the Southwest in the silvicultural treatment required. It is not to be supposed that it would be possible or even desirable to copy exactly the methods pursued in India. Because the areas dealt with there are much smaller than those in the United States, the force of rangers and guards larger, and consequently it is possible to practice much more intensive forestry. These methods, however, are the result of many years' experience, and should contain valuable suggestions for foresters in the United States.

On account of the size of the subject it will be impossible to give more than a few of the salient points in regard to the making of working plans, and the treatment of Deodar and Chir in the plan under consideration.

1. Steps in Making Working Plans general for all India.

Before a working plan is made the Conservator and Divisional Officer* talk over the policy which is to be pursued in the plan. This is done during one of the Conservator's periodic inspection trips in which he goes over practically all the important parts of the Forest with the Divisional Officer. Thus ample time is had for a most thorough discussion and mutual interchange of ideas.

N. B. * The Conservator would correspond more or less to our District Forester, although the Circle of which he is in charge is smaller than our District. The Divisional Officer would correspond almost exactly to our Supervisor.

As a result of this interchange of ideas the Divisional Officer draws up a preliminary plan giving only the lines of policy to be followed in making the working plan. This preliminary plan is then sent up to the Inspector General for approval. If it is approved they put on a Working Plans Officer to work out the details. This is generally a man of the rank of Divisional Officer who has come out from leave and has not yet been assigned to a new Division. He may be from the same Circle or not, but must always be from the same Province. He is given a force of unskilled laborers and a Ranger but no clerk. Therefore he has to work up all the figures and data himself, go over the entire Forest and make the description for every part of it, and keep a close watch on his subordinates who are making the valuation survey at the same time. The position in which the Indian Working Plans Officer is placed can hardly be appreciated by a man in the United States. He is the only white man, working with a crew of natives, and must keep his eye on his men continually. The native is of such a character that unless continually watched he is practically sure to do not only poor but fraudulent work. That is, he will hand in false returns to give the impression of having done a large amount of work.

A very simple and ingenious scheme for checking the valuation work of his men was devised by Mr. P. H. Clutterbuck, Deputy Conservator of Forests, and a man of more ability and experience in working plans than any other forest officer in India. He is the author of the working plan for the Jaunsar Forest about to be discussed. The valuation survey was made by strips. He had the figures for each compartment kept separately and turned in to him as soon as completed. In running the strips he made the men put stakes at the end of every acre and number the stakes with a number which was also put in the book, keeping each acre separate. The book was turned in to him as soon as the compartment was completed. Thus in going over the compartment to describe it after the valuation survey had been run Clutterbuck would pick up an occasional acre here and there at random and check it carefully with the figures in the book which had been turned in. By this means, the natives would never know which acre he would check and did remarkable good work. In starting a working plan the officer has a map, which has previously been made by a special department. Thus the map work, often the most difficult part of a working plan, is avoided and he can turn his entire attention to the plan proper. The mapping by a special department is a scheme which we would do well to follow in the United States.

The principapl divisions of the Forest in any Indian working plan are the following:

(1) Blocks. These are main divisions already existing before the working plan was made. They are parts of the forest which have always been known by a local name derived from custom or from the original notification (proclamation of reservation) of the forest. They have nothing to do with the management, though they may have something to do with the administration of the Forest in that their boundaries are often made to coincide with ranges or beats.

(2) Compartments. These are based entirely upon topography. They are made before the enumeration or regulation of the cut, and, contrary to general belief, have absolutely nothing to do with the management. They are merely convenient units for reference in designating any certain part of the Forest which one wishes to refer to.

(3) Working Circles. These form the basis of the management and regulation of the cut. They are primarily made according to difference of species because different species require different methods of treatment. Secondly they are based on geography, that is on location; not on topography or market, but on their position in the Forest. Thirdly they must be of such a size that there will not be too large a cutting area in one part of the forest for each year. Since a certain fraction of each working circle is cut over each year, if the working circles are too large the cutting areas will also be too large.

(4) Coupes.* These are the areas to be cut over each year. They are decided upon entirely from the valuation survey and calculation of the yield, and have nothing whatever to do with compartments. There is one coupe a year for each year of the felling period for each working circle. That is, the working circle is divided into a number of areas equal to the number of felling periods in the rotation, and each of these areas is further subdivided into yearly coupes or cutting areas.

---

* N. B. From the French word "couper", meaning to cut.

The coupe is not necessarily based on topography. It is generally divided up into smaller lots for selling.

In new forests such as those in the United States it would be possible to simplify these divisions by making the blocks correspond with working circles, and the compartments with coupes or the number of coupes in a felling period. That is, blocks could be working circles which would be divided into a number of compartments equal to the number of felling periods in the rotation. Each compartment could be then further divided into a number of sale areas equal to the number of years in the felling period.

The points which the working plans Officer shall cover as far as possible are represented in the following schedule:[1]

PART I.

Summary of Facts on which the Proposals are based.

Description of the Tract dealt with.
Configuration of the ground.
Underlying rock and soil.
Climate.
Agricultural customs and wants of the population.
The Composition and Condition of the Forest.
Distribution and Area.
States of the boundaries.
Legal position.
Rights.
Composition and condition of the crop (Stand).[2]
Injuries to which the crop (stand) is liable.

System of Management.
Past and present systems of management.
Special works of improvement undertaken.
Past revenue and expenditure.

Utilization of the Produce.
Marketable products; quantities consumed in past years.
Lines of export (means merely from the forest).
Markets.
Mode of extraction and its cost.

---

[1] From the Indian Forest Department code.

[2] Information should be given as to all that is known about growth in girth and height, of form factors for the principal species. The information here given will be utilized in the calculation of the possibility.

Net value of each class of produce.

Miscellaneous Facts.

The Forest Staff.

Labor Supply.

PART 2.

Future Management Discussed and Prescribed.

Basis of Proposal.

A concise summary (by Working Circles) of the prescriptions of the plan.

Working Circles how composed; reasons for their formation.

Compartments; justification of the sub-division adopted.

Analysis of the crop; method of valuation employed.

Method of Treatment.

Object sought to be attained.

Method of treatment adopted.

The exploitable age.

The Fellings.

The general working scheme: calculation of the possibility.

Period for which the fellings are prescribed.

Areas to be felled annually or periodically; order of their allotment.

Nature of and mode of executing fellings.

Tabular statement of the fellings to be made.

Forecast of condition of crops (stands) at their conclusion.

Supplementary Regulations.

Cleanings, thinnings or other improvement fellings.

Grazing and other rights.

Sowings, plantings, or other works special to each circle.

Improvements common to the whole area.

Miscellaneous.

Miscellaneous prescriptions.

Changes proposed in the Forest Staff.

Financial results of proposed working.

Collection of data and keep up of record; control forms:

(1) General scheme.

(2) Periodic measurement of sample plots or areas.

(3) Form factors.

(4) Fire conservancy registers and maps.

(5) Forest Journal.
(6) Compartment register (for detailed statement of all trees felled year by year.)
(7) Control forms (amount of detail necessary).

Appendices to Working Plan.

Maps.

Description of crop (stand) in each compartment; written or by stock maps.

Valuation surveys; written record of results.

Rates of growth; record of observation made.

Miscellaneous statements.

In filling in the above outline, special emphasis is put upon the "Agricultural customs and wants of the population" and on "Rights," because the regions around the forest are generally thickly populated with agricultural people dependent largely upon the forest for grazing, for fuel, for grasses to thatch their houses with, and other minor products.

The compartment descriptions (in the Appendix) are an important point, but the most important point of all, as it properly should be, is "The general working scheme, calculation of possibility." This possibility or annual cut is always very carefully worked out and when once found is rigidly adhered to until the plan is revised. Upon this depends the plan proper for "areas to be felled annually or periodically, order of their allotment."

It must be admitted that in some working plans the silvicultural data, such as growth, etc., is not always obtained in sufficient detail to form an absolutely reliable basis. However in cases where there is any uncertainty the conservative figures are always taken, and, on the whole, the result is a management which is bringing the Forest steadily up to a higher state of productivity.

The actual making of working plans in India is of course entirely different from what it would be in the United States, but there are suggestions for us in the making of a preliminary plan giving the policy to be pursued; in having a special department for map work, and in the divisions of the Forest.

Within the last two years they have established the position of Superintendent of Working Plans, showing a tendency to specialize in different lines of work, a tendency which unfortunately we seem to be drifting away from in the United States. When the pressure of the work of placing the Forests under Administration is over it is to be hoped that there will be a return to the policy of specialization.

II. *The Management of Deodar and Chir Pine for the Jaunsar Division, United Provinces.*

Although the working plan for Jaunsar deals with other important species as well as Deodar and Chir Pine, yet these two are the ones for which the management is of most importance to foresters in the United States. The management of Deodar should give a few valuable suggestions for the management of Douglas Fir, whereas the method of treating Chir Pine should give us ideas on how to treat Western Yellow pine. The plan about to be discussed was made by Mr. P. H. Clutterbuck, in 1900.

The Deodar (*Cedrus Libani* or (?) *Deodara*). The Deodar is without question the most important timber tree of the Himalayas. This is not on account of its abundance, although it covers a wider range of elevations than any of its associates, the Blue Pine (*Pinus excelsa*), the Fir (*Abies Webbiana*) or the Spruce (*Picea Morinda*). The reason for its importance is because the wood (heartwood) possesses a certain oil which makes it proof against the attacks of white ants. On account of this property Deodar is one of the woods most in demand throughout India for any form of construction which comes in contact with the ground, and particularly for railroad ties. The demand is greater than the supply.

For the proper understanding of the management of Deodar it will be necessary to give a brief description of some of the more important silvical characteristics of the tree. In general appearance this tree has no counterpart in the Southwest of the United States. Its most characteristic features are its flat, gracefully spreading branches and its short delicate needles, making it a tree of considerable aesthetic value. In the open the crown is conical with a broad base. It has a tendency, however, to grow in rather close groups in which it prunes itself well but is liable to be drawn up too much and become too tall and spindling with too small a proportion of crown. In this condition young poles are very liable to damage by snow break. Mature trees, however, which have grown in rather close stands have fine long clear cylindrical boles, often with a total height of about 130 feet.

The average diameter at breast height in mature stands is 2½ to 3 feet. For an idea of growth the following figures are given (taken from the working plan for the Jubbal State Forests in the Punjab) based on 762 trees (there would have been more trees but for the fact that the very fast and the very slow ones were excluded):

Diameter Inches.	6	12	18	24	30	36	42	48
Age	25	43	63	85	110	136	162	206

This table allows 2 inches in diameter for bark and 10 years for seedlings to reach 4½ feet.

Deodar requires a fairly deep, well drained soil, and grows on warmer, drier situations than any of its associates except perhaps the Blue Pine. It is rather intolerant, though less so than the Blue Pine. Trees suppressed 20 years will not recover. It will start under partial shade, but requires full sunlight for later development. It is considerably more intolerant than our Douglas Fir.

It reproduces well. There is some seed every year, and full seed years occur about every third year. The seeds are fertilized in September and are ripe the following November (a period of 14 months). They lie over the winter and germinate as soon as the snow goes in April. They do not require contact with the mineral soil for germination, but, the roots must be down in the mineral soil before the dry weather of June and July or else the seedling will dry out and die.

The tree is fairly fire resistant, but suffers considerably from snow break. Grazing is particularly injurious to it because the goats nibble the young Deodars in preference to any of the other species found associated with it. The silvical characteristics of Deodar cannot be said to resemble those of our Douglas Fir of the Southwest very closely. But the tendency of both species to grow in pure patches when in mixture with other species and to form pure even aged groups makes the system of management for both very similar.

The system used in Deodar is the group selection, making openings of a maximum size of one chain (66 feet) in diameter. This system is the one best suited to the tree except that the openings should be made larger, a fact which both the Conservator and Divisional Officer recognize and are trying to remedy.

Our Douglas Fir, being more tolerant, than the Deodar would not require such large openings, and it is probable that it would reproduce well with openings up to a maximum of one chain. In the working plan a plan of management is worked out separately for each working circle. Since the method and principles are practically the same in every case, parts of the plans for two working circles will be sufficient for an example.

Plan for the Mundali Working Circle.

The area of this working circle is 14,111 acres of which 3,471 acres are first class forest and the remainder second class forest. The distinction between first and second class forest is that in first class forest all rights have been bought out or cancelled by the Government, or have never existed, whereas in second class forest the people have the following rights:

(1) Timber: Each group of villages has a right to a definite amount of each kind of timber per year.

(2) Fuel: To dry fuel for their own use.

(3) Grazing: Villagers have a general right in second class forest, but the Forest Department can close any part after one month's notice. Generally cut over areas are kept closed for several years after the cutting.

Other minor rights are for cutting grass for their own use, fallen leaves, building stone, torchwood, rights to water, and fishing.

The chief species in this Working Circle is Deodar, with which occurs spruce, fir, oaks, and sometimes Blue Pine.

There are 30 compartments, averaging 470 acres each.

Analysis of the crop (stand):

Protected from Fire.			Not Protected.		
Deodar	3,230	acres	Wooded	783	acres
Spruce and fir	2,627	"	Blank	813	"
Blue pine	124	"	Total	1,596	"
Oaks	4,747	"			
Plantations	129	"			
Blanks	886	"			
Unproductive	772	"			
Total,	12,515	"			

The estimate was made by sample plots aggregating 17% of the area and took in only Deodar of Class M (28"-32" diameter breast height) and Class 1 (24"-28" D. B. H.). It gave:

Class M	8,467 trees
Class 1	8,492 trees
Total	16,959 trees

To find the exploitable age or rotation, stump counts were taken which showed the average age of 28 inch Deodars to be 122 years. It was then argued that during the next rotation the trees will be grown closer which will make them grow more slowly. Therefore to be conservative 150 years was chosen as the rotation. The period of the plan was made 30 years, and the felling cycle 15 years.

A further step was to find out the number of years which will be required for trees to pass from one class into the next class above. This is shown in the following table:

CLASS	No. of years from stumps	No. of years decided on in working plan
Seedlings (up to 5 ft. high)	20	20
5 and under (from 5 ft. high) to 6 inches diameter	19	26
4 (6 inches to 12 inches)	20	27
3 (12 inches to 18 inches)	20	27
2 (18 inches to 24 inches)	25	30
1 (24 inches to 28 inches)	18	20
Total age of Class M (28 inches)	122	150

The rotation decided on for other species is as follows:

Fir and spruce		28"	150 years
Oaks	Moru and Bhan	28"	150 "
	Kharsu	18"	150 "
Blue Pine		28"	120 "

Regulation of the Fellings.

Cutting will be on the group selection system with an area check, compartment by compartment according to the proportion of the annual possibility (see calculation below) which the compartment can provide. The 28" diameter limit must be rigidly adhered to except that trees down to 24" can be removed when necessary to complete an opening.

Other species are to be felled by limiting the number to a proportion of the exploitable classes in the compartment.

Calculation of the Possibility or Annual Cut, for the Deoban Working Circle.

Since there were no data regarding the percentage of trees which pass from one class into another the following per cents were estimated.

95%	of class	M	survive 30 years.		
$83\frac{1}{2}$%	of class	1	become	class	M.
80%	of class	2	become	class	1.
75%	" "	3	"	"	2.
60%	" "	4	"	"	3.
$33\frac{1}{2}$%	" "	5	"	"	4.

These figures are on the safe side so as to favor Deodar. From the above per cents the following are deduced:

66 2/3%	of class	2	become	class	M.
50%	" "	3	"	"	M.
30%	" "	4	"	"	M.
10%	" "	5	"	"	M.
60%	" "	3	"	"	1.
36%	" "	4	"	"	1.
12%	" "	5	"	"	1.
45%	" "	4	"	"	2.
20%	" "	5	"	"	3.
15%	" "	5	"	"	2.

Taking these percentages and the number of years in each class given above, the number of Deodar now on the ground is calculated from the figures obtained by Mr. Hearle in 1888:

Class M in 1900 $(7{,}513 \times \frac{98}{100}) + (15{,}027 \times \frac{12}{20} \times \frac{83\frac{1}{2}}{100})$ $= 7{,}363 + 7{,}513 = 14{,}876$.

Deducting 1,678 trees which have been felled we find 13,178 Class M trees in 1900.

Class 1 in 1900 $= (15{,}027 \times \frac{8}{20}) + (16{,}735 \times \frac{12}{30} \times \frac{80}{100} =$ $6{,}011 + 5{,}355 = 11{,}366$, and so on down through Class 5.

The average annual increment for the whole rotation of 150 years is then found by the following calculation:

$$\frac{\overset{\text{Class M}}{(13{,}178 \times \frac{95}{100})} + \overset{\text{Class 1}}{(11{,}366 \times \frac{3\frac{1}{2}}{100})} + \overset{\text{Class 2}}{(19{,}770 \times \frac{66\frac{2}{3}}{100})} +}{150 + \frac{15}{2}}$$

$$\frac{\overset{\text{Class 3}}{(42{,}577 \times \frac{50}{100})} + \overset{\text{Class 4}}{(117{,}590 \times \frac{30}{100})} + \overset{\text{Class 5}}{(215{,}667)}}{150 + \frac{15}{2}} =$$

$$\frac{12{,}519 + 9{,}472 + 13{,}180 + 21{,}288 + 35{,}277 + 21{,}567}{157.5} = \frac{113{,}303}{157.5}$$

$= 719$ trees per annum increment.

To find the *growing stock,* or number of Class M trees which there must always be in the Working Circle to produce the above increment the following simple formula is used:

$$C = i \times \frac{R}{2} \times L \text{ in which}$$

C = growing stock; i = annual increment; R = felling cycle, and L = loss of trees in Class M due to over maturity and other causes.

Subtstituting we have:

Growing stock $= 719 \times \frac{15}{2} \times \frac{100}{98.75} = 5{,}461$ trees. But we have found above that there are 13,178 class M trees, giving us a surplus of 7,717 trees.

As a matter of judgment it is decided to distribute this surplus over 60 years.

This gives an annual yield for the next 60 years of:

$$\frac{(13{,}178 \times \frac{95}{100}) + (11{,}366 \times \frac{85\frac{1}{2}}{100}) + (19{,}770 \times \frac{66\frac{2}{3}}{100}) +}{60}$$

$$\frac{(42{,}577 \times \frac{10}{27} \times \frac{50}{100})}{60} - 5461 = \frac{43{,}056 - 5{,}461}{60} = \textit{626 trees per annum.}$$

The cut for the next 30 years will be fixed at a maximum of 620 trees per year, of which 100 are to be for free grants and 520 for sale.

The silvicultural system for Deodar can readily be applied to our Douglas Fir and would be without doubt the best system to use under the present extensive conditions in the United States, at least in the Southwest.

The above method of calculating the possibility or annual cut is about as simple and safe a method as could be devised. The principal change would be that volume would have to be substituted for *number of trees* in applying it in the United States.

Part 3.

The Chir (Pinus longifolia).

The Chir is the timber tree of the Himalayas next in importance to Deodar. It occurs at lower elevations than the Deodar and its associates, and forms a belt between 3,000 and 5,500 feet. The value of the wood is far below that of Deodar, simply because it is less durable and not ant-resistant. The ability to resist white ants seems to be the great criterion for woods in India. Unfortunately but very few species, such as the Deodar and Sal (*Shorea robusta*), possess this property, and cannot be grown in quantities sufficient to meet the demand, whereas numerous other species which have not this quality, though yielding a good wood for ordinary construction purposes, are difficult to sell. The Chir Pine however has been introduced and its use encouraged till it is coming more and more into demand for ordinary construction where it will not be placed in contact with the ground. Another use for Chir almost as important as that for lumber, is as a source of turpentine and resin. The resin obtained from tapping the tree is not as abundant or as rich in turpentine as that from our Longleaf pine, but there is enough of it to form a very valuable and profitable industry. The Forest Department is carrying on this industry itself in a very conservative manner under the French system of narrow cuts with a cup and gutter, and is tapping a tree five consecutive years and allowing it to rest ten years. It has a distillery in the forest equipped with practically every modern improvement. When the Department has demonstrated that the industry is a profitable one it will sell out to private enterprise, this being the policy in India in regard to all such industries.

The striking feature about Chir is its close resemblance to our

Southern Longleaf Pine (*Pinus palustris*) and our Western Yellow Pine (*Pinus ponderosa*). Its needles are about the same length as those of our Southern Longleaf only they are thinner and more delicate. The crown is conical and more or less regular up to maturity, after which it becomes flattened and irregular exactly as in the case of our Longleaf and Western Yellow pines. At maturity it has a long clear cylindrical bole. It is not fastidious as to soil and moisture, though it prefers a well drained silicious soil. It grows on the drier situations, though it could not stand the deep sands of the South nor the dry rocky slopes and mesas of the Southwest in the United States because the region in which it occurs has between 50 and 60 inches of rainfall per annum. It is the most intolerant tree of the region. Though it will germinate and grow for a few years under partial shade, yet for later development it requires full sunlight. In this respect it is precisely like our Longleaf and Western Yellow pines.

Reproduction is good on areas protected from fire. There is some seed every year and heavy seed years every third year. It comes in abundantly after cuttings. It is not very fire resistant. Trees were seen 17 to 20 inches in diameter breast high by over 100 feet in height which had been so badly injured by a ground fire that they died shortly afterwards. In this case the area had been protected for 15 years and there was a very heavy accumulation of grass and litter. The growth is slow. It takes 113 years to reach 24 inches d. b. h and 141 years to reach 28 inches. It reaches a maximum of 4 feet 5 inches d. b. h. by a height of 150 feet.

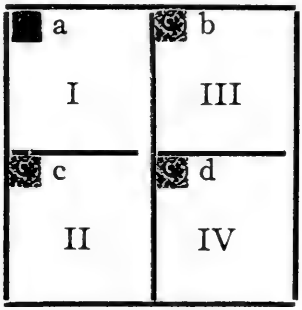
The system required with this tree is one calling for open cuttings, either the group selection system with large openings, or the Uniform Method, an adaptation of Schlich's Shelterwood Compartment System. The Uniform Method is practically the same as the Shelterwood Compartment System with its preparatory cuttings (often omitted), seed cuttings, secondary cuttings (for light), and final cuttings, except that the form of cutting is not rigidly prescribed in the working plan for a given area at a given time. A certain block must be regenerated in a certain number of years, but it makes no difference in what part of the block the cut for the year is located, or what kind of a cutting is made. Thus the officer in charge is left free to attend to the needs of the forest as they arise; to take trees from that part of the forest which needs cutting most, whether as a seed cutting, a secondary cutting or a final cutting. This is a great advantage over the rigid system of dividing the block into compartments and prescribing a certain kind of felling for each compartment for each year of the period, because under the rigid system, at least for Chir, it never works out. The seed cuttings fall in a year with no seed, and the secondary cuttings come too soon or too late, etc. In making the working plan for Jaunsar the Conservator wanted Clutterbuck to divide the whole working circle into 160 compartments (the rotation being 160 years) and prescribe the kind of cutting for each year on each compartment. Clutterbuck refused to do it, and now the Conservator acknowledges that he (Clutterbuck) was right. It is claimed that this uniform method gives excellent results in Chir and there is no reason why it should not give equally good results in Southern Longleaf or Western Yellow Pine.

The important point in the working plan for Chir, aside from the silvicultural system, is the distribution of the annual cut over the area. The important steps are as follows:

(1) A certain rotation is decided upon. In this case it was 160 years. (2) Next, a felling period is chosen which shall be a multiple of the rotation. Here 40 years was taken. (3) The whole working circle is then divided into blocks to correspond to the number of felling periods in the rotation. Four is the number in this instance. (4) The most mature of the four blocks is then chosen to be regenerated in the first 40 year period of the rotation.

On each of the other three blocks improvement cuttings are carried on merely to remove the overmature and injured trees so as to save waste. The working circle would therefore present somewhat this appearance, diagramatically:

Diagram of the Chir Working Circle During the First Year of the First Period.



a Part of Block I cut over under the Uniform Method.
b, c, d 1-40th of each of the other 3 blocks cut over under Improvement Fellings.

After dividing up the working circle into blocks, an enumeration (valuation survey) is made of all class 1 (24″ to 28″ d. b. h), class 2 (18″ to 24″ d. b. h.) trees on Block 1. The number of exploitable trees is found by the principles given above for Deodar, that is by finding the annual increment, the growing stock and the surplus. A certain allowance is then made for trees dying, and the rest divided by 40. This number serves merely as a check on the annual fellings. There is no area check, no division into coupes, etc., but the officer in charge can take the allotted number of trees from that part of the block needing cutting the most.

To prevent having too large a cut during the first period and a falling off during the last three, on account of having the reproduction cuttings on the first block and improvement fellings on the other three during the first period, Clutterbuck suggested that the diameter limit in the blocks under improvement fellings could be changed. During the first period it could be fixed at 30 inches, during the second period at 25 inches, and during the third period at 20 inches. It would seem however that by this system the amount on the blocks under improvement fellings would be greatly reduced until, when the time would come to cut the fourth block there would be a very much diminished yield. It has been suggested by an American forester of a great deal of experience that the same result could be obtained by merely cutting the block with the poorest stand of timber during the first period. In this case improvement fellings on the remaining blocks would be carried on only during the first period. This would undoubtedly be the wiser scheme since probably they would be unnecessary after the first period.

This identical working plan was dwelt upon with special emphasis by one of the most eminent professors of the Yale Forest School as the one Indian Working Plan of all others which was most suitable for application in the management of Western Yellow Pine in the United States. To anyone who has seen conditions in the South West it must be evident that this plan would be hard to improve on, for the present at least.

Conclusion.

During the first few years after the Forest Service in the United States took over control of the National Forests all the energies of the Service had to be concentrated on putting the forests under administration; buildings roads, trails, and telephone lines and enforcing the regulations, often against strong opposition. Now that this work is nearly completed it is time to turn our attention to the making of working plans for these forests. When it is remembered that upon the working plan more than upon any other one factor depends the future welfare of the forest, it will be realized that before starting in we should consider carefully any suggestions which may be derived from the experience of Foresters in other lands where they have been at it a good many years longer than we have, and where the conditions are in some respects similar to our own.

BLACK JACK AND YELLOW PINE.

By B. E. I. Terry.

Although botanists and foresters are unanimously of the opinion that the western yellow pine (*Pinus ponderosa, Laws,* or *Pinus ponderosa scopulorum,* Engelm., in the Rocky Mountain region) and the form known as "Black Jack," or "Bull Pine," are one and the same species in different stages of development, lumbermen and timber cruisers are almost unanimous in holding that they are separate species. The latter base their claim on the difference in the general appearance of the two forms,—the black rough bark of the black jack as contrasted with the smoother yellow bark of the mature pine, the bushier crown and the difference in the wood. That of the black jack is heavier, coarser-grained, and much more sappy than the wood of the yellow pine, while the knots are loose and surrounded by a ring of pitch, whereas those of the yellow pine are sound. In proof of their assertion that a tree "once a Black Jack is always a Black Jack," they will point out or refer to trees that have attained the average maximum size of the yellow pine,—3 or 4 feet in diameter on the stump,—but which still retains all the characteristics of the black jack.

The forester usually defines a black jack as an immature yellow pine, generally less than 150 years old. Although this definition is substantially correct, the cause of the distinguishing features is to be found in the vigor and rapidity of growth, age being more purely a relative matter. So long as a Yellow Pine grows rapidly and vigorously it will remain a Black Jack. A typical Black Jack in the Rocky Mountain region attains a diameter of 20 inches on the stump (18 inches high) at the age of 100 years. I have examined the stumps of a number of trees of that size, which were still growing vigorously, as shown by the wide rings next to the bark, the large quantity of sap and the small proportion of heartwood. A few rods from a specimen of that kind I counted the first hundred rings of a tree which had the characteristic bark of the mature Yellow Pine, but was only 9 inches in diameter on the stump and had attained only 6 inches when 100 years old. The rings in the sapwood beyond the hundredth were so fine that they could not be counted without the aid of a magnifying glass. In this case the reason for its slow growth was obvious,—it had been a suppressed or partially suppressed tree. The aging of most Yellow Pine that have reached maturity without attaining large size may be attributed to suppression, during at least the first 50 or 100 years of their life, although the overtopping trees may have long ago disappeared.

The average age of a mature Yellow Pine, four feet in diameter, appears to be, in the Rocky Mountain region, about 400 years. I have not found the stump of a Black Jack of those dimensions, but have seen specimens nearly or quite that size in the yellow pine forests of Arizona. Doubtless such a tree, if cut down, would reveal an age much greater than 150 years, but still young when compared with the 400 years of the mature Yellow Pine,—probably 250 or 300 years. Its outer rings would still be of fair width, denoting that vigorous growth had not yet ceased. The sustained vigor and rapid growth of large-sized Black Jacks is undoubtedly due to exceptionally favorable conditions of position and environment. Ordinarily the growth rate greatly declines before the 150th year, and then through a period of 50 to 75 years the tree gradually changes to the mature, or "Yellow Pine" state. A tree in this transition stage is easily recognized and is known to the lumberman as "bastard pine." Trees of small size with yellow bark, which the lumberman may point out as young yellow pine, will invariably be found, if cut, to have grown very slowly and to be of comparatively great age,—usually much older than thrifty Black Jack several times their diameter. Their slow growth is due to suppression or some other unfavorable condition. None of the characteristics which distinguish the two forms are specific differences, but are due to the difference in vigor and rapidity of growth.

THE DISSEMINATION OF JUNIPERS BY BIRDS.

By Frank J. Phillips.

The importance of birds in tree seed dissemination has long been apparent, but, so far, very little definite work has been done in measuring this influence, and most of what has been done is entirely secondary to some other phase of special investigation. The prime importance of such dissemination is partially apparent in the more or less indefinite statements in the literature of the last fifty years and it is largely these miscellaneous statements and the lack of special investigation that induced the writer to undertake this study.[1]

The field work is the result of six years' observations and embraces regional studies in Michigan, Indiana, Illinois, Nebraska, South Dakota and New Mexico, as well as data from other regions which have been supplied by observers along this line. All the available literature has been consulted as well as the U. S. Biological Survey and many prominent state ornithologists.

Importance of Bird Dissemination.

Out of the widely various means by which seeds are distributed through animal agencies, that by birds is without doubt the one most prolific of widespread results. Birds eat an almost incomprehensible amount of seed from herbs, shrubs and trees, and because of their rapid flight are the quickest means of seed distribution by animals. In the usual forest or forest encroachment condition, the influence of this bird activity is at a maximum, since the great majority of our birds frequent trees and many species habitually feed upon tree seeds and fruits, while many others feed upon them when driven by hunger. Furthermore, the ground beneath the forest is, as a rule, much more suitable for seed reception and germination than a treeless area and hence a larger proportion of seed germinates and grows to maturity than would be the case on a non-forested area where the seeds usually

[1] Kobbe treats the subect in a chapter of his "Birds in Their Relation to Forestry," an unpublished thesis, Yale Forest School, 1904, but his results are necessarily limited because of the inclusive nature of his subject.

fall on a site unsuited to their germination, or, if dropped on a suitable site, as on a cultivated area, the resultant growth is likely to be cut down. Birds, then, by their preference for forested areas usually distribute the seed in a good position for the development and maturing of the plant.

Avial influence in tree seed dissemination is frequently apparent and most easily studied in fruit orchards, forest plantations, and cultivated fields or other cleared areas, since such areas are usually so segregated as to allow of definite conclusions as to the method of seed introduction. In many instances, however, the undergrowth of a forest and even the forest itself may be directly traced to bird influences. The dissemination of seed over cleared lands is of importance in measuring the spread and regeneration of forest areas, while studies in naturally stocked stands are of importance in determining natural changes of type and the resulting improvement or deterioration of the stand arising from this change. Both lines of study are necessary for a definite determination of the importance of bird influence.

Since the genus Juniperus possesses such a wide range of distribution, of habitat and of economic uses, it was selected as being probably the most valuable species illustrative of the desired information. Over large areas it is a genus of great economic importance, and everywhere, over such areas, the work of the birds has been a considerable factor in maintaining and spreading the stand.

General Factors Affecting Juniper Dissemination.

Because the juniper fruit matures in fall and clings to the tree until late in the following spring, it furnishes one of the best natural supplies of bird food, and it is readily apparent, moreover, to any one making observations even during a single season that it is eaten by a large number of bird species and a countless number of individuals. The distribution of the seed by the birds is increased because of the dark purple color and whitish bloom of the fruit, which makes it readily discernible even at considerable distances. Moreover the persistent fruit remains available when weed seeds and other seed of the herbaceous type are covered by snow. The size of the berries, which range from 0.17 to 0.25 inches with an average of about 0.2 inch in diameter, has some slight effect on their dissemination, since they are more easily seen in the ground litter than a smaller seed would be. Repeated observations show that the Cedar Bird (*Ampelis cedrorum*) eats the berries from the ground litter beneath the juniper trees.

The desirability of the juniper fruit as food is manifestly of importance. Roughly stated, the protein amounts to 4-6%, the sugar from 10-30%, and the starch and cellulose from 12-20%. Besides these ingredients, there is volatile oil, various acids and mineral substances, all of which combined make a food of high nutritive value. Birds, because of a temperature higher than that of mammals and because of their extreme activity, need a rich food and a rapid digestion. Such food is found in the juniper berry, and its rapid passage through the digestive organs of the bird before germinative power is affected is helpful to its wide dissemination.

Dr. E. A. Mearns experimenting with a caged Bohemian Waxwing (*Ampelis garrulus*) found that more than 900 berries of *Juniperus scopulorum* passed through the bird between 9.00 A. M. and 2.00 P. M. An observation of this kind has much more value than the ascertainment of the mere number of seeds found in a bird's stomach when it is killed. It is the rapidity with which the seeds are eaten and cast out which bears most directly upon the value of birds in seed distribution.

Although the juniper berry is an important winter food, the results of autumnal distribution seem to be fully equal if not greater than those of winter. During the fall, several instances were noted of robins feeding on a single cedar tree in flocks of twenty or more. Other instances were noted in which cedar birds were feeding in flocks of fifty or more, and consumed all the fruit on a juniper tree in a single day. Robins have been noted still feeding on the berries of *Juniperus virginiana* as late as June 21, and it is believed that more extended observation would show that the berries are eaten throughout the summer.

Work of Mammals.

In several states, the smaller mammals are credited with considerable work in the dissemination of the juniper. In Texas, according to Prof. Bray, the food of raccoons, foxes, wildcats, chipmunks, etc., contains a large amount of juniper fruit and the seeds are often found in the fæces of these animals. He finds these animals feeding on the berries as long as they last, usually from November first to March first, and considers that mammal-scattered seed are left in a somewhat better condition for germination than are those scattered by birds.[1] In New Mexico, Mr. J. C. Blumer tried germinating such seed but secured no results. In South Dakota, observations made by the writer show that the chipmunks and other squirrels feed on the berries in very limited amounts, four chipmunks being observed feeding on the fruit of the cedar and their mouth pouches found to contain 14, 36, 39 and 51 berries respectively. In New Mexico and South Dakota, it seemed that not more than one to two per cent. of the distribution of the juniper was due to small mammals and reports from nearly every region in the United States point to a very limited distribution by mammals as compared to that by birds.

Dissemination in Natural Stands.

To maintain a species of a stand of timber under natural conditions it is necessary that reproduction replace the growth that is destroyed in the struggle for existence, and also establish new growth upon areas suitable for the species but not occupied by it. The weight of the juniper berry and its lack of special appendages prevent its spread except to a very limited degree by gravity and wind. In dense stands such as occur in Tennessee and the "cedar glades" of Texas or Florida, the effect of the birds is at a maximum for not only do the trees furnish a large supply of food but the number of bird species and individuals, both residents and migrants, frequenting these regions throughout the year aids in bringing about a maximum of seed dispersal. Because of the density of the stands, however, there is greater difficulty in determining the amount of seed distributed by birds and that distributed by other agencies. A rough estimate based on the observations supplied by southern investigators places the bird distribution at 60-70 per cent. of the total. This may, however, reach even 80-90 per cent. over large areas.

A good example of this influence is to be seen in the reproduction of *Juniperus virginiana* south of a meridian passing through Maryland and Kentucky, where it grows characteristically beside uncared-for fence rows and, in some cases, the rows of trees are

[1] A case of a herd of cattle, being brought from Texas and being harbored for a few days in the treeless part of Kansas, giving rise to a small juniper plantation came under observation of the editor some years ago.

so regular as almost to convince one that the trees were planted by man. So universal is this growth, that long lines of cedars often indicate the boundary lines of tracts from which the fences have long disappeared. In many cases, along the roadsides where the growth has not been cut down these trees extend a mile or more and have been trimmed to serve as a decoration, while many have been thinned out and used for fence posts. The frequent appearance of all or a majority of these juniper trees on one side of the fence is usually due to the birds facing the wind at the time when the seed is excreted.

Granting the influence of the birds to be at its maximum over the large stands of juniper, such as occur in Texas, and Florida, it is pertinent to consider reproduction over other areas as an index both for the regions where the species is less prominent, as well as where it reaches its best development. In these regions, the isolation of a single tree or a single stand permits greater accuracy in determining the value of bird dissemination than sample plots in the dense stands. Care was taken to obtain detailed observations in natural forests, forest plantations, fruit orchards, old meadows and fence rows and the percentage of growth resulting from bird distribution in comparison to that which was of doubtful distribution was especially noted.

Dissemination in Northwestern Nebraska.

As a basis for work in this region, it was decided to select steep slope land over which the influence of gradient would be most pronounced in affecting dissemination. Very careful consideration was given to slope as well as other influences which might prove to be factors in distribution. Doubtful cases were classified among those which do not arise as a result of bird influence. The study was made in the vincinity of Glen, Sioux County, Nebraska, over a Box Butte formation. The precipitous hills have an altitude of 400 to 700 feet above the level of White River and are everywhere cut into abrupt valleys or canyons.

The juniper in this locality was once more common than at present but has been cut largely for posts and occurs now as a minor tree in a scattered stand of western Yellow Pine. At present, the juniper is found most commonly at the heads of the deeper and more inaccessible canyons. In such places there is still a small amount of material suitable for post timber, but the majority of mature trees range from 20-30 feet in height and are too branchy for such use.

The presence of the older trees at the heads of the canyons brings about the chance for dissemination of the seeds by gravity, down the slope and down the canyons. Nevertheless, it is apparent from the study that the difference between the influence of slope and that of birds in the distribution of the juniper is in favor of the birds. On a sample plot of approximately 100 acres 56% of the junipers occurred directly beneath the crowns of Western Yellow Pine, 17% occurred beneath or close to juniper trees capable of bearing seed and 28% occurred in open spots where it could not be determined whether the dissemination was due to birds or to gravity. Since the slope was abrupt, it was considered that a large percentage of the juniper growing in the open had originated from seed which was not carried by birds, although probably they carried many of the seed which produced these trees.

The pine trees under which the juniper reproduction is found are usually within a few rods to a quarter of a mile of the parent juniper, but the item of greatest importance is the fact that most of the reproduction resulting from the bird work is up the slope from the parent junipers.

Another interesting series of cases was found on several different tracts of 3 to 5 or more acres, over which there were only one or two mature juniper trees. In no case was any reproduction found beneath the juniper trees or for very considerable distances down the slope, while a large number of cases were found in which the young junipers occurred directly beneath the pine. Over such areas as this, it was easy to see that the entire reproduction was due to bird work.

Dissemination in the Black Hills.

The Black Hills region of South Dakota reveals an equally instructive lesson. The notes on this region refer to rolling table lands in which the slope influence was too limited to be noticeable in affecting reproduction.

According to Professor Graves[1] "the distribution of red cedar

[1] Black Hills Forest Reserve, Nineteenth Annual Report, U. S. Geological Survey.

is interesting. It is found on high pinnacles above Castle Creek, at an elevation of 6,000 feet; on the high divide above Spearfish Canyon; on the high limestone plateaus above lower Spring Creek; and it finds its greatest development on the brakes at the edge of the prairie. At high elevations it is small, and only scattered individuals are seen; at the edge of the prairie, it is often a foot in diameter and is largely used for posts and rails. In Wyoming, on Pine Ridge and in the Inyankara country, it occurs in intimate mixture with yellow pine." Owing to inability to reach any of the areas in South Dakota where the juniper was of commercial value, the prosecution of the work was confined to an area near Pringle, South Dakota, where the red cedar may be said to have almost no economic importance, yet where it plainly illustrates the influence of birds as an active factor in its dissemination throughout the entire region.

On one sample plot of approximately 60 acres 86.2% of the junipers occurred directly beneath pine trees, 2.6% occurred beneath other junipers and 11.2% occurred in the open.

Again, on a tableland formed by a series of high hills, an area of approximately 100 acres was found over which there had been a severe forest fire in 1901 which had apparently destroyed most of the ground litter and practically all reproduction up to three inches in diameter. The overstory of *Pinus ponderosa,* occurring in a stand of 3,000 to 4,000 feet B. M. per acre was slightly injured but still formed a fairly dense crown cover for that region. The results as shown in Table No. 1 are indicative of the work which may result from bird influence.

TABLE NO. 1.

—Burned Area—

Entirely Bird Dissemination.

Distance of juniper from base of pine in feet:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
No. of Junipers:	17	21	26	29	25	31	21	11	16	7	4	7	4	1	3	0	1

As stated above, this area was burned over in 1901, and practically all of the undergrowth was destroyed. The junipers were introduced since the fire entirely by birds, and according to twenty measurements in 1905 had an average height of 6.2 inches.

Dissemination in Natural Forests in Illinois.

In northern Illinois one case was noted in which the juniper berries had been transported more than one-half mile by the cedar bird (*Amelpis cedorum*) to a forty acre woodlot which was being used for pasture. The growth of the juniper in the form of round, densly-topped trees, branching closely to the ground was injurious to the growth of the grass to such an extent as to demand the cutting of the junipers. Since the juniper has been cut out the work of the birds still continues and the encroachment of this species seems to be even more rapid than it was before the first growth was cut.

A similar case may be cited in Stephenson County, where dissemination has resulted from a compartively few seed trees. Thirty years ago, the Red Cedar grew naturally upon the banks of Yellow Creek in small amounts confined almost entirely to the bluffs which border the creek. Since that time, however, the dense growth of hardwoods has been continually culled with the result that the seed carried and deposited by birds has had a better opportunity for growth because of improved light conditions and larger space. Over such culled areas, the junipers are found to be growing singly or in groups directly beneath the branches of the hardwoods but they do not occur to any appreciable extent in open places. In very dense stands where little cutting has taken place, the growth of juniper is scarcely noticeable and that which does occur is stunted in growth. The lack of reproduction, at least over portions of these densely forested areas, seems then to be due to the density of the overstory, since the birds probably have deposited as many seeds upon such areas as upon those in which light conditions are more favorable.

Another element in this locality which favors juniper growth is the closeness of the limestone to the top of the soil. It is often not more than 6-10 inches to a bedrock of limestone which has a depth of 18 to 25 feet. The reproduction is, however, much better along the banks of Yellow Creek than over adjoining inland areas and in many instances forms a growth with almost perfect density. A survey of one-fourth of an acre running parallel to the stream and close to the bank in the shape of a rectangular sample plot 165 feet long by 66 feet broad gave an overstory of 62 hardwoods ranging from 50 to 70 feet in height with an understory of 134 Red Cedars ranging from 1 to 8 feet tall and 55 Red Cedars ranging from 8 to 14 feet tall with a diameter breasthigh of 1 to 3 inches. All these junipers occurred directly beneath the crowns of the hardwoods.

Another survey of a similar one-fourth acre sample plot, commencing about 5 rods from the creek and running at right angles to it, was taken to show what was considered the average difference between the reproduction along the creek banks and that occurring on higher ground. On this sample plot there was an overstory of 103 hardwoods with 68 Red Cedars ranging from 1 to 9 feet tall and 17 Red Cedars ranging from 8 to 13 feet tall with a diameter breast-high of 1 to 3 inches. These junipers like the preceding were directly beneath the crowns of the hardwoods.

Growth of Juniper on Poor Sites.

The value of the various species of Juniperus on poor sites is of high importance. Practically all the species are capable of withstanding severe conditions, and it is probable that this genus will be used to a considerable extent on poor sites as the work in forestry progresses. Along the dune region of our coastal areas, as well as along that of the Great Lakes, *Juniperus communis* is a valuable species as a soil binder. *J. virginiana* is also of considerable value from the same standpoint.

A three weeks study of the sand dune region bordering Lake Michigan, and extending over the area from Michigan City, Indiana to Holland, Michigan, furnished convincing proof that at least 60 to 85% of the growth of *J. virginiana* and *J. communis* resulted from seeds disseminated by birds. Notes were made regarding the existence of both species as undergrowth beneath large deciduous trees. In most cases, only one to a few seedlings were found beneath each tree. Near Benton, Michigan, 32 Red Cedars were found beneath a large White Oak. This reproduction ranged from three inches to two feet in height. Another case was noted near Holland, Michigan, in which 26 seedlings, ranging from two to fifteen inches in height were found growing beneath a poplar (*Populus deltoides*). In the first instance, the soil was a light sandy loam, while in the second, it was pure sand of a decidedly non-fertile nature. More striking cases were found in New Mexico on poor sites where fully 90-95% of all the reproduction of *Juniperus monosperma* and *Juniperus pachyphloea* was the result of bird work. Brown[1] obtained somewhat similar results in the bluff societies which border the Huron River in Michigan.

Bird Dissemination in Forest Plantations.

The study of bird dissemination in forest plantations was made in Illinois, which, owing to the large number of plantations, the rich soil, the presence of numerous birds and the lines of bird migration which pass through the State, may be considered one of the best states for a prolific study. Considering the scarcity of native junipers and the bird dissemination which has come from the few specimens of planted juniper or of those introduced by birds, this reproduction becomes still more significant. The line of investigation covered 1,200 miles which was traveled in a circuitous trip commencing near Springfield and extended in general, over the two exterior tiers of counties back to the point of beginning. Out of a total of 69 plantations studied, 37 showed marked results in growth of juniper and other heavy seeded species introduced by birds, while out of the remaining 32 groves, 31 were used as pasture lots for cattle, horses or hogs. This pasturing not only prevented all reproduction but in many cases proved injurious to the large trees in the plantation. The single remaining grove was only two years old and could not be expected to show results.

A silver maple grove situated four and one-half miles northwest of Rockford, Illinois, showed the most marked effect. The grove was set out in 1872 with the trees in rows, 6 x 7 feet apart. At the age of five to six years, the trees were all well pruned of shoots and low branches. During the last ten years, a large number of trees have been cut out for fuel and the present stand is estimated to have a density of .6, an average height of 60-65 feet and an average diameter of 7 inches. The tract is 520 feet long by 270 feet broad and the reproduction which was due to birds is as follows:

	Number.	*Height.*
Juniperus virginiana	186	6 inches to 8 feet
Prunus virginiana	26	1 foot to 4 feet
Asparagus officinalis	25	6 inches to 4 feet

[1] A Botanical Survey of the Huron River Valley, Bot. Gazette. Vol. 40, p. 264.

Another example of bird work is to be found on the Gillis farm near the town of Chambersberg, Illinois. Mr. Gillis has a row of eight cedar trees in front of his house from which the cedar birds (*Ampelis cedrorum*) have carried seeds a few rods to a large elm. The reproduction beneath this elm consists of 180 red cedar trees varying from 1 to 5 inches in diameter and from 10 to 16 feet in height. The reproduction covers 240 square feet. This practically represents the area of the crown cover of the elm, but owing to the effect of a moderate slope upon which the elm is situated, the seed have rolled or been washed by surface water slightly down hill so that the area of reproduction does not fall exactly beneath the crown cover.

Dissemination in Orchards and on Old Fields.

Orchards and old fields present valuable sources of information. Out of hundreds of such areas noted, it may be conclusively stated that the introduction of *Juniperus virginiana* was due entirely to birds. Cedar birds are more at rest in orchards than in the forest and this may account for the growth of a larger percent. of junipers beneath orchard trees than beneath forest trees. Such areas are most frequently noted by laymen and reports from every state east of the Mississippi River show that bird work is prevalent over such areas. A study of such dissemination made at Portage Lake, Michigan is shown in Tables 2 and 3. The fruit-bearing red cedar trees which form the centre of distribution occur about the shores of the lake and are close to the water's edge. According to authentic local report, there were very few red cedars in this locality forty years ago and most of these were confined to the immediate border of the lake. The zone-like distribution from this centre is well shown in an apple orchard of approximately ten and one-half acres which is within one-fourth mile of the Lake. The orchard is level, has a compact ground cover of sod and has been used moderately for pasture. Active cultivation is said to have been discontinued twenty or more years ago and the red cedar has had to fight against sod and the ravages of man and cattle as well as partial shading from the apple trees.

TABLE NO. 2.

Bird Dissemination in Apple Orchard, entirely Beneath Crowns of Apple Trees.

Distance of Junipers in feet from base of apple tree:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
No. of Junipers:	39	21	34	43	46	55	46	44	34	29	17	23	12	8	8	4	2	2	2

TABLE NO. 3.

Bird Dissemination in Apple Orchard.

Number of junipers under each apple tree:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
No. of cases observed:	45	31	17	10	7	4	2	1	2	3	2	2	1	1	0	0	0	0	0	0	0	1	1	1

A somewhat similar feature of bird dissemination is seen in Connecticut and adjoining states where there are many old fields which have been cleared and cultivated for years but have been abandoned for a long time and are now covered by grass and weeds. Such fields are largely used as pastures. Over many of these areas, *Juniperus virginiana* and *Juniperus communis* are known to grow in great abundance. The trees range in age from 1 to 40 years and frequently occur where there has not been any tree growth for probably a hundred years. There is absolutely no evidence to show that this growth has resulted from the introduction of seed by gravitation, man, or any agency other than that of birds. On the other hand, there is excellent reason for the belief that this dissemination is due entirely to birds such as robins and others of a similar feeding class. Robins[1] are known to be persistent feeders on the junipers during the spring and fall and are also noted as being ground feeders at the same time. During this study, robins were seen to feed upon the junipers and then to fly to pasture lots where they commenced diligent search for other food. Dissemination of Juniper would naturally result. The birds were seen to excrete seeds of juniper while they were feeding or resting on herbs or shrubs.

[1] "The Food of the Robin"—Bull. 43, Ohio Exper. Station.

Summary.

1. Birds are responsible for most of the dissemination of the junipers.

2. The work of the birds is at a maximum where the juniper occurs in dense natural stands.

3. Birds are of great importance in distributing juniper seed upwards on slopes and up stream courses.

4. General observations made throughout the study seem to point to the dense southern stands as a centre for the dissemination along the lines of bird migration. Such dissemination is especially apparent along stream courses. The subsequent growth of the juniper also seems to have succeeded best wherever it occurs over limestone areas.

5. The height of the tree directly influences the amount of reproduction beneath it, other things being equal, since birds prefer the larger trees.

6. The unexplained growth of juniper over old fields is probably a result of bird work.

7. Mammals distribute only a small proportion of juniper seed.

8. The influence of birds in distributing juniper is not to be measured by the number of seeds which are found in the birds' stomachs but rather by the rapidity with which the seed are swallowed and excreted.

9. The lines of bird migration, number of birds, prevalence of juniper berries and scarcity of other bird food are undoubtedly factors which affect the distribution of the juniper.

10. The exact influence of birds in hastening the germination of the juniper seed and in increasing the certainty of germination over seed not distributed by birds is a field for future study.

Birds That Have Been Found to Eat Juniper Berries.

U. S. Biological Survey.

Juniperus—species indeterminate.

Canachites canadensis—Canada Grouse.
Corvus brachyrhynchos—Common Crow.
Empidonax trailli—Traill Flycatcher.
Oreortyx p. plumiferus—Plumed Quail.
Pedioecetes phasianellus—Sharp-tailed Grouse.

Juniperus communis:

Merula migratoria—Robin.
Parusatricapillus—Black-capped Chickadee.

Juniperus sabina:

Tyrannus tyrannus—Kingbird.

Juniperus scopulorum:

Ampelis garrulus—Bohemian Waxwing.

Juniperus utahensis:

Meleagris gallopavo—Wild Turkey.

Juniperus virginiana:

Ampelis cedrorum—Cedar waxwing.
Carpodacus purpureus—Purple Finch.
Corvus brachyrhynchos—Common Crow.
Colaptes auratus—Yellow-shafted Flicker.
Dendroica coronata—Myrtle Warbler.
Dryobates pubescens—Downy Woodpecker.
Hesperiphona vespertina—Evening Grosbeak.
Hylocichla guttala—Hermit Thrush.
Lagopus leucurus—White-tailed Ptarmigan.
Merula migratoria—Robin.
Mimus polyglottos—Mockingbird.
Passerella iliaca—Fox Sparrow.
Pinicola enucleator—Pine grosbeak.
Sayornis phoebe—Say's Phoebe.
Sialia sialis—Bluebird.
Sphyrapicus varius—Yellow-bellied Sapsucker.
Tyrannus tyrannus—Kingbird.

CURRENT LITERATURE.

The Influence of Forests on Climate and on Floods. By Willis L. Moore, Chief of the U. S. Weather Bureau. Washington, 1910. Pp. 38.

This report, lately transmitted to the Committee on Agriculture in the House of Representatives, is an important, a useful, and at the same time a mischievous publication. It is important because it brings the discussion of an academic subject (for it is still academic) directly into the political arena. It is useful because it properly inveighs against the irresponsible lucubrations of ill informed people, against the "false reasoning and mistaken statements of well meaning enthusiasts," and effectively lays bare their ignorance. Yet, it is mischievous because it does precisely what these promulgators of ill-supported theories regarding forest influences have done, namely, select the statistics which support their theories and leave out the others. It is furthermore mischievous because, in spite of the assurance of the author that he will not be dogmatic and "reserves the right to change or still further modify his views," his conclusions will be accepted as dogmas and as proved facts by Congressmen and newspaper writers, and by all those who are fishing for arguments against the forest reformers. Indeed, these will go a step further, they will overlook the saving clauses which the author here and there puts in, and proclaim that the whole idea of forest influences is "bosh." As a matter of fact, in spite of the author's disclaimer of partisanship, it becomes more than once evident that he is biased. This crops out especially in the short reference to the effect of forest destruction on erosion.

Altogether, instead of concluding what, we believe an unbiased observer would have to conclude after a full survey of the field, namely, that we know too little to be positive one way or the other, he makes such a positive statement, as that "the runoff of our rivers is not materially affected by any other factor than the precipitation," which is, of course, not known, and philosophically hardly tenable. Several other bald conclusions could be cited which no thoughtful student of the data would accept in their baldness.

With many positions which the author takes, we are, however, in hearty sympathy, and are glad that he has undertaken to smash the false prophets of forest influences, who are dealing in broad generalizations.

We have always claimed that the arguments for forest conservancy as far as they refer to the influence on climate, and to some extent on waterflow, were skating on thin ice. There are however, we believe, data extant from France and Germany, which would make us hesitate to assert that under certain topographic and geologic conditions the forest cover had no influence on the run off.

As to the United States, and especially in the river basins which have been referred to in this controversy (the report is made as a rejoinder to several articles appearing in the report of the National Conservation Commission), we hold that, while much of the forest area has been *commercially* destroyed, there is nowhere such a denudation as to produce appreciable influence on the run off, a denudation such as we know in Italy and France, the effects of which can hardly be denied.

There is a grim joke, just now with the recent disaster of Paris in mind, in the quotation from Belgrand's report on the floods of the Seine river, which seems to prove that deforestation has decreased the height of floods.

We agree with the author that the argument of continued wood supplies is or should be the foremost one for foresters, but we would extend our consideration to those forests in particular which clothe the steep mountainsides and cover the thin archaean rocks, as in Canada, for the mere forest influence; for, these once destroyed, we know leave rocky barrens.

The fictions of those asserting broadly the salutary influence of forest cover were at least working for good. It is to be hoped that the mischief which this truth seeker has wrought will not swing the pendulum of forest conservation too much in the wrong direction.

B. E. F.

Report of the Superintendent of Forestry and Irrigation for 1908-1909. Department of the Interior, Ottawa, Canada. 1910. Pp. 96. Illustrated.

According to this report the forest area of Canada may be put at 500 to 600 million acres with a stand of as many billion feet. The fact is accentuated that this is a mere guess and that information of any value will be lacking until forest surveys are carried out systematically by the federal and local governments. The collection, by departmental coöperation, of annual statistics as to the timber production of Canada in detail is urged also.

Attention is again drawn to the lack of definite information regarding the extensive district under federal administration lying between Hudson Bay and the Rockies—a district of some 400,000 square miles. An annual appropriation of $20,000 for ten years is urged for the necessary exploratory forest survey.

The forest reserves proper comprise some ten million acres with some seven million acres of national parks. Forest surveys of these reserves have been continued so that up to date some one and a quarter million acres have been gone over in detail. The showing is not a good one. The survey of the Riding Mountain Reserve (one million acres) show it to be about 20% timbered with a stand of 210 million feet, 20% of which is White Spruce and 54% Poplar. The condition of the Pines Reserve (93,000 acres) is summed up thus: "Thirty years ago the reserve was heavily timbered; twenty years ago tie contractors left a heavy slash; following these, fires from the railroad and settlements swept it clean, until now there is not an acre left but is burned over or cut over. Scattered in patches there are 45,000 cords of fuel, one-third dead. This supply will not last ten years, and the whole tract is unsuited for agriculture." Recommendations are made for the continuance of similar investigations, especially of the eastern slope of the Rocky Mountains, and for the enlarging of some of the reserves.

The working of minerals within the forest reserves is subject to special restrictions in addition to the usual mining regulations. All applications for mining leases must pass the superintendent of forestry; leases do not carry surface rights, these being acquired by separate restricted lease; all cutting of trees by the lessee and disposal of slash is under the instructions and supervision of the ranger in charge of the reserve; and other regulations exist to minimize the fire danger. Similar regulations exist in the case of mining claims within Government timber limits.

The tree distribution work in the prairie provinces consisted in supplying 2,000 applicants with 2,500,000 trees, mostly hardwoods. General distribution of conifers is expected to begin in 1911, these to be mainly White Spruce, Scotch, Jack, and Lodgepole Pines. The organization has been changed so that applications are now dealt with directly from the Indian Head nurseries.

The hydrographic survey has been given a separate organization and the past season was occupied in inspection work and stream gauging. A full statement of the irrigation problem in the West is given.

The report closes with appended reports of the officials in charge of the different divisions of the Branch.

The work of the past year was conducted with a staff of 40 on an appropriation of $100,000. This is certainly very scant when one considers that United States has a staff fifty times as large and an appropriation of half a million.

On reading the report one cannot help being impressed by its business-like tone. There are no extra words; it is a vigorous statement of plain facts. All through it runs the cry of lack of information and a call for more generous appropriations. The Forestry Branch sees what is coming in the next decade and is anxious to be equipped when the time comes.

J. H. W.

Annual Report of the Department of Forestry for 1908. By C. R. Pettis, State Forester. Fourteenth Annual Report of Forest, Fish and Game Commission of State of New York. 1909. Pp. 84.

The work of the department for the year consisted mainly of protection, reforestation, gathering statistics and investigations at the forest experiment station.

More than one-half of the report is devoted to the discussion of forest fires. These were especially bad in 1908, largely owing to the long period of scant rainfall. 200,000 acres of timberland, 37,000 acres of which is State property, and 170,000 acres of waste land, were burned over. The fire fighting represented 75,000 days' labor costing $200,000, with a loss of three-quarters of a million dollars in timber and $45,000 in buildings. The main causes of fires were locomotives, land clearing and campers. The weakness of the protective organization lies mainly in the lack of patrol for prevention—the organization being more for fighting fires—and in the fact that the fire wardens are paid only for actual fighting. In April, oil-burning locomotives will be installed on lines through the Adirondacks. A lookout system similar to that of Maine should also be established. The fact that forestry cannot begin till the protective system is perfected is accentuated.

The mill statistics gathered showed a cut in 1907 of one and one-quarter billion feet worth 24 million dollars, hemlock, spruce and pine leading. A curve of annual production for the last 18 years shows a steadily increasing cut and more and more spruce going into pulp. The cut is much in excess of the annual increment.

The work of reforesting State lands was carried on as in previous years, only the operations were more extensive. No new plantations were begun, merely extension of former ones. Two new nurseries were established and the forest experiment station extended. About a million trees were planted in 1908, one-half of which were imported. The system of nursery practice and field planting is described (for full details see Bulletin 76, U. S. Forest Service). A new departure is the furnishing of citizens with trees at cost to be planted under the directions and regulations of the Commission.

Reforestation work has reached a high standard of efficiency in New York State, but other branches of forestry are at a standstill. The absurd restrictions imposed by the present constitution absolutely prevent real forestry practice—in fact the present policy is *destroying* the forests on the 1,655,000 acres of State land.

The report contains in addition the regular official returns. As usual it is generously illustrated.

J. H. W.

How to Grow and Plant Conifers in the Northeastern States. By C. R. Pettis. Bulletin 76, U. S. Forest Service, Washington, D. C. 1909. Pp. 36. Illustrated.

"The information in this bulletin is derived from seven years of nursery and planting operations at the New York State nurseries in the Adirondacks and from studies of planting in New England." Therein lies its value.

General directions are given for the collection of fruits and the after treatment of curing, drying, threshing, etc., to secure the seeds, with the modifications necessary for different species.

Next, the subject of nursery practice is gone into. The factors determining the establishment of a nursery and influencing its location are discussed, its shape, the questions of soil, fertilizers, etc. To produce 75,000 four-year-old transplants annually, the writer suggests two acres in order to have a rotation of two-thirds in trees with a soiling crop on the other one-third. Full details are given for the construction of seed and transplant beds, seed boxes and covers, shade frames, etc. The methods of treatment of seed beds, seedlings and transplants, both in summer and winter, are given. All these constitute a summary of experience. In the case of White Pine, the writer favors transplanting seedlings after two years and planting out when three or four years old. Such vigorous trees as the latter are necessary only in very unfavorable conditions of ground cover. Often in southern New England the first year seed beds are soaked down and seedlings picked out for transplanting till 50 to 75 per square foot remain; seedlings and transplants are then planted out after another year.

The planting work is fully discussed and the importance of organization (as also of the nursery work) from the standpoints of efficiency and low cost is emphasized. A chronological synopsis of the work of each branch is also given.

The usefulness of the bulletin is greatly heightened by the figures of cost and the appendicatory tables, derived from actual operations. In a given instance, to raise one-quarter million White Pine transplants cost $235 the first year, $87 the second and $475 the third, and $975 to plant these 6 feet apart (200 acres). The operation is then perpetual at an annual cost of $1,772. The initial investment is a matter of local conditions. Reforesting operations in New York gave the following figures of cost of production: 2-year-old White Pine seedlings, $1.29; 3-year transplants, $3.19; 4-year transplants, $3.69 per thousand. To grow and plant 2-year-old White Pine seedlings cost $11.68, $7.47 and $5.19 with 4, 5 and 6-foot spacing, respectively; 3-year transplants, $19.30, $12.35 and $8.58; 4-year transplants, $22.57, $14.44 and $10.03. These figures are from large operations in experienced hands, on a basis of labor at 22 cents, lumber at $25, lath at $4 and 10 per cent. for fixed charges; they do not include allowance for technical advice and supervision, soil rental, or interest on investment. Parallel figures are given for other species.

Other useful and handy tables are given such as nursery area required for a given number of trees and for planting a given area annually, amount of seed necessary, number of seeds per pound, market prices of seeds, cost of collecting, etc. A few figures of labor capacity are also given.

The bulletin is a good one, its value lying in the fact that there are no generalities; explicit details are given for everything, which are the result of practical operations; and the illustrations are not for decorative purposes.

J. H. W.

Native Trees of the Hudson River Valley. By Norman Taylor. Bulletin, N. Y. Botanical Garden. No. 23.

The paper of the above title is one of the two parts of the Bulletin issued as a special Hudson-Fulton Celebration number. The descriptions of the one hundred species enumerated in the paper are non-technical and cover in a general way the leaf, flower, bud and bark characters of the various species. The text is illuminated by twenty excellent photogravures exhibiting the *habitus* of the more common species.

The first half or more of the Bulletin is devoted to descriptions and explanations of the exhibits in the museum conservatories and of the various plantations at the New York Botanical Garden.

C. D. H.

The Mistletoe Pest in the Southwest. By William L. Bray. U. S. Dept. Agriculture, Bureau of Plant Industry. Bulletin No. 166.

In Texas where most of the observations were made, the harmful effects of the mistletoe are the most pronounced between the 96th and 97th meridian. This is a transition zone between the humid and dry climate of the Southwest, and the trees bear evidence of their struggle against unfavorable conditions in their sparse distribution and stunted growth. From this zone westward the mistletoe becomes more varied in form and relatively more abundant, coincident apparently with increasing aridity of the climate. In fact, where trees in perfection are the most difficult to find, they are more than elsewhere subject to harmful infection by the mistletoe. The author suggests as an explanation of this fact, the necessity of full exposure to light for the best development of the parasite; the more scanty the foliage, the greater the opportunity for the mistletoe to spread over its host.

After describing in detail the life history of the mistletoe, the author enumerates thirty-two species of trees which it infects in Texas. He is unable to explain why in some localities a species is subject to attacks of the mistletoe and in others apparently immune. Since the mistletoe attacks chiefly isolated trees or groups of trees, it has never become a forest pest, its injurious effects, from a commercial standpoint, being confined to ornamental trees and this only where trees establish themselves with difficulty. Even in the case of ornamental trees, the problem is to hold the parasite in check, not to eradicate it, since to most people, a few bunches of mistletoe add to the ornamental value of a tree. The author found that painting the infected area with creosote effectually prevented its spread, while asphalt paint and laundry soap were ineffectual unless the infected area was wrapped with burlap. C. D. H.

Year Book of Forestry. Seventh Annual Report of the Society for the Protection of New Hampshire Forests. 1909.

The state of New Hampshire has a well organized and aggressive society for the protection of forests, now nine years old. After presenting a forestry bill to the state legislature for three sessions the Society succeeded in bringing about its passage in May of last year. The act provides for a state forester (the Society had previously employed one for several years) and state fire warden and a town forest fire warden in each town of the state. It provides also for the establishment of state forest parks by the Forestry Commission, under eminent domain if necessary, whenever funds for the same are provided without expense to the state. Through the influence of the Society, the last legislature passed a bill compelling the use of spark arresters on all portable sawmills. (It is not stated whether there is a similar law in regard to locomotive engines.)

Besides a general report of progress, the Year Book contains several papers upon forestry problems notably one by Phillip Ayres suggesting that the state aid town forests in the same manner as it now aids towns in building permanent roads. Several towns already own forests. C. D. H.

Report of Chief Fire Warden of British Columbia for 1909. Department of Lands, Victoria, B. C. 1909.

Three hundred and seventy fires were reported, which burned over 30,000 acres of timber land and 40,000 acres of cut-over lands, destroying or damaging 8 million feet. Of these, locomotives caused 137, settlers 64, campers 56, donkey engines 23, lightning 19, and 71 were of unknown origin. Thirty-three informations for breach of fire regulations were laid and convictions secured in 19 cases, the fires aggregating $800.

The department consisted of 1 chief warden, 36 deputy wardens and 80 assistant wardens, with a total expenditure of $40,000, of which $12,000 was paid for fighting fires (850 men). The vigilance of the fire wardens is shown by the fact that 80 per cent. of the fires were discovered in time to be extinguished before damage was done, and in the convictions obtained.

The chief improvements the past season were in the permit system for clearing land, 2,530 permits being issued and the firing supervised, and in the more thorough inspection of logging engines. It is to be hoped that the patrol system of prevention will be still further developed, with increased powers to the rangers. The problem of slash disposal has not been touched.

J. H. W.

Treatise on the Protection of Forests from Fire. By W. C. J. Hall and B. L. O'Hara. Bureau of Forestry, Department of Lands and Forests, Quebec, Canada. 1909. Pp. 31.

This little pamphlet contains a general discussion of how fires originate and are fought, with general advice to rangers. It is simply and clearly written, and it is to be hoped that it is given a wide distribution, for its function is plainly educational. The day of discussing the *importance* of forest protection in Canada has gone by—one speaks of it now from the standpoint of *necessity.* J. H. W.

Experimental Farms Report for 1908. Department of Agriculture, Ottawa, Canada. Pp. 414.

Among the many reports included in this volume might be mentioned that of the Horticulturist. It contains, among other matters, an article on the forms of winter injury to trees and a brief statement of the condition of the arboretum, forest belts and botanic garden.

The forms of injury discussed are root-killing, bark-splitting, trunk-splitting, sunscald, body injury, crotch injury, killing-back, black-heart, killing of dormant and of swollen buds.

Speaking of the forest belts the report says: "The mixed belts, while very interesting as showing the relative ability or inability of the different species to endure shade, could with the greater knowledge gained after twenty years' experience, be planted now with less loss of good but slower growing kinds. In the mixed belt, for instance, the American Elm, Box Elder, and to some extent the Green Ash have grown so rapidly and formed such a canopy overhead that almost everything else is being killed, or promises to be killed in a short time. One lesson which has been learned is that certain few species would do well together in a mixed belt, and that several good combinations could be made of a few species in each to better advantage than a larger number of species mixed together."

The arboretum contains 3,072 species and varieties, embracing 4,652 specimens, and the botanic garden 2,037 species of herbaceous perennials. Much time is devoted to the construction of records of hardiness, growth, etc., of these species.

On page 345 is given information regarding the present size of 13 species of forest trees planted at Indian Head, Saskatchewan, mostly in 1892.

A more prompt issuance of the report to the public after submission would be a desirable feature. J. H. W.

Indian Woods and Their Uses. By R. S. Troupe. Economic Products Series, Vol. I, No. 1. Published by the Superintendent of Government Printing, Calcutta. 1909. Pp. 273. Price, Rupees 2-12.

The object of the work is to give particulars of those woods which are used or are suitable for specific purposes. Five hundred and fifty-four species are dealt with. The subject matter is divided into two main parts. In the first, the purposes (arranged alphabetically) for which woods are employed and the kinds of wood used for each are given. In the second part the various woods, mentioned in the first part, are described in alphabetical order and the uses of each are also given. There are two appendices giving in the form of indices the vernacular names and the English or trade names and in both cases the equivalent scientific name is given.

From The Indian Forester, December, 1909.

The Andaman Marble Wood or Zebra Wood. By R. S. Troupe. Forest Economy Series, No. 2. Superintendent of Government Printing, Calcutta. 1909.

This handsome timber is *Diospyros Kurzii,* a variegated ebony, the chief value of which is for ornamental purposes, lies in the remarkable effect produced by alternating streaks of black and gray. The monograph deals with the vernacular names, distribution, type of forest, description and size of tree, size of timber obtainable, description of wood, weight, strength, seasoning qualities, method of working and extraction, outturn, demand, price, uses of the wood and inquiries regarding the timber. There is a good plate to illustrate the variations in type of the marblewood, but the distinctive feature of the pamphlet is the actual specimen of the wood, a veneer, which is framed in cardboard and accompanies it. This is the first of a series dealing with some of the more important Indian timbers, many of which are at present insufficiently known in commercial circles. Similar pamphlets will be brought out from time to time and will contain such information as is likely to be of use to wood-merchants, engineers, architects and others interested in the utilization of Indian timbers.

From The Indian Forester, December, 1909.

Forest Protection. By C. A. Schenck, Ph. D.

This excellent outline of Dr. Schenck's lectures on Forest Protection at Biltmore should be in the hands of every American forester. It is divided into two parts, Part A dealing with protection against Organic Nature, and Part B with protection against Inorganic Nature.

In Part A the chapter dealing with protection against man himself discusses the subject of Adverse Possession and gives considerable space to the subject of Forest Fires, which is discussed with particular reference to American conditions.

The chapters on protection against Domestic Animals, Wild Vertebrates, and Insects follows somewhat similar lines to the European text books. The pages dealing with methods of protecting the forest against insect damage are of particular interest, the references to literature on the subject being a valuable feature.

The third chapter outlines practical measures for combatting pernicious weeds and fungi, and is also written from the American standpoint.

In Part B, the paragraphs dealing with Protection Against Frost, Heat, Snow and Sleet, Wind Storms, Erosion, Shifting Sands, and Noxious Gases only need to be read to prove that they are written by a thoroughly practical forester.

A valuable feature of the book is an Index of Species Affected and a very complete "Index of Malefactors."

A. H. D. R.

Der Waldbau oder die Forstproduktenzucht. Von Dr. Karl Heyer. Fifth edition by Dr. Richard Hess. Two volumes. Leipzig, 1906 and 1909.

This is undoubtedly the most comprehensive treatise on silviculture in the German literature, the best for a student who wishes to become fully acquainted with the great variety of silvicultural methods that have been practiced or only discussed. Heyer was one of the clearest and most systematic expounders on whatever field he wrote, and his editor, Hess, excels in the same direction. The first volume expounds the theory and methods of silvicultural operations. The second volume treats of applications in silvicultural management.

It may be admitted, as some reviewers have urged, that, the work, especially the last volume, lacks "modernism of treatment," that it is impossible to discuss so systematically and dogmatically advantages and disadvantages of this or that system, and give rules of procedure. The learner, however, will welcome the clearness of language and statement, well aware that, in practice, judgment must direct him in the application of rules. Although the author conscientiously weighs advantages and disadvantages of natural regeneration and artificial methods, he undoubtedly inclines to the latter, for which those of Gayer's school will be apt to find fault. B. E. F.

Studien über die Grundbegriffe und die Systematik der Forstwissenschaft. Von Dr. Lorenz Wappes. Berlin, 1909. 73 pp.

This booklet is of interest in connection with the educational movement lately launched of standardizing the teaching at forest schools. It is an attempt to systematize and classify all that which may be considered forestry science, if such a name is justifiable. Wappes doubts the propriety of calling what we commonly so recognize as science, and points out that in practice forestry becomes a mere trade. To this we may object that, while this is perhaps the attitude of the practitioner, the literature of later years testifies to the development of a true science. Charlatans are found in medicine, law, philology or any other profession without justifying us to withhold from those professions the designation science. Nevertheless, his strictures on the tradelike attitude of foresters is perhaps deserved not only in Germany but in other countries we know of.

We agree with Wappes only conditionally that not the forest, but forest management (forestry) is the basis of this science. "The forest is a natural phenomenon, which is an object of natural science. This cannot be the theme of forestry, for then it would be identical with botany." He wants to admit only the investigation of the relations of forest to man as the function of forestry science. Surely, this is narrowing the realm unreasonably. Certainly that portion of botany which concerns itself not any more with the study of the plant, the single tree, but with the aggregation, the forest, with its life history and the conditions and methods of its propagation may be properly segregated as forestry science, even though the ecologist may in part occupy this domain of the forester. At any rate we can claim that there is a sufficient, well organized amount of a series of sciences, natural, mathematical, financial, etc., involved in and underlying the art of forestry, to justify the name of forestry science for this aggregate.

"The task of forestry investigations is to find out the laws underlying forest management as an economic organism, as a process of production by the natural forces of the forest directed by human endeavor for human purposes; and their aim is to reduce to general laws the phenomena here occurring, i. e., of systems, methods, operations and of the forces at work."

"Into commonplace," he says, "we may translate the attitude of the forester thus: Where the eye of the botanist sees plants, the forester sees forest; where the layman sees trees the mental vision of the forester is filled with forestry methods and systems. The tree to him is not plant but apparatus for wood production, the forest not phenomenon but means for an economical object, the wood not material but product."

Restricting in this way the field of forestry, Wappes produces a system of forestry knowledge in analogy to biological science, dividing into: Forest-economic Geography; Forestry Taxonomy; Forestry Morphology (organization of service); Anatomy (business conduct); Physiology (mechanics of forest management and dynamics, movement of values); Biology of forest management.

Altogether while there is much that is suggestive, the author takes a rather high-flown attitude and the attempt to produce a system analogous to that of biological science is not quite successful and lacks practical as well as theoretical soundness.

B. E. F.

Die ökonomische Entwicklung der bayrischen Spessartstaatswaldungen, 1814 bis 1905. Von Dr. K. Vanselow. Leipzig, 1909.

From a review of this volume by Hufnagel, in the Centralblatt, we cull the following interesting facts relating to one of the most noted forest countries of Germany, the Spessart mountains, noted for its legends as well as its magnificent old oaks, many of which now yield as much as 1,000 mark to the Bavarian treasury (see F. Q., vol. VI, p. 285 and 437) the history of its management furnishing an insight into the profitableness of forestry in general.

Originally covered with oak and beech, gradually, owing to deterioration, the result of early mismanagement, the pine encroached until now it forms one-third of the stand. In olden times the beech was more favored as furnishing the best fuel, until the rise of prices of workwood led to the favoring of the oak and reducing the rotation of beech to 120 years and 90 years.

The statistics show that from 1821 to 1905 the net income grew to nearly six times, the receipts for wood alone increasing at the average rate of 4.1%. The price of workwood for first class oak rose from 15 cents per cubic foot in 1836 to $1.24 in 1907 and for select as high as $3.30. From 1872 to 1905 prices for the three best classes by 61%, the three medium classes by 30%, the two poorest classes by 18%, showing the relative greater appreciation of the better classes. Meanwhile, while the price for beech workwood of class I nearly quadrupled to now 33 cents, beech fuelwood has remained since 1840 nearly the same in price.

It is interesting to note how thinnings have increased to now 35% of the final harvest yield. This is largely due to the increase in pine and mixed growth, which may be thinned after the 30th year, while beech and oak, subject to rights of user, may not be thinned before the 60th year. B. E. F.

Jahresbericht über Veröffentlichungen und witchtigere Ereignisse im Gebiete des Forstwesens, etc., für das Jahr 1908.

As usually this useful reference volume to the progress of forestry science is published as a Supplement to Allgemeine Forst- und Jagdzeitung.

The same deficiency which we criticised before and which is a blemish to so much of the German literature continues to appear in this issue, namely, the absence of an index. There is a well subdivided table of contents, but this is hardly as convenient as a subject index. This lack reduces the usefulness of the work very considerably.

While naturally the references are mainly to the prolific German literature, there is more and more, although scanty room given to foreign, especially American publications. While useful in its way, we would consider the volume more useful, if, like the Forestry Quarterly, it would give fuller briefs of the important articles and a mere enumeration of the ephemeral.

B. E. F.

Mitteilungen der Deutschen Dendrologischen Gesellschaft. 1909.

The current issue of this elaborate annual is of particular interest to foresters in this country. Seven of the papers treat wholly or largely of American species, and three of them are of American authorship.

An exhaustive illustrated monograph on the genus Sambucus, by Graf von Schwerin, brings to date the taxonomy and nomenclature of this genus. Prof. R. Demeker, of New York, discusses entertainingly the development and disappearance of the North American forests, with notes on the characteristics of certain broadleaf species. Unfortunately the paper contains many glaring inaccuracies.

Among the many American species treated, Douglas Fir is given special attention. Circular 150 of the Forest Service, on Douglas Fir, is translated, and the relative merits of the "green" and "blue" forms are discussed in papers by Schwappach, Mayr, Seydel, and others. The superior frosthardiness of the slow-growing "blue" form and of the new variety, *P. douglasii caesia* Schwerin, is attested by seven reports from experimenters.

The subject of frost damage to tree growth, with especial reference to exotic (chiefly American) species and to the winter of 1908-9, is given prominence in six papers. L. Beissner discusses at some length the characteristics and desirability of Western Larch (*Larix occidentalis*) for European planting. Japanese species and forests are treated in three papers, one of them by Prof. J. G. Jack, of Harvard. Johannes Rafn, Copenhagen, contributes a valuable article on the germination of tree seeds, which is separately reviewed below. E. H. F.

Forest Tree Seed Researches in the Season of 1908-9. By Johannes Rafn.

This paper gives the results of a large number of tests conducted with seed from many localities. To American readers the results with American species are necessarily of the most interest. These results showed that very many of the seeds collected in the fall of 1908 were poor in quality. The seed of the valuable coast form of the Douglas Fir was notably poor, as were also most of the species of Abies. The author notes in particular the poor quality of the seed of *Pinus lambertiana* and *Pinus insignis* *(radiata)*, compared with samples of the same species collected in previous years. He draws the conclusion that the seed supplied to him during three consecutive seasons, 1906, 1907, and 1908, came from cones of the same season, 1906, and that in several cases, European, as well as American, the poor quality of the 1908 seed is directly traceable to its age. N. H. G.

OTHER CURRENT LITERATURE.

The Forests of the United States: Their Use. By O. W. Price, R. S. Kellogg & W. T. Cox. Circular 171, U. S. Forest Service, Washington, D. C. December, 1909. Pp. 25.

Some Insects Injurious to Forests: The Southern Pine Sawyer. By J. L. Webb. Bulletin 58, Part IV, Bureau of Entomology, Washington, D. C. November, 1909. Pp. 56.

Some Insects Injurious to Southern Forests: Insect Depredations in North American Forests, and Practical Methods of Prevention and Control. Bulletin 58, Part V, Bureau of Entomology, Washington, D. C. December, 1909. Pp. 101.

Veneers for 1908. Forest Products, No. 5, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service, Washington, D. C. December, 1909. Pp. 13.

Tight Cooperage Stock for 1908. Forest Products No. 6, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service, Washington, D. C. September, 1909. Pp. 12.

Record of Wholesale Prices of Lumber. U. S. Forest Service, Washington, D. C. 1910. A quarterly issue of f. o. b. mill prices.

Twentieth Annual Report of Missouri Botanical Garden. St. Louis, Missouri. 1909. Pp. 223. Illustrated.

British Columbia Royal Commission of Inquiry on Timber and Forestry: Interim Report. Victoria, B. C. 1910. Pp. 2.

Courses in Forestry. Bulletin No. 60, University of Montana, Missoula, Montana. 1909. Pp. 8.

Annual Report of Botanic Gardens and Government Domains for 1908. By J. H. Maiden, Director. Sydney, New South Wales. Pp. 36. Illustrated.

Contains some handy bibliographies.

Annual Report of the Department of the Interior, 1908-09. Ottawa, Canada. 1910. Pp. 400. Price, 45 cents.

Annual Report of the Department of Trade and Commerce. 1908-09, Parts I & II. Ottawa, Canada. 1910. Pp. 567+102. Price, 35 cents.

Insect Intruders in Indian Homes. By E. P. Stebbing. W. Thacker & Co., London, England. 1909. Price, Rupees 4-8.

A popular account of the commoner intruders one encounters in the home, garden and jungle.

Smithsonian Miscellaneous Collections. Volume 52, number 1872. (Volume 5, number 4 of Quarterly issue.) Washington, D. C. 1910. Pp. 110.

Contains an interesting article on the geologic work of mangrove formations in Florida.

Report of Connecticut Agricultural Experiment Station on Fertilizers. 1909. Pp. 126.

Soils of the United States. Bulletin 55, Bureau of Soils, Washington, D. C. 1909. Pp. 243, 1 map.

A comprehensive bulletin summarizing the activities of the Bureau since 1898 and giving the classification of United States soil.

Proceedings of the Twelfth Annual Meeting of the American Society for Testing Materials. Volume IX. 1909. Pp. 698.

Contains of interest to foresters: Report of Committee on Standard Specifications for Grading Structural Timber; Some

Results of Dead Load Bending Tests of Timber by Means of a Recording Deflectometer, by H. D. Tiemann.

How Much Does it Cost to Grow Timber. By R. S. Kellogg and E. A. Ziegler. A paper read at the annual meeting of the National Lumber Manufacturers' Association held at Seattle, Washington. July, 1909. Pp. 18.

PERIODICAL LITERATURE.

GEOGRAPHY AND DESCRIPTION.

Plant Geography of the Chiricahua Mountains.

The Chiricahua mountain range in southeastern Arizona is fifty miles long, extending almost due north and south, and it rises from an elevated plain of approximately 4,000 feet altitude to 9,700 feet above sea level. After spending ten months botanizing in these mountains, Mr. J. C. Blumer has written an interesting paper upon the distribution of their vegetation. He asserts that if three maps of the mountain range were to be drawn to show the three chief factors of its floral geography, the first would give altitudinal zones similar to those outlined by Merriam for the San Francisco mountains of northern Arizona, except for the absence of the two highest zones of Merriam, due to the lack of sufficient elevation and except, again, for the presence of evergreen oaks which to a large extent replace the pinyon zone of the San Francisco mountains.

The second map showing the distribution of the plants governed by aspect of similar rock outcrops and similar soils of the same altitude, would look like very crazy patchwork, the adjective perhaps to be literally applied to one making such a map, because of the influences other than that of aspect, such as seepage and the physical character of the soil, which enter into the determination of distribution on these sites.

The third map based upon the character of the rock strata and the soils without regard to either altitude or aspect would lead to divisions denoted by vegetation on transported soils and on residual soils derived from limestone, recent eruptions (basalt) older eruptive and metamorphic rocks (Andesite, rhyolite, granite, quartzite).

The boundary lines of plant associations and formations based as above upon the rock derivations of the soil are very sharply marked and bear no relation to aspect, and within certain limits, little or none to altitude. For example, the basaltic hills (recent eruptive) are treeless and shrubless, being covered with grasses and other herbs, while the andesitic and rhyolitic hills (old eruptive) of the same general altitude and the same aspect are covered with evergreen oaks and junipers. Here, however, the historic element may be of influence. The most striking example is that of the evergreen oaks (seven species) which are almost absolutely absent from pure limestone soil. The only oak on limestone in the region studied is deciduous and it is found only on limestone.

The author believes that the controlling forces in the plant distribution of the Chiricahua mountains point strongly towards the physio-chemical character of the soil. (In this connection the reader is referred to the review of *The Soil Preferences of Certain Alpine and Sub-alpine Plants,* by M. L. Fernald, in *Forestry Quarterly,* Vol. 6, p. 400.)

Science, November, 1909. Pp. 720-724.

BOTANY.

Concavity of Leaves and Illumination.

Some years ago, Wiesner called attention to the fact that the upper surface of the peripheral leaves of woody plants were characteristically concave, while the leaves within the shadow of the crown of trees were prevailingly flat or nearly so. He regarded the concavity of the outer leaves of the crown as a protective device against injury to chlorophyll by excessive sunlight. Prof. J. Y. Bergen has recently taken up the subject and his measurements confirm Wiesner's as to facts, but he is not so sure in regard to Wiesner's theory as to cause. The assumption that greater concavity goes with greater illumination meets many exceptions. For example, in the genera Prunus, Pyrus and Salix all of the leaves of a tree may be concave whether grown in the sun or shade. And moreover, leaves side by side receiving apparently identical illumination vary greatly in concavity.

Botanical Gazette, December, 1909. Pp. 459-461.

Sap Pressure in Birch.

Merwin and Lyon believe the two chief factors concerned in producing the sap pressure of birch stems are root pressure and the thermal expansion of the cell walls. The maximum pressure from each comes in the daytime, the former shortly after sunrise and the latter shortly after mid-day. The senior author found that the thermal expansion of a given volume of birchwood, forty to fifty per cent. of which was saturated cell wall, to be about one and one half times the expansion of an equal volume of water. Since the external dimensions of the tree change imperceptibly, the change in the volume of wood is at the expense of the volume of the cell cavities. The effect of this is to diminish pore space in the wood and consequently to produce pressure upon the liquid or gas occupying the pores. If the pores were filled with liquid alone, the elastic expansion of the wood due to heat might give rise to very high pressures, but the cell cavities of the wood probably always contain gas. The compressibility of the gas in the wood pores lessens to a considerable extent the effect of thermal expansion in producing pressure. Formulae to determine the amount of expansion of saturated cell walls accompany the paper.

Botanical Gazette, December, 1909. Pp. 442-458.

SOIL, WATER AND CLIMATE.

Rainfall Distribution.

In an address on the types of rainfall and their geographic relations Dr. Ruhl furnishes the following lucid statement.

The distribution of total precipitation follows mainly two laws. In general a reduction of amount takes place from the equator to the poles, parallel to the relative humidity of the air. In the tropics the largest amounts fall, in the average perhaps 2,000 *mm*. At the limit of the tropics the air, which in the tropics had ascended due to the heat, returns to the earth, and occasions here a rain-poor zone, which is characterized by deserts and plains on both hemispheres. Going north, a second and subordinate maximum of precipitation is met in the subtropics and lower latitudes, which is caused by cyclonic air movements accompanied by rain. Towards the poles, rains are reduced due to low relative humidity, so that finally the polar regions belong to the driest of the globe, often securing not more than 100 to 200 *mm* of precipitation.

The second law is that generally precipitation decreases from the coast to the interior, mainly because seawinds bring the moisture, although evaporation from the soil furnishes not inconsiderable quantities, as has lately been shown, so that oceans are by no means the only source of moisture. A great difference, however, is produced by location. In the tropics, the trades from the East make these sides of continents rainier than the West sides, where even deserts may exist at the coast close to the seashore. From the 40 degree north this condition is reversed, the west-winds becoming dominant.

Of all meteorological phenomena rains are most modified by local conditions. The principal cause of precipitation is the ascent of masses of air, hence every elevation, every mountain range, since it forces air to rise, tends to produce rain. Hence the windward side is always rainier than the leeward, so that mountain ranges become division lines between wet and dry country, short distances apart, as is particularly noted in North America, especially British Columbia and the Rocky Mountain districts.

In the distribution through the seasons also a great difference between tropics and the higher latitudes is noticeable, periodicity being the rule in the former, more or less even distribution in the latter.

In the mediterranean countries winter rains prevail, and summer is a dry season, the same as all the west coasts of subtropical latitudes, while in the temperate zones rains occur at all seasons.

A special type of precipitation are the monsoon rains.

Centralblatt f. d. g. Forstwesen. December, 1909. Pp. 541-543.

SILVICULTURE, PROTECTION AND EXTENSION.

Advance Planting of Spruce.

Oberförster Sieber reports on the experience with planting spruce under the shelter of old stands before their removal (Vorverjüngungsbetrieb.) This novel method has been practised in the Frankenwald, in the dukedom of Reuss, north of Bavaria, for the last 20 to 25 years, and hence at least a preliminary judgment of its value can be formed.

To assure the reader, that Sieber's judgment is entirely unbiased, we repeat verbatim his final expressions which need to be driven home in our country with its young practitioners. "We cannot strongly enough warn against the assumption, that any one method is the only advantageous one. The very attempts which are made in the literature to make one method appear superior to another prove the opposite. So many are recommended with good reasons, that the practitioner must reserve the choice and the right to go his own ways"

The region in which this little known method of underplanting was practised in districts of about 10,000 acres in extent, lies on an elevation of from 1,500 to 2,200 feet. While the soil is mostly very fertile, being classed on the average under site class II, the climate is rather unfavorable, rough and liable to frosts and snow breakages. The stands are rather open, with tops frequently broken, the soil covered often with raw humus in quantities and liable to weed growth, especially huckleberry.

The reasons for devising this method of regeneration were various. Natural regeneration had been unsatisfactory on account of the competition of weeds, while soil preparation occasioned too much expense. Clearing was dangerous on account of windfall and frosts from which plantations in the open suffer.

Sowing with spruce and fir under the old stands had been tried, but moss choked out and game destroyed the young crop. Hence, the underplanting was tried. In a selection cutting the existing openings were enlarged and denser groups evenly opened up, so that about one third of the volume was removed. Then strips, 1.5 feet wide and about 4.5 to 5 feet apart had their soil cover removed and into these four to five year old spruce were set with the Wartenberg plant iron, a yard apart, keeping five to six feet away from trees. In the darker places only plats or short strips were so planted. It was soon found out that the removal of one-third was not sufficient, and further thinnings for the benefit of the young crop became at once necessary. At each thinning repair planting was done and, of course, existing volunteer growth was utilized. In this way in 20 to 25 years a satisfactory reproduction had been secured and the old stand entirely removed. In the decade 1885/94 some 425 acres in 52 parcels had been so treated, on areas of upwards to 25 acres in extent.

The result is of course an uneven young growth, the first plantings 15 to 20 feet in height, the last, on the final skidding trails and roads, of smaller plants. And of course, other stands whose regeneration is not yet completed show a variety of conditions. The main objection raised by the author to this procedure is the possible damage by wind and snow breakages to the old stand and by the felling and skidding to the young crop. The first was found no worse than in a clearing system, the timberwood per cent. showing no essential difference. The old stands here evidently were quite windfirm, a condition which by careful thinning practice can be secured elsewhere.

The damage to the young crop is undeniable, and it is to be kept in mind that it affects single plants, each of which represents value. Yet, the spruce is remarkable for its capacity for repair. Moreover, the damage can be reduced by timely careful removal to roads of logs and cordwood. This is costly, $2.00 per acre, which is chargeable to the method.

The influence of the old stand in preventing frost damage was unmistakeable. Only in portions that were kept too dark loss in droughty years was experienced.

While by a careful investigation, in 1894, it appeared that in these plantings 7% less loss was experienced than in open plantations, the author believes that this advantage is only partially due to the method and explained in part by difference in planting ground. At a cursory inspection, 10 years later, the difference was less obvious, except where the proper light conditions had been secured for the underplantings.

An interesting result on the increment of the old stands was proved by careful analysis which brought out the fact that the age-class 81-90 had increased its volume increment per cent. from 1.9 in the full stand to 2.3 in the regeneration areas; in the age class 91-100 the figures were 1.5 and 1.9 respectively.

Interesting also is the result that the smaller diameter classes show a greater benefit than the larger, especially in the younger age classes as appears from the following:

Diameter Class	*Volume increment per cent.*	
cm	*Full stands*	*Regeneration areas*
20	1.4	2.4
25	1.8	2.4
30	1.9	2.3
35	2.1	2.2
40	2.2	2.0

Admitting that the experiences with this method are too few and too short to allow a decided judgment of advantages and disadvantages of the same it seems to prove itself adequate to secure a satisfactory regeneration. A special advantage of any kind of advance regeneration, the author points out, is that the production of the soil continues without interruption, while in clearing systems, always 1 to 2 years are lost, which under the short rotations profitable for spruce means on large areas a considerable loss.

The author also points out that with this system larger contiguous areas can without detriment be taken into hand than in clearing systems.

Ueber Fichtenvorverjüngung mittels Unterpflanzung. Forstwissenschaftliches Centralblatt. Dec. 1909. Pp. 631-640.

Growth Studies in Spruce.

Dr. Schiffel reports on the results of an investigation on the increment of spruce in an experimental area, severely thinned (Lichtungszuwachs). The stand originated in natural regeneration, and at 90 years, having been slightly thinned up to 80 years, still shows age differences of 15 years. The experiment has been carried on for 15 years. The stand was divided into four plots of .5 *ha* each; the first for comparison was thinned in the usual moderate way, the others were reduced to about .8 of the cross section area found on area I. Five years later another thinning reduced area II to .8, area III to .65, area IV to .5 of the cross section area of the area I. A storm, however, threw the trees on area IV in 1900 and ruled it out, the other areas remaining undamaged. (Showing that a 90 year old closed stand of spruce may not be opened to half its density.) The results are fully tabulated. The total increment of timberwood was in all three cases almost alike in the 15 years, the thinnings having no influence on *quantity* of increment, although in area II 52 per cent., in area III 99 per cent. more wood was removed than on area I. In all three cases a sinking tendency in the current increment was noticeable.

TOTAL CURRENT INCREMENT PER HA.
Timberwood.

	1893/8	1898/03	1903/08	1893/1908
I	14.4	13.6	12	13.3
II	14.8	13.6	12.4	13.6
III	16	14.4	11.2	13.8

While this table shows almost the same volumes the factors making up the volumes were, however, very considerably varied, as appears from the following:

	I			II			III		
Period.	*Stem Number Decrease.*	*Height Increase.*	*Diam. Decrease.*	*Stem Number Increase.*	*Height Decrease.*	*Diam. Increase.*	*Stem Number Decrease.*	*Height Increase.*	*Diam.*
	In per cent. of amounts in 1893.								
1893-1908	50.7	13.3	36.6	63.4	13.6	44.8	75.5	17.1	62.4

The quality is very considerably increased, area III with one-quarter the number of trees that were present in 1903 has nearly double the average diameter as compared with area I.

Diameter increment, ring width and diameter increment per cent. remain very nearly alike through the three periods in areas I and II, but in area III, a continual increase of all three items in the average tree are noticeable, which is in part at least attributable to the treatment.

The increment percents are generally highest on area III, lowest on area I, especially on the smaller stems, while on the 20 stoutest no considerable differences were found, leading to the conclusion that the opening does not influence the increment of the stoutest. (They were in full enjoyment of light before!—Ed.)

To avoid error in these conclusions, the increment of the same number (20) of trees of same diameter in the same periods were compared.

From this comparison the same beneficial influence of the thinning in area III becomes evident; the difference in diameter increment of trees of same size in favor of area III was for stout trees 13 *mm*, for medium sized trees 22 *mm*, for small trees 25 *mm*. To make further sure of the generality of the influence the arithmetic mean tree was investigated. While according to Weise this tree lies at 40 per cent. of the total number from the stoutest down, in these areas, it was found just so in area III, in area I at 41%, in area II at 45%. To prove that the average tree of the remaining stand, on all three areas *i. e.* without reference to the different treatment, gave also the average cross section area, a calculation was made of the 10 per cent. of the trees around the average tree, and it was found that they also represented about 10% of the total cross section increment.

The volume increment was found the same in area III with 178 trees as in area II with 244, and in area I with 399 trees. It was found unusually high, namely, 170 cu. ft. per acre, which, occurring in the 90th year, compared with the usually noted 100 cu. ft. of the yield tables shows what discrepancies there are in the latter.

While these data are local, they probably exhibit general laws, at least for the spruce.

1. They seem to prove again formerly expressed statements as correct, namely that an open stand does not produce essential changes in *total* product of wood, at least when the opening does not go below .65 of the cross section area of a full stand.

2. By opening up, a quality improvement is secured due to the increased increment on the remaining stand, besides increasing the financial advantage due to earlier receipts.

3. The "light" increment takes the places on the smaller trees to a greater degree than on the dominant, originally well crowned trees; here lies mainly the quality increment which must be well differentiated from the automatic improvement that comes from the increase of the average tree diameter due to removal of smaller trees.

The author then goes into an exhaustive inquiry whether the actual average tree of a stand represents also the average diameter, cross section area and volume. He comes to the conclusion that this is the case only as long as the tree number does not change perceptibly, hence, *stem analysis for finding the increment of stands can play only a subordinate role.* The only sure way of securing knowledge of the volume increment is by measuring entire areas at two different times.

Zuwachsstudien in einem Fichtenbestande. Centralblatt f. d. g. Forstwesen. December, 1909. Pp. 505-527.

Germination of Seeds.

There were 184 samples of forest tree seeds tested in 1907 at the Prussian testing station for forest tree seeds at Eberswalde under Dr. Schwappach, 450 in 1908, and 289 in 1909. The tests made for the state forest officers formed 28% of the whole in 1907; 58% in 1908; and 44% in 1909. Poor seed years deprive foresters of a supply of seed from their forests and their purchases in the market must be tested to determine their value. Thus the poor yield of pine seed in 1908, and of spruce in 1909 sent more samples to the testing station.

The average maximum and minimum of viability for species of which more than ten samples were tested follow:

Species.	*Average.*	*Viability. Maximum.*	*Minimum.*
Scotch Pine,		97	36
Norway Spruce,		96	50
European Larch,		50	30
White Pine,	52	86	33
European Oak,	74	90	36

These results were obtained in a lighted room at a temperature of 25° C.

There are two accepted styles of germinating dishes, one of porous clay, one of bibulous paper. The germination secured is different in the two dishes, the paper giving 9% more than the clay for Scotch pine seeds. For spruce no difference was evident. Rapidity of germiniation varies in the same way between the two dishes.

At the International Congress for Agriculture and Forestry at Vienna in 1907, officials of the various seed testing stations organized for discussion and agreed upon the following points.

1. When the regular viability test is completed the remaining ungerminated seeds are to be cut open and record made of those apparently viable. For fir, maple, ash and *Carpinus* the knife is used without first germinating the seeds. Acorns and nuts, and other large seeds are buried in damp sand for 30 days, and then cut open.

2. A variation of five per cent. in the use value is allowable in seeds whose germination per cent. exceeds forty. Below forty per cent. no limit is to be set until further study.

3. Germination tests are to be concluded after a set time as follows:

Larix europaea, and nearly all pines, *Chamaecyparis* (all species),	20 days
Pinus sylvestris,	30 "
Pinus strobus and *maritima,*	60 "
Alnus and *Betula,*	20 "
Other Broadleaf Trees,	30 "

The germination per cent. found at the testing may be lower than that determined and guaranteed by the dealer due either to a deterioration during the interval, or to difference in methods of sampling. Haack has recently studied the effects of secular deterioration (Forestry Quarterly Vol. VII, p. 328). A sample should truly represent the lot from which it is taken as regards size, color and ripeness. Whether it is thus representative is not readily determined.

White Pine seed germinates very slowly, and under ordinary conditions continues to sprout for a year. Quicker results have been secured by exposure to a low temperature (5°-10° C) first, and later raising to 25° C.

Stored fir seed deteriorates rapidly. Freshly gathered seeds placed in damp sand germinated very slowly, indicating that they require a period of rest. Fir seeds are usually examined for viability by the knife test. Whether the knife or germination tests better indicate what to expect in seed beds is as yet unknown.

Black Locust seeds germinate much more rapidly after a three minute treatment with boiling water.

Acorns sprouted in damp sand give results very much below the value indicated by cutting open. Germination when half submerged in water in shallow pans gave higher results, but not high enough.

Mitteilungen aus der Waldsamen—Prüfungsanstalt Eberswalde. **Zeitschrift für Forst und Jagdwesen. November, 1909. Pp. 753-762.**

Experience with Banksian Pine.

Raumer reports most satisfactory experience with *Pinus divaricata* on the very poorest sand soil, on which the Scotch Pine produces only a miserable growth yielding in 108 years with not over 50 feet in height a final harvest of 1150 cubic feet per acre.

An experiment substituting White Pine failed. A small plantation of Banksian Pine with yearlings on unprepared soil was choked out by the heather in two years. A second trial on thoroughly prepared soil proved a great success. The soil work consisted in removing the litter and roots, and plowing strips 12 inches wide and 12 inches deep, 3.5 feet apart, at a cost of $8, which was not considered excessive These strips were planted with yearlings, 2 feet in the row, with a planting iron, at a cost of $15 per acre. At the same time a similar area was planted with yearling Scotch Pine. Both plantations started well, but after 7 years the appearance is very different. The Banksian Pine forms a perfect dense cover of sound plants with a height of over 10 feet maximum, and 8 feet average height, the soil covered with needles, the heather suppressed. The Scotch Pine does not exhibit any desirable features. Although there are no fail places, the growth, due to several attacks of the "Schutte" is uneven, heights averaging over 5 feet, with tendency to cripples, the soil covered with heather.

Another plantation with Banksian Pine on less carefully prepared soil (cost of $4.50) shows as good results.

This pine bears seed early, namely, at 6 years, the seed producing vigorous seedlings. An observation which we have not seen recorded elsewhere, is that the Banksian Pine makes 2 and 3 whorls and length shoots in one year, so that age cannot be determined from the whorls.

Einiges von der Banks-Kiefer. Forstwissenschaftliches Centralblatt, November, 1907. Pp. 582-586.

Hardiness of Douglas Fir.

The fact that the "blue" Douglas Fir, *i. e.* the Rocky Mountain form is hardier than the "green," *i. e.* the Pacific form has again been proven in Germany this last year, not only in seedlings but in older plants. Dr. Fürst observed that during the winter, 3 year old Douglas Firs died from the top down to one-half, one-third, or entirely, while others standing between the dead and injured remained perfectly healthy. Just so, on trees from 3 to 10 feet in height, two or three years' shoots became red, while others showed no damage. A portion of yearlings which showed no damage were transplanted but more than half of 20,000 died, freezing of roots being assigned as the cause. Trees over 12 feet in height, however, showed only occasional small damage. All damaged plants were found to be of the "green" form.

It is supposed that an early frost did the damage, for low winter temperatures have so far been well sustained except the unusually low ones of 1879.

Auffallende Beschädigungen von Douglasien. Forstwissenschaftliches Centralblatt. November, 1910. Pp. 586-88.

MENSURATION, FINANCE, MANAGEMENT.

Theodolite as Dendrometer.

Dr. Schiffel, well known for his development of the form quotient $\dfrac{\text{diameter at middle height}}{\text{diameter at breast height}}$ (see Forestry Quarterly, vol. I. p. 6 and 56; vol. II. p. 258, 263), as a means of determining more precisely volumes of trees, which, however, requires measuring of diameters at middle height, shows how these measurements can be done by a simple theodolite with arc which permits measuring angles within one minute accurate, and must have a micrometer screw for measuring horizontal movement of the alidade to measure the small angle formed by sighting each side of the tree through the cross-threads.

The trigonometric details are given at length with great simplicity. The simple attachment for measuring and counting the screw turns is described. Tables for the determination of heights corresponding to measured angles are worked out as auxiliaries for rapid work in the woods, and give the diameters directly without calculation.

Practical needs for measuring sample trees are: Sample trees should be straight, at least not incline to or from the instrument; the base line should not be longer than the height of the tree, indeed, the nearer to the tree the more exact the measurement, foot, middle and top being visible from the instrument.

Trial measurements have given most satisfactory results.

In the May number of the same Journal (May p. 237) Dr. Wimmenauer points out that the method could not work when trees move, which is much more frequent than supposed, and that then only an instrument with double cross-threads, like his own dendrometer, will answer.

Schiffel admits this in part, but claims that the movement at the middle of the tree is not in proportion to that at the top, since the movement is that of an elastic body. With considerable movement even the best dendrometer, becomes useless, while small movements can be takn care of by observing the swinging across the cross-threads.

Die Waldbussole als Dendrometer. Centralblatt f. d. g. Forstwesen. March, 1909. Pp. 97-107.

Silviculture and Forest Organization. In a scathing article, a lecture before practical forest managers at Vienna, Hufnagel points out, how, in the endeavor for orderly procedure in the forest according to working plans, the main object, revenue, and the means to that end, silviculture, are forgotten, or the latter forced into narrow and schematic limits. "Millions have been sacrificed to the moloch 'order.' This," the author says, "is especially true for Germany with its extensive State forest systems, while in Austria conditions are more favorable, for here forest devastation caused by adherence to working plans has not reached the same extent, and extensive mixed stands, highly differentiated, still call on the silviculturist for thought, consideration and work."

As regards theory and practice of silviculture, they are far apart. Theory presses for a return to natural regeneration, practice prefers artificial planting; the former excludes choice of species since in a large way only the shade endurers can be regenerated, while the planting practice is apt to limit the choice to the easy transplants, spruce, pine, larch. The call for mixed stands is in natural regeneration an "accidental possibility," in planting a "breadless art" as long as mixing of individuals and small groups is to be forced.

What species will be desirable for future use, who knows?

Mixed forest, and especially such as Mayr proposes in large groups, and natural regeneration are the horrors of forest organization, because the working plan is to tell exactly when an area is to be cut and regenerated, and even the best artist is unable to furnish this at a given hour. The whole management in working blocks, with different species and rotations disturbs the needs of silviculture.

After paying some compliments to Wagner's one-sided new proposition of strip selection regeneration, based on a few limited observations and to his condemnation of artificial reforestation, he quotes Mayr to the effect that natural regeneration is economically applicable only with a certain minimum of precipitation (about 16 inches)

"And why should the regeneration be 'natural'? Every culture is a forcing of Nature: milk would be an expensive delicacy if cows were treated naturally; hence use natural regeneration only where it comes unsought, to mainain certain species that do not thrive when planted, and to preserve natural beauty—those are its limitations." He then riles against the formalism which forest organization and proper bookkeeping entails upon the forest manager.

By laying stress on orderliness in time and space, and especially the latter in the area allotments, he is gradually forced to clearing system which is the direct road to orderliness, and the simplest. The normal stock or formula methods which attempt only orderliness in time, and which in Austria to the welfare of the forest were much practised and are still in force in Baden, are excellently adapted to bridge over the antagonisms of silviculture and organization; they determine a felling budget by volume, but leave the manager to cut where considerations of silviculture require, the orderliness in space becoming subordinate. "Volume and increment are the foundation stones for the management," although not as convenient as area. Whatever may be desirable in the State forest, in private forestry the yield is the object.

On the other hand, time is money, in the forest more than elsewhere; the silviculturists forget that if they propose to make the utilization dependent on the success of natural regeneration (instead of substituting planting); they must insist on the working plan giving them the possibility of making regeneration cuttings at the proper time as needed, perhaps in any stands above half the rotation, but they should not be allowed to leave ripe timber standing until natural regeneration has succeeded.

In conclusion the author cites a very successful private forest management in Bohemia, which determines a felling budget by volume for only half the rotation and then leaves free hand to take it where silviculturally desirable in the stands older than half the rotation.

Beziehungen zwischen Waldbau und Forsteinrichtung. Centralblatt f. d. g. Forstwesen. July, 1909. Pp. 289-299.

Determining a Felling Budget.

Those who are familiar with the theory of forest organization will remember that the eventual aim is or ought to be, besides satisfying present needs to approach normal conditions which would permit a regular sustained yield, changing intermittent into annual, if possible equal revenue.

The most rational way to attain this object is the combination of an area allotment with a formula which attempts to control the volumes and increments.

Instead of making the annual budget by area equal to $\frac{A}{r}$ which would in one rotation establish normal age classes, a shorter period than r will usually be found practicable and more to the interest of the owner, say d, making the felling area $\frac{A}{d}$ Similarly in Heyer's well known formula $b = \frac{Ic + Sa - Sn}{e}$, a period of equalization e is determined, a "felling rotation" during which it is most advantageous for the owner from both the standpoint of his present interests and of the approach to normality to cut over his forest. The area budget and the formula budget must be brought into proper relations. The difficulty lies in finding a proper principle for the determination of the period of equalization. In the area budget this is more or less given by the existing age class distribution, but in the formula budget no such natural conditions present themselves. Properly applied according to Heyer's intention, the formula serves merely the purpose of orientation. By introducing various values for e we get an insight how budget and equalization period are related to each other and how the equalization of the growing stock is proceeding, Usually, however, a certain-sized budget is demanded, the need or ability to save or to cut more determines, and not a certain time in which the growing stock is to be adjusted; and with such a demanded budget and a few trial calculations the length of c is determined. This method of procedure Gascard considers moving in a circle, and proceeds to develop an improved method by the following reasoning:

If the area alone were used as regulator, the whole forest would be cut over in d years, but since the volume formula is to influence the budget, there would in d years be cut over not the area A, but a. The areas A and a represent the two principles (area and volume) of budget regulation, and if the two are to be equally considered, the average $\frac{A + a}{2}$ will furnish the budget for d years. In the volume formula the equalization period may according to the original Austrian method be chosen as r.

If now the area budget were for the next period not to be normal, on account of age class conditions, but should be only 2/5 of normal, then the budget could not be the arithmetic mean of the area and formula budget.

A preliminary reduction of the formula to 2/5 would be indicated. This requires, however, a correction, since, if in a normal forest, where area and formula budget are equal, each year 2/5 of the volume budget were cut, the areas cut over would annually become smaller, and in a decade really not 2/5 of the normal felling area would be utilized. To make sure that the annual areas remain 2/5 of the normal decennial area, the volumes must be (if I = increment, b = normal budget, V = volume of cut):

In the first year: $V = 2/5\ b$.

In the second year: $V = 2/5\ b + 2/5\ I$.

In the third year, etc.: $V = 2/5\ b + 3/5\ I$.

In the tenth year: $V = 2/5\ b + 12/5\ I$.

Total for 10 years: $10 \times 2/5\ b + \frac{60I}{5}$.

Similarly may be deduced the correction of the felling budget in abnormal forest.

If here b, determined according to the formula, is to be taken during d years cutting over the area A, then it corresponds in area to $\frac{A}{d}$, i. e., equal to the oldest stand of a normal forest of the rotation d area A, and increment I. Hence, the same correction of the formula is applicable $\frac{b}{d}$, in this case, being substituted for I. The corrected budget then becomes $V = 2/5\ b + \frac{6}{5}\ \frac{b}{d}$

If the area budget has been chosen larger than normal, (e. g., because of excess of old age classes) say 5/6, the corrective is deducted, and the formula would read $5/3\ b - 5.56\ \frac{b}{d}$.

The author produces a table in which for varying areas the correctives are calculated for ready use.

The author then gives the following example: Given a forest of 348 *ha* of abnormal age classes, under rotation of 120 years, to be cut over in 100 years, hence, normal decennial felling area 34.8 *ha*. On account of a very extensive and thrifty regeneration in old stands there is to be utilized in the next decade an excess:

hence the felling area is increased to 55.75 *ha.* which would contain 1650 *fm.* According to the formula the volume budget would normally be 900 *fm.* This is to be modified to correspond to the abnormal felling area. The relation $\frac{55.75}{34.80}$ approximates $\frac{8}{5}$ to which in the table corresponds the corrective 4.80, hence the budget becomes $\frac{8}{5} \times 900 - 4.80 \frac{900}{100} = 1397$ *fm.*

Silviculturally the larger budget 1650 *fm* would be preferable, but consideration of the approach to normality and sustained yield calls for the lower; a compromise of the two aims would make the arithmetic mean 1523 *fm* the desirable.

This method, the author argues, avoids the trials which the Heyer formula with an arbitrary period of equalizations requires, basing the choice of the latter on sound principle.

Dr. Wimmenauer in a note points out that after all the difficulty of determining the equalization period—the most advantageous time during which to prepare for normality—is not solved, and that really Heyer's method which calls for a complete working plan as one of the guides seems to be superior.

Zur Frage der Hiebssatzbestimmung. Allgemeine Forst- u. Jagdzeitung. November, 1909. Pp. 314-319.

Long Rotations and Value Increment.

That rotations based on value increment lie beyond 150 years in pine on good sites is now well established. In stands of Scotch Pine 120-200 years old, Dr. Storp found that the current value increment still exceeds considerably the average increment, i. e., has not reached its maximum, hence, a rotation of 140 to 160 years on I and II site was advocated by Frey, especially when the pine is underplanted with beech after 60 years as soil protection and to furnish valuable fuel.

Dr. Schwappach in his monograph Die Kiefer, comes to the same results as Storp. He figures for a 130 year old stand on site I, the *average* annual value increment at nearly \$5 per acre, while the *current* value increment is nearly \$6 per acre. For site II the figures are \$3.60 and \$4.42 respectively.

Nevertheless, Schwappach finds the financially profitable rotation according to the soil rent theory with 3 per cent., by using

Martin's formula, at 30 to 40, by Faustmann's at 60 years. He does not, however, recommend this rotation, but, in view of the expected rise in prices, and because the soil expectancy value sinks only slowly with increasing age, he justifies a rotation of 100 to 120 years. Frey chuckles over this jugglery with financial theories. The author then expatiates on the silvicultural method which insures the production of this high-priced, narrow ringed material, namely, dense sowing or dense natural regeneration, deprecating the usual planting with naked root as producing only inferior stands.

Die Erziehung hochwertigen Kiefernnutzholzes. Forstwissenschaftliches Centralblatt. December, 1909. Pp. 609-615.

UTILIZATION, MARKET, TECHNOLOGY.

Efficiency of Gang Saws.

A most elaborate theoretical discussion with a mass of mathematical apparatus by Dr. Zelisko determines the conditions under which gang saws perform the maximum cut, which, of course, depends on the rapidity of motion of the log against the saws. This is at present left to be decided by the "feeling" or judgment of the sawyer, which the author hints at as most unreliable, and he points out that the increase of the advance by 1 mm. per oscillation often means an increase of efficiency of 10 to 15 per cent.

A simple ingenious attachment is described by which the propelling apparatus can be tested as to whether it works with the determined velocity.

Unter welchen Vorschubbedingungen erreichen Sägegatter ihre höchste Schnittleistung? Centralblatt f. d. g. Forstwesen. November, 1909. Pp. 471-483.

Metal Railroad Ties.

That metal ties (of proper construction) have proved their value is apparent from the fact that the German Railroad department—about 50 per cent. of the German railroad mileage lies on metal—continues to increase their use, so that the Association of East-Prussian wood merchants saw fit to pass a resolution petitioning the department not to favor the metal tie, which "in spite of the demonstrated superiority of the wooden tie is being employed increasingly from year to year."

Silva, 1909. P. 753.

Melted Wood.

By excluding oxygen and after removal of the by-products or without doing so, wood can be melted in a heat of 800 to 900 degrees under pressure of two atmospheres. The result is a compact amorphous mass, which can be cast into forms. By adding preservatives, this wood can be made indestructible. Commercial value is predicted for this new material.

Bulletin de la Société Centrale Forestière. 1909.

German Wood Trade.

During the year 1908, the imports of wood into Germany amounted to 2,688,000 tons, against which an export of only 703,000 tons is to be offset. Of these around two million tons of import, 664,000 tons came in as logs, 632,000 as workwood from European countries, and only 37,000 tons of extra-European wood; 542,000 tons were represented by railroad ties, mine props and fuel, and nearly 100,000 tons by bark.

The total movement of wood on railroads involved 19.3 million tons, 17 million of which represents home trade.

Silva, 1909. P. 748.

Wood Prices in Germany.

Prices in Germany are of interest as indicating what eventually ours must be. The best basis for ascertaining wood-values is furnished by bids for lumber supplies of the Railroad Department of Hanover, lately published. These were as follows per M ft. B. M., and they are believed to be lowest prices, ranging slightly higher than the previous year of depression:

Oak, square edged, ...	$39	to	$60
Oak, waney edged, ...	42	to	53
Oak, flooring, ...	34	to	41
Oak, car sills, ...	30	to	31
Pine, square edged, ...	25.50	to	30.50

Fir, square edged, ...	28.50	to	29
Spruce, square edged, ...	23.50	to	28
Beech, waney edged, ...	21	to	30
Ash, waney edged, ...	40	to	45
Poplar, waney edged, ...	23	to	31
Maple, waney edged, ...	39	to	42.50
Walnut (American), ...	109	to	112

Sales of pulpwood, mine props and polewood from the spruce forest of East Prussia, ravaged by insects, brought from 2 to 5 cents per cubic foot solid.

Railroad ties of pine secured by the Prussian Railroad Department to the number of nearly 6 million ranged in price from 63 cents to 90 cents, mostly in the neighborhood of 75 cents; beech ties up to $1.00

Average prices for sawlogs in five districts in various parts of Prussia, last winter, averaged 24 to 53 cents per cu. ft. for oak, 12 to 18 cents for spruce, 14 cents for pine. This last price might be translated into $18 per M. ft. B. M.

Silva, 1909. P. 763.

STATISTICS AND HISTORY.

Forestry in Brazil.

South American republics are beginning to stir in the matter of forest conservation. Last year the question was discussed in the parliament of Brazil with a view of formulating legislation by which private forest management might be influenced. It was objected that as long as the government is doing so little for a rational management of its own lands, some 35,000 square kilometers, it was not opportune to hamper private owners. Colonization in the forest region should be limited. Conditions of the colonists in the forest regions were such that forest destruction must for some time still be his aim, to secure fields. It is easy to talk conservation, but difficult to execute it—just as with us in some parts.

Silva, 1910. No. 2. P. 14.

Forestry in China. Under German influence and in imitation of the reforesting work begun by the Germans within their sphere of influence in Tsingtau, the Chinese government has begun also to make plantations, especially in the neighborhood of Mukden. Here since two years a forest school is in existence; some 600 acres were planted with Acacias and trials with other species are made. Some 25,000 acres have been purchased for reforesting. Private owners have also become active. Three mining companies and the Shantung Railroad is planting along its right of way for 260 miles.

The success of the German plantations of Acacias, but also larch, walnut, oak, ash, fir, which already furnish mining props and firewood was such, the dry climate notwithstanding, as to encourage these extensions. Theft and caterpillar are the greatest troubles. The latter can be combatted only by hand picking. In 1908 some seven million caterpillars were gathered by Chinese boys, and, treated with lime, used as manure.

Silva, 1910. No. 2. P. 13-14.

Russian Conditions. According to an official report the forest area under the crown lands department was on January 1. 1907, altogether 921,725,000 acres. Of this area only 48,893,000 acres were under working plans, and another 85,704,000 had been examined for working plans. Of the total area only 259,254,000 acres were the exclusive property of the crown. The forest area in Europe is placed at 275,795,000 acres.

According to estimates, 394,632,000 acres are fit only for forest purposes, of which 223 million in European Russia.

In 1906 the felling budget for the crown forests had been determined for 345,000,000 cubic feet, but only 130 million cu. ft. were cut; yet this was the largest cut on record. The total sale value of this cut was $27 million. Under the supervision of the conservation committees there were altogether 136,442,000 acres, and their expenses amounted to only $63,000. The total expenses of the crown forest department were little over $5 million, the returns $27 million.

Allgemeine Forst- u. Jagdzeitung. December, 1909. P. 428.

POLITICS AND LEGISLATION.

Forest Legislation in Switzerland.

That even in the well ordered countries of the old continent not everything is plain sailing as regards forest administration is exemplified by the result of a referendum to the people of a law which had in view the execution of the Swiss federal forest law of 1902 in the canton of Tessin. This was overwhelmingly negatived, although its provisions seemed to be quite reasonable. Such is the conservatism of the people, that merely to name the forests of the state, municipalities and corporations "public forests," i. e., forests to be managed in the public interest, roused a storm, because it was feared private rights would thereby be imperiled. The proposition that the forest owners should contribute 20 to 40 per cent. to the very low salaries of the foresters (according to rank from $200 to $900) was opposed by the corporations, the contributions hitherto having been one-third. Similar opposition was offered to discontinuance within ten years of the practice of parceling out to citizens the usufruct in corporation forests, which naturally has led to mismanagement.

Formerly, the corporations contributed 3 per cent. of their net yield to the federal treasury for the execution of the protective service, a raise to from 4 to 7 per cent. was resisted, as well as the proposition to discontinue the distribution of the incomes among the citizens and, instead, either reserving it as a whole in bank as a savings fund, or using parts for improvements.

The report concludes that even if the forest law in every respect were satisfactory, the foresters of Tessin would find it still for decades an exceedingly difficult and thankless task to improve forest management on the southern slope of St. Gothard.

Das tessinische Forstgesetz. Schweizerische Zeitschrift für Forstwesen. January, 1910. Pp. 24-26.

Forest Fires in Prussia.

According to a report of the Statistical Bureau of Prussia the damage occasioned by forest fires during the period 1903-07 amounted to around $800,000, namely, from year to year, rounded off, $44,000, 335,000, 200,000, 67,000, 190,000 respectively. The extraordinary variation from year to year is notable.

Only $140,000 of this loss was insured and the insurance did not pay more than $60,000. This is considered due to an over-cautious attitude of the insurance companies; for if the average value of an acre were placed at $50 the total forest area of Prussia would be worth around $1000 million, and if in five years only $800,000 are burnt up, the risk is exceedingly small, much less than in the case of house and furniture insurance, in which at least one per mill of insured values is destroyed while in the forest the annual average risk would be less than two in ten thousand.

Silva, 1910. No. 3. P. 22.

Large Forest Fires in Bavaria.

In the spring of 1909 Germany, especially in the northern plain, in the pineries, experienced many and relatively extensive forest fires in spite of all the precautions which are usual there. The southern country is much less endangered but there is near Nürnberg in Bavaria an extensive forest of 75,000 acres of pinery on poor sand, in which some 15,000 acres of young plantations are the result of an insect pest in 1892 to 1896. Here two "large" forest fires occurred in May; one set by sparks from the locomotive destroyed 225 acres, and ten days later another fire probably occasioned by carelessness of a smoker destroyed 130 acres, although it was almost immediately noticed by the fireguard and some 400 soldiers in addition to other fire fighters were put in requisition. In reporting these fires it is stated that these are probably the two largest forest fires from which this much endangered forest has suffered during the last half century.

Grosse Waldbrände in Bayern. Forstwissenschaftliches Centralblatt. November, 1909. P. 605.

OTHER PERIODICAL LITERATURE.

Canadian Forestry Journal, 1909,—

The Nova Scotia Forest Survey. Pp. 141-142.

The Spruce Budworm. Pp. 143-144.

A statement of the work of this *Tortrix* in Quebec Province the past season.

The British Columbia Timber Situation. Pp. 144-150.
Remedies suggested by Professor F. Roth and Dr. J. F. Clark.

Fire Protection on Forest Reserves. Pp. 151-153.
A brief statement of the methods in use by the federal Forestry Branch.

American Forestry, 1910,—

Perpetuating the Timber Resources of the South. Pp. 3-12.

The Crisis in the Southern Forests. Pp. 21-31.
Addresses of conservation and policy.

The Indian Forester, 1909,—

National Afforestation. Pp. 594-604; 703-713.
A very complete discussion of the Report of the British Royal Commission.

Fibre-producing Plants in India. Pp. 561-569.

Utilization of Wood Waste. Pp. 618-624.
General information as to methods followed.

Irritant Woods. Pp. 662-663.
Reference to the effects on workers of certain tropical woods.

Reproduction by Coppice Shoots. Pp. 667-670.

Effect of Rainfall on Forests. Pp. 682-683.

The North American Conservation Conference. Pp. 717-725.
The declaration of principles in full.

Forest Leaves, 1909,—

State Forest Academy. Pp. 68-69.
Details of the method of educating foresters at State expense in use in Pennsylvania.

Taxing Land Held for Reforestation. Pp. 73-75.

Suggests legislation to exempt tracts of 500 acres or more, the State to reimburse the counties.

Financial Drawbacks to the Practice of Private Forestry. Pp. 75-78.

These are: inability to figure future profits definitely, uncertainty of future taxation, and fire danger.

Quarterly Journal of Forestry, 1909,—

The Natural Pine Forests on the Ulea River, North Central Finland. Pp. 311-320.

Descriptive.

The Reafforestation of Wastes. Pp. 332-339.

General.

[1910],

Scottish Forestry Tour in Bavaria. Pp. 1-9.

Thin Versus Thick Planting. Pp. 30-33.

Transactions of the Royal Scottish Arboricultural Society, 1910,—

Sitka Spruce as a Tree for Afforestation. Pp. 7-16.

Afforestation of Catchment Areas. Pp. 22-30.

An account of work done by municipalities within the last eight years.

Forestry Notes from Germany. Pp. 38-51.

Notes on use of manure in cultural operations, on planting methods, on mixed forests, and on forestry in German colonies.

Forestry Notes from France. Pp. 57-67.

Visit to the Forests of Bavaria. Pp. 72-79.

An account of the annual excursion of the Royal Scottish Arboricultural Society for 1909. Following this come some 20 pages of interesting notes and observations.

Quarterly Bulletin of the Canadian Mining Institute, December, 1909,—

The Relation of Mining to Forestry. Pp. 87-92.

American Lumberman, 1909,—

Progress in Forest Conservation in the Northwest. December 11, pp. 44-45.

An account of proceedings at a special meeting of the Western Forestry and Conservation Association at Spokane, Washington, held to create an interest among timber land owners in organizing for better care and protection of the forests.

[1910],

Unwise and Impolitic Timber Policy of a Great State. January 8, p. 42.

Some very pertinent remarks regarding the policy of New York State.

Review of British Columbia Timber Land Situation. January 8, p. 42.

Contains some interesting figures of land values.

Phenomenal Development of Canada's Pulp Industry. January 8, p. 67.

Yale Forest School. January 22, pp. 31, 40-41.

A report dealing mainly with the relation of lumbermen to forestry education and giving a detailed outline of the course on the lumber industry.

Washington Forest Fire Association. January 22, pp. 41-42; February 12, p. 37.

Gives a summary of its work for the year and very useful details of the methods for protection.

The St. Louis Lumberman, 1910,—

The Annual Fire Waste. January 15, p. 24.

Statistical.

Foreign Trade of America in Forest Products. January 15, p. 53.
Statistical.

"Even Lengths" Wastage. January 15, p. 83.
Statistics resulting from an investigation by the U. S. Forest Service.

Bulletin of the American Geographical Society, 1909,—

Surveys and Maps. Pp. 751-754.
Remarks on topographical surveys and maps.

The Pulp and Paper Magazine of Canada, 1909,—

A Review. Pp. 321-325.
Pulp and pulpwood statistics.

Newfoundland Timber Areas. P. 333.
Descriptive.

[1910],

Treatment of Waste Paper. P. 5.
Describes the Herz method of reclamation.

Natural Resources of Quebec's Hinterland. Pp. 15-17.
Discusses the pulpwood areas in a general manner, and emphasizes the fire risk.

The Botanical Gazette, Volume 49, 1910,—

Microtechnique for Woody Structures. Pp. 57-58.
Method in detail.

The Ohio Naturalist, Volume 10, 1909,—

The Twig Girdler. Pp. 1-7.

The Gymnosperms of Ohio. Pp. 9-12.

List of Insects Affecting the Maple. Pp. 36-37.
A classified list of 100 species.

The Midland Naturalist, 1909,—

Notes on Populus. Pp. 113-118.
Discusses *Populus alba* and *P. canescens.*

Nyssa sylvatica. Pp. 128-137.
Morphology and anatomy of the species.

Bulletin of the Torrey Botanical Club, 1909,—

Study of Winter Buds with Reference to Growth and Leaf Content. Pp. 117-145.

Some Aspects of the Mycorhiza Problem. Pp. 165-169.

Some Unsolved Problems of the Prairies. Pp. 265-271.

A New Fungus of the Swamp Cedar. Pp. 341-343.

On the Characters and Relationships of the Platanaceae. Pp. 389-395.

The Western American Birches. Pp. 421-440.
Describes seventeen species, seven of them new, with key.

The Crataegi of Mexico and Central America. Pp. 501-514.
Describes eight species.

Science, 1910,—

The Relation of Plants to Peat Formation. Pp. 38-39.
A brief of an account of two common types of peat deposits and ecological relations of the plants from which they are formed.

The Agricultural Gazette of N. S. Wales, 1909,—

Poplars. Pp. 955-963.
Notes on 14 species.

The Philippine Journal of Science, Botany, 1909,—

Indo-Malayan Woods. Pp. 409-592.

Rod and Gun, 1909,—

Conservation of Our Natural Resources. Pp. 126-127; 623-624.

Deals with fish and game.

Kaliki, the New Rod Wood. Pp. 602-603.

Spiraea discolor from Vancouver Island.

NEWS AND NOTES.

A conference of forest schools was held at the invitation of Mr. Pinchot on December 30 and 31, 1909, in Washington, D. C. at which 15 Universities and colleges giving instruction in forestry were represented.

As a result of the discussions a committee of five was appointed to consider and report to the conference a scheme for establishing a minimum standard curriculum in forestry and to report also on the feasibility of permanently organizing the present conference. The motion was carried unanimously.

The membership of the committee selected by Mr. Pinchot as chairman, is as follows: Messrs. Graves (Chairman), Pinchot, Fernow, Roth and Fisher.

During the afternoon session of December 31, Professor Graves for the committee, presented to the conference the following resolutions:

That the committee recommends:

1. That the conference goes on record in favor of an association of forest schools.

2. That a committee be appointed with power to call a meeting of the conference at its discretion.

3. That this committee be charged with the formulation of a constitution for the proposed association.

4. That the committee, in consultation with the Forest Service and other employers of foresters, formulate a standard of forest education.

5. That the proposals of the committee be submitted to the members of this conference in advance of the meeting at which they are to be considered.

The resolutions were passed unanimously and upon motion of Professor Mulford, the temporary committee was continued in office for performing the work defined by the resolutions.

Those present were: F. A. Goetze, C. C. Curtis, Columbia University; R. T. Fisher, Harvard University; C. A. Scott, Iowa State College; H. S. Drinker, R. W. Hall, Lehigh University; F. W. Besley, Maryland Agricultural College; J. F. Baker, Michigan Agricultural College; J. A. Ferguson, Pennsylvania

State College; G. E. Tower, University of Maine; Filibert Roth, Walter Mulford, C. L. Hill, University of Michigan; S. B. Green, University of Minnesota; F. J. Phillips, University of Nebraska; R. B. Miller, University of New Brunswick; B. E. Fernow, University of Toronto; F. G. Miller, University of Washington; H. S. Graves, Yale University.

Some of the addresses will be found in this issue.

In Prussia hitherto the hunting in the state forest was conducted in two ways: the "high" game, stags, roebuck, etc., was administered, a certain annual budget to be shot and the sale value to be delivered to the treasury, while the "low" game was at a more or less nominal sum rented or leased to the district manager and the proceeds came into his pocket. Last year this leasing system was abolished, and the low game is "administered" like the high game.

The Commission of Conservation of Canada held its first meeting at Ottawa on January 18th.

The Canadian Commission, different from the American (May 19, 1909) is instituted by legislative act, and hence under federal appropriations. It is composed of thirty-two members, twelve of whom *ex officio,* being the officials in charge of crown lands in the various Provinces, ten are appointed as representatives of provincial Universities and of the remaining appointees, three are members of the legislature. Mr. Clifton Sifton, also a member of Parliament and former federal Minister of the Interior, noted for his administrative ability, is the appointed chairman. An excellent secretary is in charge of the offices in the person of the former Chief Geographer of the Dominion, Mr. James White.

The meeting, lasting four days, was opened with a masterly and statesmanlike address by the chairman, setting forth the wide scope of the work before the commission, and explaining the policy to be pursued, namely, mainly an educational, persuasive campaign, leading, rather than forcing to less wasteful use of the natural resources. The whole of the second day was devoted to the reading of papers by experts on various subjects; the third day to discussions and organization into committees, the chairmen being appointed by the ex-officio members from the other membership. Besides committees on Forests, Lands, Waters, Fisheries, Game and Fur-bearing Animals, a committee on Public Health was created, man, himself being recognized as a "natural resource."

On the fourth day, each committee submitted a brief report outlining the directions in which it proposed to work. The question of appropriations being recognized as circumscribing the activities of the committees and the commission, the amount to be asked for was discussed. It was decided to go slowly and ask only for an additional $50,000 to the $10,000 originally appropriated for organization of the central offices. The meeting was then adjourned until May, when it was expected more definite ideas as to practicable lines of work might be submitted.

The Committee on Forests proposed at least two immediately practicable lines of activity, namely, to secure legislation making federally or provincially owned railroads liable for damage by fire, and subject to the provincial fire laws; and the compilation of a report on forest fire fighting methods in use.

Meanwhile the Commission acting through its chairman and offices has already found its functions growing unexpectedly, namely in the direction of keeping watch of developments inimical to a conservation program, representing the interests of the people, especially in questions of water power development.

Mr. Asa S. Williams, for several years past Forest Engineer for the Lidgerwood Manufacturing Co., builders of the Power Logging systems, has just been appointed Manager of the Logging Machinery Department of the Allis-Chalmers-Bullock Co. of Canada. This Company has acquired the Canadian rights to the Lidgerwood Systems. They will build and instal these electrical and steam appliances for all conditions of provincial use.

Mr. Williams, who graduated from Cornell in 1903, is known to the readers of the Quarterly as a contributor and one of the associated editors. Indeed, it was due to his efforts while still a student that the Quarterly came into being.

Mr. Williams, in the seven years since leaving the college has had a varied experience in all parts of the United States and is probably the best posted man on the economics of logging.

Mr. Chas. A. Scott, professor of forestry at the State College, Ames, Iowa, has accepted the position of state forester of Kansas and professor of forestry in the agricultural college. He will begin his duties June 1.

Mr. O. L. Sponsler has been appointed to the position of adjunct professor of forestry in the University of Nebraska, where he will teach the subjects of forest mensuration, study of woods and dendrology. Mr. Sponsler has had experience as a laboratory assistant at the University of Michigan Forest School, where he assisted in forest botany and forest mensuration. He has had field experience in the lumber camps of British Columbia, in the lumber yards of Michigan and in a study of forest conditions in Ohio.

It is proposed to hold a United States Agricultural and Industrial Exposition modelled somewhat after the national exposition which is held in Canada. The temporary headquarters are at Hartford, Connecticut. The following foresters have been appointed to the advisory board: U. S. Chief Forester H. S. Graves, F. W. Besley, F. J. Phillips, R. T. Fisher, C. A. Schenck, Ralph S. Hosmer and Alfred Akerman. It is expected that the fair will be permanent and give annual exhibitions. It is the intention to have a large tract of land which shall serve as a forestry demonstration area, and to have a forestry building which will be adapted to permanent use.

Forty-three members comprising the present class of the Biltmore Forest School, have settled in their winter quarters at Darmstadt, Germany, where they will remain until the end of April, at which time they return to Pisgah Forest, Biltmore, N. C. This movement is in accordance with the new policy of the school which aims at imparting a much greater variety of knowledge than can be gathered under purely local conditions. The pine forests to the north and west of Darmstadt and the great hardwood forests to the south and east of that city offer exceptional opportunities to the students who are delighted with their surroundings, claiming them to be nearly ideal. The class has been received in Germany with every demonstration of friendship.

The spring field work of the Senior class of the Yale Forest School will begin at Clarks, La., on March 7, and will close on

June 11, 1910. The work will be conducted on the holdings of the Louisana Central Lumber Company, of which Mr. J. B. White, of Kansas City, is General Manager. Mr. White is one of the foremost lumbermen in the United States and a strong advocate of forest education and forest conservation. Professors Bryant and Chapman will be in charge of the party.

In California, Mr. G. B. Lull, a graduate from Cornell, has resigned his position as State Forester to become Field Manager for an Eastern company engaged in the production of Eucalyptus in the Sacramento Valley.

Since the Pennsylvania Railroad Company's planting operations for the year 1909 involved the planting of 70,000 red oak in the fall, the summary was not worked up until the end of the year. It shows that there were shipped from the Company nursery during 1909 a total of 1,240,381 trees, which cost to produce $3.08 per thousand. Of this number 186,371 were disposed of for use outside of the Company's planting operations, the remainder, 1,054,010, being set out in commercial plantations on Company land. The planting work involved 12 separate tracts of an aggregate area of 662 acres. The average cost of the plant material delivered at the planting sites was $3.15 per thousand, and the cost of planting $4.56 per thousand, or a total cost planted of $7.71 per thousand, or about $9.25 per acre. The total number of trees planted up to date is 3,482,186, and about one million trees are now on hand in the nursery.

The Colorado School of Forestry opened its fourth year auspiciously last September with a total enrolment of 30 and an entering class of 17, many of whom came from the East.

Professor Winkenwerder (Yale F. S. '07) left to take charge of a new school of forestry connected with the University of Washington, Seattle, Wash. He was succeeded by Walter J. Morrill (Yale F. S. '05) who was acting Supervisor of the Rio Grande National Forest. Philip T. Coolidge (Yale F. S. '07) Forest Assistant on the Rio Grande National Forest accompanied Mr. Morrill as Assistant Professor of Forestry.

Colorado School of Forestry is fortunate in its environments, within walking distance of the Pike National Forest, a half hours ride from the largest forest nursery in Colorado.

This winter the School like several others is conducting a ten weeks' ranger course in coöperation with the United States Forest Service. Two weeks are spent at the School and the remainder of the time on their 13,000 acre tract in the Pike National Forest. Tuition is free and the Forest Service participates in the instruction. Sixty rangers and deputy supervisors from the Service are among those in attendance without, of course, any deduction of salary.

The University of Montana in addition to its regular course in forestry is giving a special course for the Government rangers by arrangement with the U. S. Forest Service, January to March. The University is fortunate in its proximity to some of the National Forests and in the presence of the central offices of District No. 1 in Missoula.

At the January meeting of the Pacific Northwest Forest Protective and Conservation Association its name was simplified to the Western Forestry and Conservation Association. This is a central medium for facilitating the work of all the local conservation and forest protective organizations of the states, Montana, Idaho, Washington, Oregon and California. Its meetings enable representatives of the individual associations and of the State and of the Forest Service to exchange ideas and devise ways and means for carrying out their purposes in harmony. The Association has the usual objects in view and has engaged as forester, Mr. E. T. Allen, formerly U. S. district forester. At present efforts are being mainly directed towards obtaining coöperation by the people, legislators and lumbermen, and the perfection of fire protection system.

A bill has been introduced in the House of Commons, Canada, making it illegal for any member of the Commission of Conservation or any official employed by it, to acquire franchises, powers, mines, lands or timber limits under penalty of forfeiture of the property and payment of $1,000 fine for each violation.

The New York Central and the Delaware and Hudson Railway

Companies have been ordered by the public service commission to instal oil-burning locomotives on their lines through the Adirondacks, with a view to lessen the number of forest fires. 168 gallons of oil are said to be equal to a ton of coal.

The Ontario Legislature has taken power to proclaim any part of the public domain as a Crown Forest Reserve, after date of proclamation of which no land within such reserve shall be located, sold, leased, or disposed of for agricultural settlement. Each reserve shall be under the control and management of the Minister of Lands, Forests and Mines. Timber thereon damaged by fire or which has attained mature growth may be offered for public sale subject to the regulations. The Minister, for the purpose of creating a Crown Forest Reserve, may arrange with any holder of a timber limit which has been cut over and upon which young pine is growing, or which the Minister is satisfied will generally reproduce pine timber, for the surrender of such limit or any part thereof upon such terms and conditions as to the remission of any timber dues or ground rent or any part thereof which may be due or owing to the Crown in respect thereof and upon such other conditions as may be set forth in the report of the Minister and approved by the Lieutenant Governor-in-Council, but no payment of money shall be made for any such surrender until an appropriation for that purpose has been made by the Legislature.

Henry Nordewich, United States Consul at Christiania, reports as follows concerning the manufacture in Norway of wood flour and the uses to which it is applied: Wood flour, or pulverized wood, is an article distinct from wood pulp and cellulose. It is made use of in the manufacture of dynamite and linoleum. It is made from sawdust from sawmills. The requirements are that the sawdust shall come from spruce or pine logs, mixed or unmixed, and that it shall be perfectly clean and unmixed with any particles of bark. The sawdust is first kiln dried and then ground between millstones, in about the same manner as wheat flour; it is led through a tube into the hopper of a vibrating sieve, built somewhat on the principle of a fanning mill. The sieve is furnished with cloth covered slides, through which the mass must pass. The cloth is of such fineness that it holds from 2,500 to 4,000 meshes, or punctures, to the square inch. The cloth is manufactured in Germany. For shipment, wood flour is packed compactly in sacks by machines imported from the United States. The flour is made in six or seven grades. The principal markets for the Norwegian product are the United Kingdom, Germany and France; some is also exported to the United States. The export from Norway in 1907 amounted to 6,218 English tons, valued at $12.73 per ton, or $79,140. This value is that placed on the article for statistical purposes. Nearly all of the output is exported, as only small quantities are made use of in Norway.

Forest fires in the National Forests in Oregon and Washington were 366 last year as compared with 450 in 1908, the acreage being reduced one-half, and the destruction of the timber from $101,108 in 1908 to $75,521. These decreases are due largely to the continued development of trails and telephone lines and the coöperation of the settlers. The causes of these fires were: lightning 6%, brush-burning 8%, railroads 12%, campers 26%, miscellaneous 8%, and unknown 40%.

Professor Farrier, of McGill University, Montreal, who has been studying the sawdust-alcohol problem for many years, states that one ton of sawdust will produce 20 gallons of alcohol at a cost of 6 cents a gallon.

The 27 million acres of forest reserves in Alaska are estimated by the U. S. Forest Service to have 60 to 75 billion feet of standing timber, 60 percent. western hemlock and the remainder spruce and red and yellow cedar.

In consideration of a gift from Mr. B. C. Jordan, the State of Maine offers five prizes, of $500, $250, $125, $100 and $25, for the five best lots of young forest growth in the State. The prizes are to be awarded every 18 years and in accordance with rules devised by Mr. Jordan as to size of lot, dimension of trees, species to be used, etc.

Germany, taking time by the forelock, is busily investigating the timber possibilities of her African colonies. The areas of

Kamerun accessible to the large rivers and the two railway lines under construction have been studied by experts and they report a good percent of forest, one-half of commercial value. The forests are mainly hardwood and are characterized by the large number of different species. Good water power exists for mill use.

A movement is on foot for the preservation of a tiny yew woodland in the Bavarian mountains, near the village of Patersell and not far from the royal city of Munich itself, the great part of which is included in the state forest reserve. This primeval forest land, according to a recent account, comprises about 845 large and 1,456 small trees. The larger trees are at least 200 to 500 years old, while the smaller trees are all under fifty years. The largest of the trees at a height of 4 feet from the ground, has a circumference of 8 feet 8 inches, and many of them are more than 6 feet in circumference, with heights varying from 50 to 60 feet. These rare trees are much damaged by storm and still more through the cutting away in the spring of the young sprouts, which are much used for wreaths and decoration. This tree, the wood of which was so eagerly sought in the days when the cross-bow was still a dangerous weapon of warfare, was widely distributed over Germany in the middle ages, but is to-day almost extinct.

The Grand Rapids and Indiana Railway Company plans to establish an experimental forestry farm at some point along the line, with a view to growing timber for ties.

D. H. Day, lumberman of Glen Haven, northern Michigan, secured working plans from a government expert five years ago for the care of his 1,400 acre tract of young timber which lies between Glen Lake and Lake Michigan. The trees are sugar maple, beech, red oak, black cherry, white ash, aspen, paper birch, white pine, Norway pine and hemlock. Thinning has been done, fire lines have been carefully maintained and Mr. Day is much pleased with results from a commercial standpoint.

For the first time in Canada a city is taking steps to guarantee its water supply by reforestation. The city of Guelph, Ontario, is this spring planting the first 25 acres of the watershed from which its water supply is derived. In time, of course, the scheme will also yield financial returns.

Some data regarding the giants of the California Sierra, which are not quite generally known are extracted from a private letter emanating from the Forest Service: The principal owner of the Calaveras trees is Robert B. Whiteside of Duluth, Minn., this in spite of the efforts of many interested citizens, and in spite of the law of February 8th, 1909, which ordered the purchase of the grove by the Federal Government. In the absence of funds to purchase outright, the Department of Agriculture was authorized to secure the grove by exchange for other lands or other timber. This transaction is, however, not yet completed. In all about 40,000 acres are involved in two parcels; the northern grove containing 93, the southern 1,380 Sequoias, including only trees of 18 feet circumference. Some 25 of these giants have a diameter of 25 feet and over; some 70 between 15 and 25 feet diameter, of which from 1 to 4 feet goes for bark. The maximum height is over 400 feet. Two trees produced 14,750 and 13,000 cu. ft. respectively.

COMMENT.

The event which has agitated the forestry world in the United States since our last issue, has been the removal from office of Mr. Pinchot, deliberately provoked by him. The true inwardness of this step by Mr. Pinchot is so far not publicly known, nor is there at present writing anything developed in the Glavis-Ballinger case which would justify the provocation. While from the standpoint of ethics there is much to be regretted in the incident, from the standpoint of the profession the loss has been minimized by the appointment of Prof. Graves as Mr. Pinchot's successor. Indeed, we believe that at this juncture the Forest Service has gained by the change, for Mr. Graves is not only perfectly capable of administering the Service, but, without having his attention distracted by other interests and political ambitions, he will be able to devote himself unreservedly to that administration, and to the development of the technical side of its problems.

In a movement of economic reform, like the forestry movement men of different type are needed at different periods of its progress, and, we believe, the right man has come in at the right time. Although appearances are still from time to time against the assumption that the federal forest policy has arrived at a stable basis, the momentum of the established is bound to carry it over the occasional setbacks, and an efficient interior administration is all that is needed. Meanwhile, Mr. Pinchot will be able in his private capacity, unhampered by official considerations, to advance the conservation movement, and to do what he is best fitted to do,—educate the public to a proper attitude in these matters.

It will be noted that a large part of this issue is given up to discussions of an educational character through the publication of some of the addresses delivered at the conference of forest schools, of which we bring a brief report on page 123, and by other contributions.

This conference was an important event, and one of the most useful movements in educational lines, for which Mr. Pinchot deserves full credit. The mushroom-like development of forest schools, which we have experienced during the last five years, threatened to lower the standard of forestry education, and the proposition to standardize the instruction which shall be acceptable for a graduate from a forest school to take a position in the profession comes most timely. It was wise for the conference not to attempt to formulate anything definite, but to leave the matter to a committee and gradual evolution.

The strictures which "A Professor" advanced in our last issue, if in some respects undeserved and, we might be permitted to add injudicious, nevertheless voiced the feeling that must have been somewhat general; otherwise this conference would probably not have been necessary.

It was interesting to note that the question as to whether we are "overdoing" forestry education as regards the number of institutions offering such, which also means a great increase in the number of students, seemed to be negatived by most of those present, sanguine expectations as to the employment of professional foresters being expressed. That in the long run hundreds, nay thousands of foresters—of varying degree of education—will be needed, can hardly be questioned. It may, however, be questioned whether at the present stage of development the market might not be easily overstocked, and will absorb readily the output, which wants *now* to earn its bread and butter in this profession.

This same question has lately been ventilated in Germany—at the other end of development as it were—where nine institutions are competing to prepare for the higher grade positions. At the meeting of the German forestry association the desirability of concentration, in order to keep up the standard, was generally advocated, and a *numerus clausus*, a limit of students to be admitted for State service, has become necessary in order to relieve the overcrowded profession.

The question which created most discussion at the conference was as to the length of courses and character of the instruction needed, and especially how far "practical" instruction could or should be given at a forest school, referring, of course, to higher grade schools. There are many ways to Rome, so there are many ways to an education. Whether this or that road is preferable depends upon the object of your travel and the ability to benefit by it. If getting to a certain place is the object, the shortest road is the best, provided it offers fair traveling chance; but, if results of a broader kind are the object, the longer, more circuitous route, which insures variety of view and experience, is to be preferred.

It was gratifying to the writer to note that if not the consensus, yet the weightier opinion, and even of those who formerly had laid stress on the need of practical education, was to the effect, that at a school, theory and principle could alone satisfactorily be taught, that the acquisition of practical things must be left to practical life or life in practical pursuits, as is done in other professions. Just as an engineering school does not turn out engineers, or a medical school physicians, but only men who are prepared to become engineers and physicians, so a forest school cannot expect to do more than prepare men to become foresters; experience, judgment, practical knowledge, come only from practice, and are to be learned in the practice. All the school can expect to do is to illustrate principles and theory by some practical demonstrations. In other words, you cannot learn everything in schools. How far to carry or limit this demonstration work must in part at least depend upon the accidental or deliberately prepared opportunities which each school has at its disposal. Expediency and necessity has hitherto required young men without practical experience to shoulder responsibilities for which they could hardly be prepared in schools. Many blunders were, therefore, unavoidable. The remedy for this state of things can, however, hardly be found in the schools, but in a proper realization on the part of students as well as employers, that schools cannot turn out accomplished chief engineers, that, as in other professions, these are developed through practice by gradual evolution from lower grade employment.

A proper organization of the Forest Service for instance, with a more or less assured, regulated and graded progress from lower to higher positions would do much to promote the end in view, namely, the development of forest managers without too many blunders.

In the end there must be variety of education in any profession as there will be variety of men, and of positions for them to fill.

We hope that the final report of the committee to whom the standardizing of forestry education is entrusted, will be based on broad conceptions of this needed variety.

The communication of "A Professor" published in the last issue (Vol. VII, No. 4) criticising the insufficient education of foresters and trying to find reasons for it, has provoked two letters in rejoinder of which we give the substance. Both writers object to the Quarterly publishing anonymous letters. The Editor, however, does not see any impropriety in publishing contributions which do not contain any direct personal reflections without the name of the author, as long as he is known to him as a *bona fide* person entitled to be heard. In the present case the contribution was signed, and at the suggestion of the Editor the name was withdrawn in order to avoid the possibility of arousing unnecessary personal aspersions which might lead to unprofessional altercations. These, it will always be the policy of the Quarterly, to keep out as far as possible. It is for this reason too that the names of the two letter writers although signed, are not given, since their names would not help the argument. Both of them are in practical work, one in the West, the other in the East, the first being a Forest Supervisor, and speaking much to the point.

"A Professor" claims that the professional forester does not receive due recognition in the United States and places the blame largely on the Forest Service for its practice of "dubbing every unqualified man they pick up with the title which belongs properly to the trained man alone." Admitting a certain amount of truth in his statements, does not his article show a woeful ignorance of the work of the Forest Service and the present needs of forestry in our country? Conditions are such as to call for a broader and more practical training than can be secured by a technical education alone. The technical man will find his place in later years, but for the present it is a man who can adjust forestry principles to local conditions, who can bring order out of chaos, and has the business ability and practical education necessary in paving the way for the more professional man of the future. The American forester of to-day is essentially a pioneer and the work he is called upon to do is so varied in its phases as to be beyond a man who has been trained and educated along the lines of technical forestry only. The Civil Service examinations are intended to meet present needs and will no doubt be adjusted to meet the advance of forestry in our country. The Forest Service constitutes the most loyal, enthusiastic, and efficient body of men in the Government employ to-day. Perhaps, in many instances, they have not all the qualifications of the professional forester, but the main point is that they are doing the work of the hour, that which is most urgent, and their success along this line cannot be questioned by one who is even partly familiar with the work of the Service and the results obtained to date, as evidently the "Professor" is not.

J. R.

I object to the statements made by "A Professor" that the employment of a forester by a lumber company for the better cruising of its timber is an insult to the profession and a disgrace to the man who continues to hold such a position and contents himself with such work—"The forester should refuse such work and the makeshift forester be discredited by the profession."

Now that would really be too bad. The "Professor" would deprive the lumber companies of the services of foresters for the better cruising of their timber. The "Professor" evidently believes the forester could cruise the timber better than any one else, for he uses the word "better" to describe the cruising done by a forester, but, nevertheless, says that "better cruising" should not be done. That is rather hard on the lumber companies, is it not? The "Professor," it seems, would have them go back to the old-time methods which were in vogue before the advent of forestry to this country, for surely, it would never do to allow the noble profession of forestry to be insulted. But where does the insult come in? Is it an insult to the profession of medicine to call in a doctor if one feel ill? Is it an insult to the profession of law to retain a lawyer if one wishes to defend one's self in court? Is it an insult to the profession of engineering to employ an engineer to lay out a railroad? Cannot even the poor abused lumber companies employ engineers, lawyers, and doctors without committing a breach of etiquette? I never heard anyone, not even a professor, say that those professions were insulted by such employment. Then, pray, why should not a lumber company employ a forester to do that which is the first step in management of any forest, *i. e.* to take account of stock?

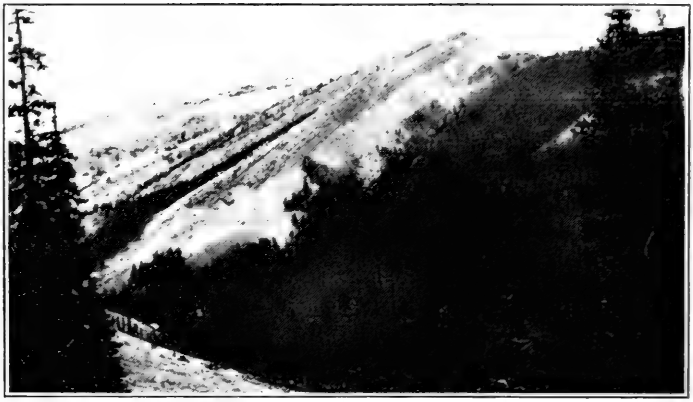
There are many foresters employed by lumber companies for the "better cruising" of timber. I am sure that the foresters so employed are honorable men with a pride in their profession. Perhaps some of them are "makeshift foresters," but I know many who are not. Either they are woefully ignorant of the disgraceful position in which they are placed or they are wilfully erring. I prefer to think that the "Professor" is wrong, that he has a wonderfully misconstrued conception of three things; first, of what American forestry is; second, of what an insult is; third, of what a profession is.

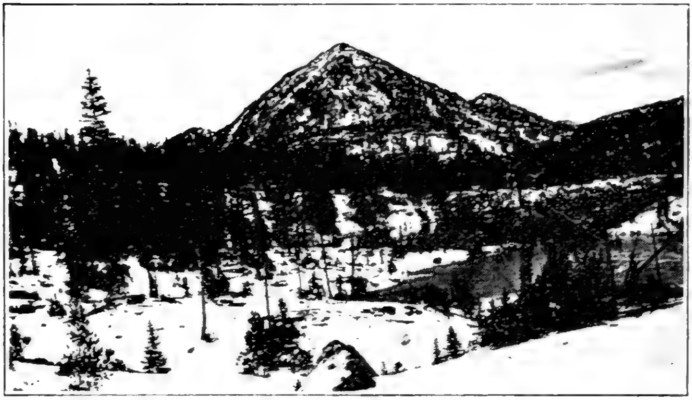
There would be many foresters without positions if all who are employed by lumber companies for the purpose of cruising timber should refuse such work.

D. E. L.

In the rapid development of the wood preserving industry in the United States, it was but natural that many preservatives and processes of questionable value should be put on the market, and the strange part of it is that many of these impractical short-cut schemes have found acceptance with concerns which should know better. The number of useless preservatives is legion, but their use, as a rule, is not extended to the larger consumers who have taken the trouble to find out what they really want. A rather startling exposure, however, of a supposedly standard process of treatment was made at the January meeting of the United States Wood Preservers' Association in Chicago. It concerned the American Creosoting Company, which is one of the largest concerns in the country and which controls and uses the Lowry process. The claims for the patent have been that, after injecting 12 to 15 pounds of creosote into the ties to be treated, about 60% of this amount could be withdrawn by a quick, high final vacuum, the much exploited advantage of the treatment being in the use of a minimum amount of oil and therefore in the economy which results. The claims for this process have been so well presented that several of the large railroad companies have been having their ties treated by this process, and although the only decisive test of it—which is that of time—has not been applied, it has been assumed that the 2½ pounds which are supposed to be left in the wood are ample to prevent decay during the period before the tie would fail from mechanical wear. It was brought out very clearly, however, at the Association meeting, that it is physically impossible to withdraw anything like 60% of the oil injected into a piece of timber and a series of actual tests at other plants showed that not over 10% at the most can be withdrawn, and probably 3 or 4 per cent. of this amount consists of drip from the inside of the cylinder and from the cylinder cars. The theory in the case backs up the results of unbiased tests and is based on the well-known fact that if a vacuum is applied at both ends of an open tube containing a liquid, none of the liquid will be withdrawn, and the same, of course, is true of the cells and tracheids in the wood, the vacuum in the cylinder being equal in all parts, and hence no recovery of oil can be made unless it is forced out by air pressure from the inside of the wood.

In December, 1909, a meeting of railroad representatives was held in Chicago at the instigation of the Forest Service to discuss the problems relating to railroad timber supply. About forty railroad men were present and Mr. Pinchot personally acted as chairman of the meeting. The discussions covered the problems the railroads are now facing in relation to their timber requirements, and it was brought out very clearly that there is an actual railroad timber problem, because prices are continually increasing and the quality is becoming poorer. There did not, however, seem to be any definite idea in the minds of most of those present as to what should be done, and some of the Middle Western roads expressed the sentiment that they were practically helpless in the matter because their only recourse was planting and that planting would not serve to ward off the coming timber crisis, and that even if planting were advisable from every point of view it would be difficult to finance a planting policy which would provide adequately for the future. One of the Government foresters present read a paper which showed the comparative costs of producing ties of four different species and placed the rotation in each case at 50 years. This seemed to convey the impression that a railroad company, in order to provide for its own timber supplies, must make an investment now from which no returns would be derived for half a century, and there did not seem to be a clear realization that the purchase of mature timberland for immediate use and second growth for the near future would be the logical solution. It is not likely that the meeting will result in any definite coöperation with the Forest Service, even though the Service expressed a willingness to assist in any way. The reason for this is plain, in that the point of view of the railroads and of the Service is so radically different, and the latter is not prepared—nor could we expect that it should be—to clearly and definitely suggest what the railroads could and should do to provide for their timber requirements for all time.





TYPES OF COUNTRY IN FLATHEAD FOREST, KOOTENAY RANGE, MONTANA.

The Continental Divide at the head of Sim River. Flathead Forest.

An illustration of the kind of country mapped. Kootenai Range, Flathead Forest.

A mountain meadow, Flathead Forest.

FORESTRY QUARTERLY

VOL. VIII] JUNE, 1910. [NO. 2.

THE COST OF FOREST MAPPING AND ESTIMATING IN MONTANA.

KARL W. WOODWARD.

In 1907, the Forest Service and the Northern Pacific Railway Company entered into an agreement to map and value the holdings of the latter Company within the National Forests of Montana. Since these comprise approximately a million and a half acres and the adjacent lands were also to be examined, the total area covered was roughly three million acres. To do this work, there was only a small force of technical men available and yet the total area was to be covered as rapidly as possible. Consequently, the methods which were used were those which allowed of rapid work and yet did not require a large force of skilled men.

Wherever the work of the United States Geological Survey covered an area to be examined or the General Land Office had surveyed it these maps were accepted and merely corrected if necessary. But when no accurate maps of the area were in existence it was necessary to prepare topographic maps with a contour interval of not less than 100 feet.

The original intention was to furnish estimates of the standing timber by sections, but the cost and time necessary for such close work were later considered too great and estimates by townships were furnished instead. Since there were no trained cruisers available for this work, the estimates were based on caliper strips, 66 feet wide, run at intervals of a mile or half-mile according to the density and value of the timber.

The estimating was of course merely a preliminary step in the valuation of the timber but also the most costly part of the appraisement, the data upon which the stumpage prices were based being secured without much additional labor. For the most part the timber upon the Railway holdings was inaccessible and only such as had been considered as valueless by private parties. This also held true of the lands of the Railway Company. Since the policy of the Company has been to dispose of these holdings as fast as possible and every encouragement has been offered to prospective settlers the grazing and agricultural lands within the National Forests were the least desirable of any of their holdings.

After the field work had been completed, reports were prepared on the lands within each of the National Forests examined giving a brief statement of the physical and economic conditions of the area covered, the basis for the land and timber valuation, and tables summarizing the information obtained by townships. The ideal which was kept in sight in the preparation of these reports was to furnish all of the information necessary to show the reason for the land and timber prices settled upon, and give in addition sufficient information to enable the Forest Service to have a basis for intelligent management of the parts of the National Forests covered. That included, therefore, not only the practical conclusions necessary for the valuation of the railway holdings but a great deal of information of interest only to the technical forester. Accompanying each report was a map showing the topography and distribution of the forest and land types and the location of the scattered railway holdings.

Character of Country.

For the most part the National Forests of Montana lie in the main range of the Rocky Mountains. Only one forest in the eastern part of Montana, the Custer, was examined. The conditions on this forest differed considerably from those in the rest of the area covered. There the country was relatively level and could be traversed throughout by wagon. The timber was restricted to the moister coulees and covered a comparatively small area in comparison to the grazing lands.

The other forests examined may be divided roughly into two groups, those east of the continental divide and those west. On the eastern side of the main range, the rainfall is much less and the only tree species which attain merchantable size are Yellow Pine, Douglas Fir, Lodgepole Pine, and Englemann Spruce. The stands are relatively open, timber of large size scarce, and only lumber of the poorer grades obtainable. The main industry in this part of the State is grazing. What little tillable land there is is used merely for raising winter feed for the stock which range in the mountains during the summer. The Gallatin Valley forms, it is true, a notable exception to this general statement. Mining is desultory with the exception of the Butte district and lumbering is purely local in character. All of the higher grades of lumber are shipped in from the Western Coast. The local timber is only fit for rough construction work and mining timbers.

On the west side of the continental divide the climatic conditions are more similar to those on the Pacific coast. The rainfall is slightly heavier than on the east side of the range and in addition to the tree species enumerated above Western Larch and White Pine reach commercial size. Grazing, farming, and mining except in the Butte district are industries of secondary importance while the greater part of the wealth at the present time is derived from lumbering. On account of the density of the timber and roughness of the country packhorses must be used in going around through the mountains. But while transportation is consequently more expensive there is much more water available for drinking and irrigation purposes. On the eastern side grass abounds everywhere and the main factor in choosing camp sites is the presence of drinking water, while west of the divide water is commonly abundant and horse feed is the principal consideration in choosing a camp.

Costs.

Provisions. The average cost used per man per month was $15.00. When a party was of sufficient size to justify the hiring of a cook, whose wages varied from $50 to $75 per month, the cost of feeding per man per month amounted to at least 75 cents per day. The larger the party the lower the cost of feeding per man became when a cook was employed. In no case did a party consist of fewer than five men for any considerable period and it was found that one cook could do all of the work for ten or twelve men if the teamster supplied him with fuel. By reasons of the long distance from the railroad at which the supplies were usually bought the prices per unit were always greater than prices for the same article in the larger towns. Every effort was made, however, to reduce the cost of provisions by buying in large quantities and securing at least the semblance of competition by informal bids. There is given below a ration list which shows the amount of articles used on the average per man per month. The list was not always followed closely since it was often found possible to make substitutions and secure a greater variety. The list differs from the Army and Geological Survey lists in not calling for so many canned goods. From a desire to reduce the weight of the supplies carried as well as for reasons of economy, canned fruit was for the most part excluded. A little forethought on the part of the cook made it possible to have a continual supply of dried fruit and it was not only less harmful but cheaper and lighter.

RATION LIST.

For 1 Man for 30 Days.

Bacon	5 lbs.	Ham of fresh meat	10 lbs.
Baking powder	½ lb.	Hominy	¼ lb.
Beans, lima	1 lb.	Lard	2 lbs.
Beans, navy	2 lbs.	Macaroni	.3 lbs.
Butter	4 lbs.	Matches	2 boxes
Candles	6	Milk, evap. (1 pt. each)	10 cans
Canned corn	2 qts.	Oatmeal	1 lb.
Canned peas	2 qts.	Onions	2 lbs.
Canned tomatoes	3 qts.	Pepper	⅛ lb.
Catsup	½ pt.	Pickles	1 pt.
Cheese	1 lb.	Potatoes	20 lbs.
Cocoa	½ lb.	Raisins, seeded	2 lbs.
Coffee	1 lb.	Rice	1 lb.
Cornmeal	2½ lbs.	Sago	¼ lb.
Cornstarch	1 pkg.	Salt	2 lbs.
Dried apples	½ lb.	Soap	2 cakes
" apricots	1 lb.	Sugar	10 lbs.
" peaches	1 lb.	Sweet chocolate	2 lbs.
" prunes	1½ lbs.	Syrup	1 qt.
Eggs	2½ doz.	Tea	¼ lb.
Erbswurst	½ lb.	Yeast	1 pkg.
Flour	15 lbs.	Hard tack	2½ lbs..
Ginger	⅛ lb.		

Equipment. An army 7 x 9 tent was found to be the most useful for sleeping quarters. Two men could be accommodated very comfortably and as many as four were often quartered in them. The main objection to camp life is the difficulty in keeping one's bedding and clothes clean. The best way to avoid this was found to be to use stretcher beds. These beds took the place of cots and are much cheaper and lighter. Since they are merely a piece of canvas with holes at each side through which to thrust spreading poles, there was only the canvas to carry from camp to camp. The chiefs of parties who had the most orderly camps made it part of the business of camp pitching to secure head and feet logs and poles for the stretcher beds as soon as the tents had been set up. By using one of the horses attached to the outfit the head and foot logs and poles could be dragged quickly into camp. In this way each man was sure of a clean, dry place to sleep and the extra time and labor spent in this work was more than repaid by the cleanliness and comfort secured. Of course the use of stretcher beds had to be abandoned during the early spring and late fall since they, like cots, require one to have almost as much bedding underneath as over one. Then bough beds were used almost exclusively. Even during the summer some men preferred the bough beds, but the cutting of trees for this purpose was discouraged in the scantily timbered regions. This applied more especially to the eastern side of the divide where the best material for bough beds, the Douglas Fir, had a hard struggle to maintain itself so that it was felt that the Forest Service parties should not set the example of destroying the young, bushy trees best adapted for bed material.

For a party of ten or fifteen men, a 14 x 14 mess tent was found to be none too large, but such a heavy tent was to be avoided except when cold weather made it necessary to have the cook stove enclosed. Since a 14 x 14 tent of the army pattern weighs 150 pounds with all of the guy ropes attached it was a heavy load for a packhorse when wet. Of course, if wagons were used as the means of transportation, the weight of the cook tent did not matter so much, but even then merely a wagon sheet was found desirable as a shelter for the cook and his stove during the summer months. For a party of five or six men a 10 x 12 tent with four foot walls was found to be most useful. Made of ten ounce duck such a tent was not too heavy for a pack outfit. All cook tents should have a stovepipe hole fitted with an asbestos ring with a piece of canvas to cover the hole when the stove is not used in the tent.

The kind of utensils purchased for cooking depended in part on the method of transportation used. When it was necessary to use packhorses entirely the most important consideration was the reduction of weight to the minimum, and light sheet iron stoves and tin dishes were used. Of course a few graniteware pots were necessary for the cooking of dried fruits and other materials the acid of which would corrode tin dishes, but as much as possible the lightest material was used for the cooking outfit. While aluminum in addition to its lightness resists the corroding effects of organic acids, dishes made of this material are too expensive for rough use. The pack outfit cook stove must weigh not more than 40 pounds. This is about the maximum weight that one man can handle readily, and with a cook stove of this weight the packhorse that is used for carrying it can also take some of the other bulky articles, which need to be placed on a horse that takes care of his pack. Sheet iron stoves sufficiently large for a party of five or six men can be purchased ready made for about $5.00, but they are apt to burn out quickly and are so lightly made that they don't stand much hard use. There are given below the specifications of a stove designed by Mr. E. D. Fletcher of the Forest Service for a party of ten men. This stove gave very good satisfaction, was an excellent bread baker, and withstood a whole season's packing so well that it will probably last another full season. The cost of this stove, made at a local tin shop, was $20.00.

Material—14 gauge sheet iron well riveted
Outside dimensions
  Width 20 inches
  Length 30 inches
  Height 14 inches
Oven
  17 inches x 12 inches x 30 inches (raised 2 inches at the bottom to allow fire to draw under)
Fire box
  8 inches x 14 inches x 30 inches
Asbestos lined drum between oven and fire box with a curvature of 3 inches
2 8-inch holes on top
2 draft holes at end
6-inch pipe hole on top
4 2 foot lengths of telescoping stove pipe.

As far as possible it was extremely advisable to have the cooking utensils pack snugly. The nesting outfits supplied by sporting goods dealers met this requirement best, but it was out of the question to secure such an outfit when the cooking utensils were purchased at local stores. In place of nesting outfits enclosed in canvas bags, holders of canvas can be made which will not only preserve the dishes but are very convenient for keeping the dishes in camp. These dish holders are made up after the pattern of the "wall pockets" advertised by camp outfitters. Another very great advantage of these holders is that they prevent the dishes from rattling when put upon packhorses. This is a consideration of great weight if there are any wild horses in the outfit.

Transportation. Wagons were mostly used for transporting the outfits on account of their greater cheapness and convenience. To the uninitiated the places where a careful teamster can take a wagon seem impossible of access for any wheeled vehicle. In general, it was found possible to use wagons on the eastern side of the divide but west of the divide the hills are not only steep but heavily wooded. In the eastern part of the state it is not so much the lack of rocky ledges and the absence of steep hills which made it possible to use wagons as the fact that there were roads and the stands of timber were open so that wagon transportation was seldom impeded by the fallen trees and dense growth of timber. The cost of freighting by team averaged about 5 cents per hundred pounds per mile. Since packing by horses was about four times as expensive per mile, wagons were preferable for this reason in addition to the greater ease with which the wagon can be loaded. For an outfit of ten men two-horse wagons with a capacity of about 2,500 pounds each were ideal, but a heavy wagon and a light express wagon were often used. The light express wagon was, however, not strong enough to carry much weight and was mainly useful to send to town for the mail and small loads of supplies. The usual price charged for an outfit of four horses, harness, a heavy wagon, and an express wagon, exclusive of repairs, shoeing, and horse feed, was $5.00 per day.

Although wagons were used on the east side of the divide as the main means of transportation, at least a couple of pack-saddles were furnished to every outfit in order to have a method of transporting tents and supplies back into the mountains away from the roads for the use of small parties in temporary work away from the main camp. In the western part of the state pack-horses were the chief reliance for transportation. When hired for three or more months at a time these cost $15.00 per month, the owner doing his own shoeing and supplying the pack-saddle outfits. When the work was more than twenty-five miles away from the supply point, a packhorse for each man in the party was usually allowed, and, even with this number, great care had to be exercised in order to not have too many food supplies on hand when it was necessary to move camp.

Mapping. This work was comparatively inexpensive when General Land Office or U. S. Geological Survey data were available since it was merely necessary then to check up the maps. The preparation of a contour map, however, when there were merely a few preliminary points from which to work was an entirely different matter. The cost of such work in the rough mountain country was 2½ cents per acre exclusive of the final preparation of the map in the office.

Estimating. All of the estimating was done by means of caliper strips 66 feet wide. This method was adopted because it gave rapid results and could be used with unskilled men. The caliper crew, consisting of a tally man, compass man, and two caliper men, covered on the average about 28 strip-acres per day. In the eastern part of the state the average distance traveled per day was over 36 strip-acres but on the western side of the divide the average daily distance was about 20 acres. Since there were 20 working days per month during the period from May to November, one caliper crew should cover on the average 589 acres per month.

Land and Timber Valuation. To value the timber it was necessary to figure carefully the cost of exploitation. This was frequently a very difficult task because the work was generally in regions where little logging had been undertaken so that there was a great lack of reliable data to use as a guide in figuring the logging costs. On the eastern side of the main range the timber was so much scattered that the most economical way to handle it would be by small portable mills. Such mills were quite common in the region and sawed rough lumber for local consumption. The price which these mills obtained gave a very good figure for the average selling price of the lumber. But the problem was more intricate on the western side of the divide where there was enough large timber to justify the erection of permanent sawmills. In these, the output was carefully graded, and it was very difficult to determine the average selling price.

To determine land valuations careful inquiry was made to ascertain what prices had been paid locally and what rentals different kinds of land were yielding. The only two classes of land which were assigned any special value were agricultural lands and grazing lands. The former were divided into those which were irrigable and those upon which water could not be put easily. The price for unimproved irrigable lands ranged from $3.00 up to $25.00, according to their location and the climate of the locality in which they lay. For non-irrigable lands the values varied from $2.50 to $12.00 per acre. The grazing land was given a price on the basis of the number of stock which could be grazed there during the season. The length of the season, the quality of the grass, the presence of poisonous weeds or noxious insects, and the distance from ranges where the cattle could be wintered were also factors which affected the valuation. For summer grazing land, within which class most of the grass land fell, the values ranged from $2.50 to $0.50 per acre. The actual cost of determining the proper valuation for railway lands and timber was not figured separately since the information upon which the prices were based was gathered in most cases incidentally.

Office Work. This work consisted of four parts—the computation of the average stand per acre for the different forest types and stand classes distinguished in the field, the calculation of the area of these types and stand classes to determine the amount of timber, preparation of the final maps from the field data, and the compilation of the reports upon the work done in each National Forest. The estimates, and the timber and land values were given by townships because it was considered inadvisable to attempt to calculate more closely when such a large area was covered so rapidly. The work of stand calculation cost about 1-10c. per acre, including the planimetering of the areas and the preparation of the final tables. Five copies of each map showing the types in colors and the exact location of the railway lands were prepared at a cost of 7-100c. per acre. A high standard was required in the reports. They not only contained all the necessary information but had to be expressed in a clear, forcible English. The points covered are indicated in the following outline. This work required the highly paid men and cost approximately 17-100c. per acre.

General description:

Location of area examined; Topography; Drainage; Rocks and soil; Climate; Settlement and transportation.

Development of the country (Area examined in its relations, now and in the future, to—)

Agriculture; Grazing; Lumbering, Mining.

The Forest:

General features (natural distribution of types, etc.);

Species (in order of importance, common and scientific names with altitudinal range);

Type description (for each type):

Name of type; Situation (flat, lower slopes, benches, etc.); Altitudinal range; Aspect and gradient (average); Species (common names only), principal, associate, incidental.

Soil:

Kind: Character; Depth; Moisture; Humus; Ground cover; Underbrush; Reproduction; Young growth.

Density (on scale of 10).

Silvical condition; Stages of development; Site quality (on scale of 3); Age classes.

Merchantable condition of mature stands:

Character (suitable for saw-timber, ties, shingle bolts, poles, etc.).

Clear length (per cent. of average height for merchantable size).

Virgin, second growth, or cut-over.

Damage:

Character (fire, fungus, insects, etc.).

Average merchantable stand per acre:

Saw stand; Tie stand; Cut-over stands; Burned stands.

Percentage of volume composition by species.

Average number of trees per acre, species.

Average height.

Average diameter.

Valuation of the timber:

Factors determining valuation; Estimating (brief outline of method): Location (division of forest into blocks, main watersheds); Stumpage prices (brief outline of method of arriving at these values).

The Land:

General features (classification, distribution, etc.).

Types and classes (description of each including their adaptability to grazing, agriculture, etc.).

Valuation of land:

Prices paid in local sales; Returns from grazing, farming, etc., in order to fix amount of capital invested; Per cent. of timbered lands fit for grazing where there are no open areas over 40 acres in extent.

Table 1.—Area and value of land comprising Northern Pacific holdings (by classes, townships, and blocks).

Table 2.—Area of forest types, stand and value of timber (by classes, townships, and blocks).

Table 3.—Combined land and timber values of railway holdings.

The total cost per acre averaged 2 1-5c. and was divided as follows:

Field work, ...		80%
Salaries, ...	44%	
Transportation, ...	20%	
Provisions, ...	10%	
Equipment, ...	4%	
Inspection, ...	2%	
Office work, ...		20%
Report preparation, ...	8%	
Computation, ...	7%	
Drafting, ...	4%	
Stenography, ...	1%	

These results can be expected from work done in a rugged mountain region where a rapid but fairly correct estimate of timber and land values is required.

THE EFFECT OF GRAZING ON FOREST CONDITIONS IN THE CARIBOU NATIONAL FOREST.

E. R. Hodson.

The Caribou National Forest comprises 740,740 acres and is located in southeastern Idaho along the Caribou Mountain Range. Surrounding it is a country capable of much development through irrigation, and on the north and west particularly the settling up is rapidly progressing. An important feature of this forest is that it protects, wholly or in part, the headwaters of the Snake, Blackfoot, and Bear rivers, all of which are exceedingly important in present irrigation or power projects.

In view of the importance of this Forest to the region in which it is situated and the different interests dependent upon it, an investigation of the actual condition of the timbered areas seemed necessary. This was carried on with special reference to its use for grazing purposes; the effect of this grazing upon the present cover itself and on the conditions necessary for its thrift and perpetuation by natural reproduction.

In the course of this investigation field trips were made over the whole forest from Georgetown, near the south end, to Conant Valley, on the north. Special attention was given to certain parts of the forest, in addition to the general observations made while traveling through it. The field examination was made toward the close of the grazing season in October, 1909.

This paper is an attempt to view in a broad way the relation between the grazing industry and the silvicultural interests of a forest, and, particularly to bring out clearly the limitations of an intense form of grazing in a forest of this general character.

Places Examined in the Forest.

At the south end, trips were made in Red Pine Canyon, Georgetown Canyon to the summit, and down Diamond Creek to a point near the Blackfoot River, and from there east across the range and between Stump Creek and Tygee Creek to Auburn, Wyoming. From this point trips were made to Tygee, Smokey, and

Stump creeks, Tom's Canyon, and the vicinity of Thayne. On the way to Gray's Lake the sheep driveway on Stump Creek and west across the range was examined, and on the way north to Conant Valley the driveway on Keenan and McCoy creeks was also examined. At that point trips were made to Garden, Pritchard, Fall, and Indian creeks, and special attention given to the old cuttings on Garden and Pritchard creeks. A comparison was also made of the leased grazing land outside of the forest on the northwest.

Character of the Forest.

In the Caribou Mountain Range there are three principal forest types: Douglas Fir, Lodgepole Pine, and Aspen. Aspen as aspen thicket is the most widespread and is important mainly from a protective standpoint, and as a nurse to Douglas Fir and Lodgepole Pine, particularly the former. There being no Yellow Pine, Douglas Fir is the most important type economically. It is the only one in which there are stands of saw timber size of any consequence; it is also most valuable for other qualities than size, as strength, durability, etc. Lodgepole Pine, while not important economically at present on account of its uniformly small size, has considerable protective value because of the dense stands which it commonly forms.

The forest has suffered much damage through fire. This damage has continued until very recently. There are many large areas of forest land burned over 50 to 100 years ago; some of these are reproducing satisfactorily and others scarcely at all. The most general burning, according to local testimony, dates back about 30 years. This is supported by the stage of reproduction on much of the burned area. The recent burns date from 5 to 15 years, and are usually smaller in area, but many of them are exceedingly severe on account of repeated burnings over the same area, as well as the unfavorable location for forest growth of many of them. A great majority of these recently burned areas are said to have been fired for the express purpose of improving grazing conditions and to facilitate the handling of sheep.

A glance at the forest atlas map sheets of this forest will show that a large percentage of the area has been given as restocking burns. This is all too true as to the amount of area burned, but unfortunately not so true as to the restocking condition of the tracts. Many old burns are not restocking at all, largely because of lack of seed trees, and others but thinly on account of scattered seed trees. However, these maps serve to emphasize the fact that a large proportion of the timbered area is in the reproduction stage.

From the great extent of the burned areas, it is estimated that the forest cover has been reduced 75% during the last 75 or 100 years. The present forest cover is approximately but one-fourth of the cover at that time. What this means to the regulation of streamflow by seasonable distribution can hardly be estimated in exact terms of figures. That it is enormous can scarcely be disputed, for, whatever the difference of opinion as to the influence of forest cover and the accompanying conditions on streamflow on small areas and under special conditions, there is hardly a reasonable doubt when sections, townships, and whole mountain ranges are considered.

In this important forest function, that of rendering the flow of streams more adaptable to economic use, the efficiency of this forest has been greatly impaired, and is but slowly regaining the original condition through natural restocking.

Sheep Grazing.

Practically all other grazing than sheep grazing is negligible on the Caribou. In 1907 it is estimated that 450,000 sheep were grazed, in 1908, 400,000 were allotted, and in 1909, 370,000 were allotted. During the present year the allotment for cattle and horses was 15,000 but somewhat less than this number were grazed.

The grazing of 370,000 sheep on 740,740 acres is at the rate of one sheep to each 2 acres. This rate will be still further increased by deducting the cattle range, which in Districts 1, 2, and 4 amounts to 120 square miles, or 76,800 acres. On the area actually grazed by sheep the rate is probably not far from one sheep to each 1.75 acres or may occasionally be as high as one to 1.5 acres.

Sheep grazing is distinct from cattle grazing in two points; the method of handling and in the manner of grazing. Sheep are close herded and graze an area more closely each time over; cattle run at will and graze more lightly; sheep browse to a considerable extent on underbrush and rough forage while cattle browse little and live mostly on grass or other strictly forage plants. Sheep in browsing may be placed about halfway between cattle and goats. Goats are able to live on underbrush altogether while sheep are only driven to it as an exclusive feed by scarcity of other forage although they browse to a considerable extent however plentiful the forage.

The driveways show to what extent sheep will browse when compelled to live on scant forage.

Damage to Timbered Areas from Sheep Grazing.

In considering the effect of sheep grazing on the trees themselves and on the forest conditions, only areas already forested or those which from all indications may be considered capable of reforestation from natural reproduction are considered; south slopes, meadows, areas above timber line, dry rocky points, etc., are excluded.

Through the habit of browsing and the method of handling by more or less close herding there is some damage at all times to timbered areas and particularly to the reproduction. This damage increases in proportion to the concentration of the sheep and to the scarcity of forage. It is made plain under those conditions but it exists at all times. In the case of small seedlings (one year) it is difficult to detect the damage done as little evidence of it is left.

The amount of damage depends upon the stage of development of the stands, decreasing with maturity and density.

The damage inflicted by sheep grazing may be separated into two kinds, direct and indirect, the former the actual damage to the trees themselves and the latter that to conditions which insure the wellbeing and reproduction of the forest.

The damage to the trees takes place mainly when they are small. After they reach a height of three feet they are beyond severe injury since it is the top or leader which suffers most. Some seedlings are killed outright but the majority are only distorted and subjected to subsequent fungus and insect attack. Some are killed by being barked and some by having the foliage stripped off. Seed trees are sometimes killed and this is most apt to happen in unfavorable situations where they are scattering and are therefore most needed. The sheep hunt the shade of the few trees in such places and kill them out by trampling the ground away from the roots and packing it.

The damage to conditions which favor forest reproduction consist of injury to the soil, to the soil cover, and to the underbrush which serves as a nurse cover. The soil is trampled and packed hard and prevents or greatly reduces the percentage of germination of seed in addition to the little seedlings killed outright. The destruction of the soil cover destroys favorable moisture conditions which are essential to the germination of the seed or to the survival of the seedling in its struggle with the adverse conditions of an arid climate. Likewise a reduction in underbrush lessens the chance for reproduction or deteriorates the quality of the seedlings which are produced. Douglas Fir seedlings under Aspen cover are of much better quality than those open grown which is also true, but to a less degree, of Lodgepole Pine. The cover is conducive to a rapid height growth and the early clearance of the lower branches. Seedlings produced under these conditions are in marked contrast to the short bushy seedlings with a dozen or more leaders which have been browsed by sheep for ten or more years. In the latter there is a loss in quality in addition to time lost in growth.

Seedlings are injured to the greatest extent in the following order: Douglas Fir, Aspen, Balsam, Lodgepole Pine, Engelmann Spruce.

Practically no damage was done to cedar seedlings.

The driveways showed the most severe damage. Practically no reproduction can take place on them and existing reproduction is being killed out. These driveways in the aggregate comprise 3.4% of the forest area of 25,000 acres—a little over one township. Where these driveways pass through timber or over areas capable of producing timber it means just so much area lost to forest growth.

Liability of the Forest to Injury from Grazing.

As pointed out before, the Caribou Forest has been severely and repeatedly burned for the last hundred years. Three-fourths of it is in the reproduction stage and is classed as restocking burns. The old burns which have produced scattered seed trees as a first crop after the burn, are now filling up the spaces with a second and sometimes a third crop of young seedlings. There are large stretches of aspen thicket which are largely the result of fire. Some of these thickets protect young seedlings, others have none. There are also burns bare of aspen which have no seedlings. All of these are potential timber areas. There are also some indications that Douglas Fir is capable of extending itself to a limited extent where no forest growth, apparently, has been for a long time. This species is in many places the advance guard of the forest.

It is reproduction to which sheep do most injury. Here is a forest, 75% of whose area is struggling to regain its lost ground and is covered with small seedlings or underbrush and other nurse cover suitable for seedlings. Upon this forest at this stage is concentrated the heaviest sheep grazing—at the rate of one sheep to two acres or less.

The Douglas Fir type is the most valuable type on the Forest; its reproduction suffers the most. On the driveways all seedlings suffered alike, Lodgepole Pine equally with Douglas Fir, but outside there was a great difference; here Douglas Fir on account of its tender foliage was most injured. The injury was most severe at the weakest points, where the seedlings were thinly scattered and at the lower limit where the type was extending into the sagebrush.

Therefore the forest is deteriorated both as to the quality of the different species and to quality of its composition. It is retarded in covering over burned areas and restricted in extending its area.

At present the limit of feed is the only protection which the timbered areas are given. Grazing is pushed to that limit and even past it as shown by the fact that the present season one grazer with five bands of sheep removed three of them after only three weeks of grazing on account of shortness of feed.

The past three years the rate of grazing has been 450,000, 400,000, and 370,000 sheep per year respectively. The past three years have been also very wet ones producing the maximum quantity of feed. With the present number of sheep and a favorable season producing the maximum amount of feed, the amount produced was inadequate. With a dry season half the present number would be a dangerous number. At such a time not only the forage would suffer but the forest would suffer many times the injury it ordinarily does from browsing.

Using the forage limit as a means of protection for the Forest is simply moving along the path of least resistance. Grazers desire to use all of the feed on the Forest. It is easier at the present time to grant this and let the forest take care of itself or to fancy that the feed limit will sufficiently protect the Forest. It will not and the fact may as well be clearly recognized. The reasons are that the amount of feed is subject to violent annual variations in amount; that these variations are largely dependent on weather conditions during the grazing season and therefore can not be foreseen before the season opens; that some damage is done under the most favorable conditions of forage; that the extent of damage depends on the proportion of the Forest in the reproduction stage, that is, it is liable to most damage when there are large areas of small seedlings.

Another important consideration is the length of time the young seedlings on the Caribou Forest have been subjected to injury from grazing. There are probably few places where there has been heavy grazing, that is, to the limit of forage, for more than 25 years. Most places have not been heavily grazed longer than 10 or 15 years. It is probably safe to say that the forest area as a whole has not been heavily grazed for a longer period than 10 years. Ten to twenty-five years is the time required by seedlings under ordinary conditions to reach three feet in height when they are practically out of danger. This period is delayed where burned areas with small seedlings on them are heavily grazed, since a certain percentage are always dwarfed, made bushy, and held back to such an extent that more than 50 years are required for them to reach a height of 3 feet. They are therefore liable to injury much longer than is apparent at first.

In future allotments of sheep to the Caribou Forest, it must be remembered that the entire area is now considered and the further fact that it is planned to graze the entire area indefinitely and that too by a very intense form of grazing. It means that instead of a few tracts being grazed, as 25 years ago, and a larger number 15 years ago, the entire area is to be attacked and systematically grazed for an indefinite period. Whatever damage to the timbered areas of the Forest attendant on this close grazing (to the limit of feed as at present carried on) will operate over the entire area and for an indefinite period. Hence the importance of keeping the allotment within a safe limit.

Protective Measures.

When any measures for protecting the timber interests of this Forest are considered, the great importance of the sheep industry comes to the front and the danger of handicapping it by severe restrictions becomes obvious. There is no necessity of dwelling on this point. The grazing industry is extremely important. It is moreover strong and on this Forest it is strongly intrenched. It is the thing that yields the income and it requires practically all the time and attention of the Forest force. The adjustment of the rights of the different grazing permittees are things that demand immediate attention. On the other hand, the timber interests are weak. The greater part has not reached the revenue producing stage and it requires little attention. There is therefore naturally a strong tendency to overlook the importance of the timber areas. This is not due to negligence of the individual officers or to the force as a whole nor is it the fault of the administration. It is simply due to force of circumstances. The grazing industry on this Forest requires most of the time and attention because of its magnitude. The perplexing questions which confront the administration and demand immediate solution, of necessity, minimize the importance of other interests, particularly when they are not apparent.

In adopting restrictive measures to protect the timber tracts on this Forest there are two main courses: one is to make a substantial cut outright of the total amount of sheep grazed on the Forest; the other is to entirely exclude sheep from the principal timber tracts, particularly burns or other areas which consist largely of small seedlings. The latter course would be more effective but would increase the difficulties of administration in the field. It is believed that it would be better at present to make a substantial cut and to exclude sheep wholly from only a few areas largely for experimental purposes but with the view of eventually extending this method gradually. A cut of 60,000 sheep is desirable immediately on the Caribou Forest, but in order that the industry may have time in which to adjust itself to the changed conditions, the total reduction must be gradually made through a period of several years. The necessity for a gradual reduction on account of the large interests, of a business nature, involved should not, however, be allowed to confuse the issue; it should not obscure the fact that a cut of 60,000 sheep is by no means the extreme called for from the timber standpoint alone. From that standpoint a 100,000 cut is amply justified when the liability of this Forest to damage from sheep grazing is considered. During the past year on 740,740 acres, 370,000 sheep were carried, one to each 2 acres. It has been an exceptionally favorable season as have the two preceding seasons and the maximum amount of feed was produced, yet there was a scarcity of feed.

In a year of drought half the present number of sheep would give trouble and do great damage to the range and more to the timber. In such an event, with the present allotment many acres would have to be grazed almost as closely as the sheep driveways are and with probably as much damage to the timber. These dry years will come and must be considered. It is a mistake to key up the allotment to the number which can be barely accommodated in a good year with the maximum forage. That is the present situation. If it is continued there is certain to be trouble.

A cut of 60,000 from 370,000 to 310,000 would still leave the rate high, one sheep to each 2.39 acres, which would be still higher by excluding the cattle range. It is true that the range yields good forage due to a limestone soil, and a large proportion of open country, but on the Weiser Forest, a region with rich soil and good range, there are approximately only 90,000 sheep to 400,000 acres, one sheep to over 4 acres, a rate which is there considered high.

The heavy reduction of sheep in future allotments is urgent for the following reasons:

1. The Forest is now grazed to the full capacity in seasons of maximum forage production.

2. A large proportion of the Forest consists of tracts of small seedlings, mostly on burned areas, and therefore very susceptible to damage from sheep grazing.

3. The Douglas Fir type which is the most valuable on the Forest is damaged most.

4. The forest area is prevented or greatly delayed from ex-

tending itself and thereby prevented from increasing the value from a watershed protection standpoint.

5. The limit of forage is not sufficient protection for the timbered areas, particularly when so large a proportion is in the reproduction stage.

6. Forest cover, particular low aspen thickets, is damaged by browsing and therefore its value as a nurse cover for forest reproduction is lessened.

7. The Forest is in the process of slowly regaining its original area which had been destroyed by fire; this is retarded by the present heavy grazing.

In brief, the sheep industry is to the front at present, but the real object of the Forest is to grow the maximum amount of timber in order to supply the direct demand upon it for wood for the rapidly settling districts around it and to protect completely the headwaters of its streams which will be called upon to the maximum for irrigation and for power as the country is developed.

In order to gradually introduce the method of protection by closing timbered areas in the reproduction stage to sheep grazing, the northerly slopes of certain canyons should be closed. They may be selected where it is easiest to hold the sheep out. There should be one or two in each district if practicable. They will serve the double purpose of an experiment and of increasing the area protected.

It is advisable to close large recently (5 to 10 years) burned areas to sheep grazing where it does not render the administration of adjacent grazing areas too difficult.

In order to protect timbered areas, sheep driveways should avoid such areas as far as practicable and when absolutely necessary to go through timber the trail should be narrowed down to an eighth of a mile or less, widening out when open range is reached. Also the rate of travel should be increased in the timber if practical and slowed down below the average on reaching the open. The object is to do as little damage as possible to the timbered areas the trails are obliged to pass through.

For the purpose of getting more definite information on the extent and precise effect of sheep grazing on forest reproduction, sheep tight enclosures of two acres each are desirable for each of the principal types. The value of these enclosures is, that grazed and ungrazed conditions are side by side and the results obtained will be sharply contrasted. Evidence of this kind on the ground can not but be most convincing in establishing a grazing policy which will safeguard adequately the silvicultural interests of the Forest.

On this Forest there should be at least two enclosures for this purpose; one in the Lodgepole Pine type in Red Pine Canyon at the south end near Georgetown, the other may be located on Pritchard Creek (Conant Valley) in the Douglas Fir type.

Conclusions.

1. The amount of injury to the timbered areas of a forest through sheep grazing is proportional to the area in the reproduction stage.

2. In the case of sheep grazing the forage limit does not sufficiently protect the timber interests of a forest.

3. Different forest types suffer unequally through the intense form of grazing by sheep; frequently the most valuable types suffer most.

4. The deterioriation of quality in the reproduction of sheep grazed areas is an important consideration in addition to the time lost in growth through browsing.

5. The injury to the conditions which insure the reproduction and well-being of the forest should be given due weight in considering sheep grazing. This is distinct from the direct injury to the trees themselves.

6. All the points of difference between cattle and sheep grazing, particularly, method of handling and manner of grazing, should be considered in determining a grazing policy which will best protect the silvicultural interests of a forest.

7. It should be clearly recognized that the protective capacity of a forest is lowered through damage to the forest cover and the accompanying conditions attendant on excessive or intense grazing. The consequent effect of this reduction in the protective value of a forest on the flow of streams, with the far reaching interests involved, should be thoroughly appreciated.

COMPARISON OF LARGE AND SMALL SAWMILLS ON TAHOE NATIONAL FOREST.

M. B. Pratt.

The Tahoe Forest, which is situated in one of the earliest settled timbered regions in California, is particularly well suited for observations on the trend of the sawmill business. The advanced state of the exploitation of its resources makes deductions possible along this line, which though local in character, apply generally to conditions in the northern Sierra Nevada.

The rush of gold seekers in early days resulted in a prodigal use of the timber in the vicinity of the mining camps. Small mills were busily engaged in cutting timber for local demand, paying little attention where they cut, and moving from place to place as the supply of timber easily reached became exhausted. On the Foresthill Divide, there were eleven mills in the early fifties, which number had decreased to five in 1876 when mining activities were on the decline. At the present time there is one mill operating on the Divide, the local demand being very slack. Within the past few years, the bulk of the privately owned timber in this vicinity has passed into the hands of a large lumber company. The history of this region is identical with that of other sections, the early demand causing a multitude of small independent mills to spring up, their number gradually decreasing as placer and gravel mining declined.

As railroads and other means of transportation began to open up the country, the value of the timber, which had only been used locally, became apparent, particularly to eastern lumbermen who foresaw the exhaustion of the middle West forests. These men sent out cruisers who located the best of the timber, very little of it being privately owned at that time. Under the loose laws governing the acquisition of public lands, this choice timber land soon passed into the control of large lumber companies. About ten or twelve years ago, the conditions became favorable for the general establishment of large mills of 50,000 board feet daily capacity or more. Small mills which had been cutting more or less for the general trade, began to expand and seek more holdings. They found, however, that the big lumber companies had acquired the best locations, and that they had only a few years run in sight. At once there began a gradual reduction of small mills which reduction is becoming greater all the time as the small private holdings are cut out.

The large mills, by running box and cut-up factories, were enabled to utilize the poorer grades of pine, and White Fir, a species that the small man generally left in the woods. The market for boxes for the fruit trade in southern California and for the Nevada mines encouraged better utilization by the large mills, but the small man, having no facilities for disposing of his lower grades, cut only the best of his timber. He had a general market for only the higher grades, and when the timber was of poor quality, filled up his yards with lumber that he could not dispose of. The local trade required only a part of this supply, besides the big mills took away a part of the trade that had formerly all been his. Some of the small mill-men managed to get along by disposing of a part of their box and commons to box factories, but the sale was uncertain, since the demand for boxes, pickets, lath and other by-products was usually not large enough to warrant the factory using more of the lower grades than was produced by the large mill with which it was run in connection. The majority of box factories are under the control of an association which provides a market for their output. The short run of the average small mill-man and the small capital he has at his command, puts it out of the question for him to run an establishment of this kind. There have been combinations effected between several small mill-men, but these ventures have not proved successful because of the small scale on which they were conducted.

Th small mill-man is able to dispose of his better grades to an advantage, since the prices of No. 2 shop and better enables these grades to be shipped some distance. The sale of the higher grades, however, unless there is a good local trade, is hardly sufficient to enable the average small owner to compete with the large mill, and, as a result, more and more of these mills are becoming associated with the large mills and cease to exist as independent concerns.

The situation on the Tahoe Forest can best be shown by a presentation of the actual conditions found there. At present there are thirty-three mills cutting timber within its boundaries, sixty per cent. of the Forest being patented land. Of these mills, twenty-nine are independent concerns and four are cutting timber for large mills. Nine of these mills have a capacity of 50,000 board feet or over, the remaining twenty having capacities ranging from 5,000 to 50,000 board feet, and averaging about 15,000 board feet per day. Of these twenty independent small mills, five are cutting for the general market in competition with large mills, five are operated in connection with mines and ditch companies, cutting for the companies only, and ten cut for the local demand. Six of these independent small mills depend wholly upon the National Forest for the timber they cut. The remainder will either draw upon it within the next five years, or go out of business.

There are five of the large mills which have bought timber from the Forest, chiefly small tracts lying adjacent or surrrounded by their holdings. One of these large mills has cut out its holdings and has removed to another section; another is dependent upon railroad and government timber; several have holdings estimated to last not over five years, and three companies have enough for twenty to twenty-five years run. In addition, there are several large tracts of timber lands in different parts of the Forest held by lumber companies which have not begun cutting.

These facts seem to show what the outcome of the sawmill business will be. The small mills competing with the large mills have about come to a point where they will be forced out of business, except in those localities where government timber can be had in abundance. Unfortunately, the large bodies of government timber are remote from transportation facilities, the pieces lying conveniently near the railroad being too small to warrant small mills going after them at the present time. The large mills can handle these pieces, however, as they come to them, and it is generally good silvicultural and business policy to sell this timber when applied for, especially when the tracts will be isolated by the removal of the surrounding timber.

The independent small mills cutting timber for the local trade, and remote from the large mills, will continue to exist for some time, even though their holdings are largely exhausted. The fact that they cannot cut timber where they please as in days gone by, has not forced many of them out of business. The general rule is that the small man supplying a local demand, will pay what stumpage is required and tack the price he pays to the price paid by the consumer. The mines and ditch companies run mills only when there is not an available source of lumber for their needs, and being backed with capital, are willing to pay what the stumpage is worth.

The small mill is not a paying proposition as a rule. The antiquated methods of logging, large circular saws and crude mill equipment wastes as much lumber as is produced. The high price charged for lumber makes it possible for the operator to get along in a way, by leaving the poorer grades, or about half of the timber he fells, in the woods.

Even the policy of the Forest Service in selling timber to the local man for local use in preference to the large operator cutting for the general market, cannot relieve the situation, or keep the small man in business for many years under present methods. It is getting harder and harder for the small man to find suitable mill sites except on the holdings of the large operators. It will gradually come about, therefore, that the small mill-men will cut the timber of the large operators under contract. The large mills will not increase in capacity, but rather will diminish and rely principally upon the cut of the small contractors who will operate mills owned by the large companies and equipped with band-saws and other modern equipment. In a few years it will only be in isolated mountain communities that the independent small mill will exist. Even there it is probable that its timber will be bought up by the big mill man if it is possible to get the lumber to his mill at a moderate cost.

When the exhaustion of the large holdings, which will be within the next twenty to twenty-five years, occurs, the small mill with modern equipment will be found throughout the mountains. These mills will not have capacities of over 25,000 board feet, will be easily moved from place to place, and will be under the control of large operators. All the present isolated pieces of government timber will then be sought out, since the price of lumber will warrant considerable expense in getting out the timber. Sawmills operating in belts of White and Red Fir will give place to wood-camps cutting wood for pulp mills. The pulp and paper industry is certain to follow the logger of early days who culled out the pine and left the fir as worthless.

To conclude, the present indications on the Tahoe National Forest are that the large mills which now largely control the output, will more and more gain control of the small mills operating in their vicinity, and that the independent small operators will go out of business except in remote communities where they cut for a purely local demand.

YIELD TABLES OF WESTERN FORESTS.

In the absence of published yield tables of our Western Forests the following, constructed by Mr. E. I. Terry, upon admittedly scanty data, referring to northern Rocky Mountain conditions will be welcome.

Yield Table for Western Yellow Pine.

Kootenai National Forest, Montana.

Quality I—

Age Years.	*No. Trees per Acre.*	*Average Diameter. Inches.*	*Average Height. Feet.*	*Average Volume per Tree. Feet B. M.*	*Yield per Acre. Feet B. M.*
40	400	8.6	45	17	6,800
50	380	9.0	50	23	8,600
60	360	9.5	54	30	10,700
70	330	10.0	58	38	12,600
80	300	10.6	63	50	15,200
90	275	11.3	68	70	19,200
100	250	12.2	75	90	22,400
110	190	14.0	84	130	25,200
120	140	16.0	94	200	28,500
130	100	17.6	101	320	31,600
140	80	18.5	105	420	34,000

Quality II—

Age Years.	*No. Trees per Acre.*	*Average Diameter. Inches.*	*Average Height. Feet.*	*Average Volume per Tree. Feet B. M.*	*Yield per Acre. Feet B. M.*
40	256	8.4	43	17	4,400
50	250	8.6	45	22	5,400
60	245	8.8	48	26	6,400
70	240	9.0	51	30	7,400
80	235	9.4	56	35	8,400
90	220	10.0	62	40	9,500
100	204	10.8	70	50	10,600
110	160	12.2	82	70	11,600
120	100	13.3	89	130	12,800
130	80	14.0	95	170	14,000
140	70	14.6	98	210	15,000

Quality III—

Age Years.	*No. Trees per Acre.*	*Average Diameter. Inches.*	*Average Height. Feet.*	*Average Volume per Tree. Feet B. M.*	*Yield per Acre. Feet B. M.*
40	260	6.8	40	10	2,700
50	250	7.1	43	13	3,200
60	230	7.4	45	16	3,800
70	215	7.7	48	20	4,400
80	190	8.0	51	25	4,800
90	170	8.4	54	30	5,300
100	136	8.8	56	40	5,800
110	110	9.4	60	55	6,200
120	88	9.9	63	70	6,500
130	70	10.4	67	100	6,800
140	56	10.8	70	130	7,100

Yield Table for Western Larch.

Kootenai National Forest, Montana.

Quality I—

Age Years.	No. Trees per Acre.	Average Diameter. Inches.	Average Height. Feet.	Average Volume per Tree. Feet B. M.	Yield per Acre. Feet B. M.
40	300	9.9	76	30	9,500
50	290	10.2	79	40	11,500
60	280	10.4	83	50	13,500
70	260	10.6	86	60	16,000
80	244	10.8	88	70	18,000
90	224	11.0	90	90	20,500
100	204	11.6	92	115	23,500
110	184	12.4	94	140	26,500
120	168	13.6	98	180	30,000
130	160	14.6	102	210	34,000
140	152	15.7	108	250	38,000

Quality II—

Age Years.	No. Trees per Acre.	Average Diameter. Inches.	Average Height. Feet.	Average Volume per Tree. Feet B. M.	Yield per Acre. Feet B. M.
40	320	8.0	60	20	6,500
50	300	8.6	63	26	8,000
60	280	9.3	67	30	9,500
70	255	9.8	71	40	11,000
80	224	10.5	75	53	12,300
90	188	11.1	79	70	13,500
100	154	11.6	84	100	15,500
110	136	12.1	89	130	17,500
120	125	12.6	94	160	20,000
130	116	13.00	99	200	23,000
140	110	13.5	104	240	26,000

Quality III—

Age Years.	No. Trees per Acre.	Average Diameter. Inches.	Average Height. Feet.	Average Volume per Tree. Feet B. M.	Yield per Acre. Feet B. M.
40	285	7.8	55	14	4,000
50	275	8.4	60	18	5,000
60	264	9.0	66	25	6,000
70	254	9.2	69	28	7,000
80	240	9.4	71	32	7,600
90	228	9.5	73	37	8,500
100	216	9.7	75	40	9,100
110	208	9.9	76	50	10,200
120	200	10.2	77	60	11,500
130	190	10.4	79	70	13,000
140	184	10.8	81	80	15,000

YIELD TABLE FOR MIXED TYPE OF WESTERN LARCH, WESTERN YELLOW PINE AND DOUGLAS FIR.

Kootenai National Forest, Montana.

Quality I—

Age Years.	*No. Trees per Acre.*	*Average Diameter. Inches.*	*Average Height. Feet.*	*Average Volume per Tree. Feet B. M.*	*Yield per Acre. Feet B. M.*
40	330	8.9	65	45	15,000
50	320	10.1	72	55	18,000
60	308	11.4	80	70	21,500
70	295	12.4	90	80	24,500
80	276	13.2	97	100	27,500
90	260	14.00	102	120	30,000
100	224	14.7	106	140	32,500
110	200	15.2	109	170	34,500
120	170	15.7	112	210	36,700
130	140	16.1	114	280	38,700
140	120	16.5	116	340	40,500

Quality II—

Age Years.	*No. Trees per Acre.*	*Average Diameter. Inches.*	*Average Height. Feet.*	*Average Volume per Tree. Feet B. M.*	*Yield per Acre. Feet B. M.*
40	250	8.2	55	40	9,500
50	232	9.2	59	50	11,500
60	220	10.0	65	60	13,500
70	200	10.8	74	70	15,500
80	180	11.4	84	90	17,000
90	160	12.0	91	120	19,000
100	144	12.4	97	140	20,600
110	130	12.8	101	170	22,200
120	116	13.2	104	200	23,500
130	104	13.6	107	240	25,000
140	96	13.9	109	280	26,500

Quality III—

Age Years.	*No. Trees per Acre.*	*Average Diameter. Inches.*	*Average Height. Feet.*	*Average Volume per Tree. Feet B. M.*	*Yield per Acre. Feet B. M.*
40	212	7.5	45	20	4,500
50	198	8.0	50	30	5,400
60	180	8.4	54	35	6,300
70	160	8.8	58	40	7,000
80	148	9.2	63	50	7,800
90	132	9.6	67	60	8,600
100	122	10.0	71	80	9,400
110	112	10.4	75	90	10,000
120	100	10.8	78	110	11,000
130	88	11.0	81	130	11,800
140	72	11.2	83	170	12,500

Volume Table for Western Yellow Pine.

Bitterroot National Forest.

Scribner Decimal C.

D. B. H. Inches.	Number of 16-foot Logs. 2	3	4	5	6	7
10	5					
11	6	10				
12	7	11				
13	8	13	19			
14	9	14	21			
15	10	16	24	31		
16	12	18	26	34		
17	14	20	29	38	49	
18	16	23	33	42	56	
19		26	36	46	64	
20		28	40	51	72	
21		31	44	56	80	
22		35	49	61	88	
23		38	54	67	96	
24		42	59	74	104	
25			64	81	113	148
26			71	89	122	157
27			77	98	132	168
28			84	108	142	178
29			91	119	154	190
30				131	166	201
31				144	179	214
32				158	193	226
33					206	240
34					219	254
35					232	269
36					246	284
37						300
38						316
39						334
40						352

All trees scaled as though sound.
Scaled to top diameter inside bark of 6 to 10 inches.
Average height of stump, 1.5 feet.

NOTES ON THE WOOD STURCTURE OF THE BETULACEAE AND FAGACEAE.

Contributions from the Phanerogamic Laboratories of Harvard University No. 25.

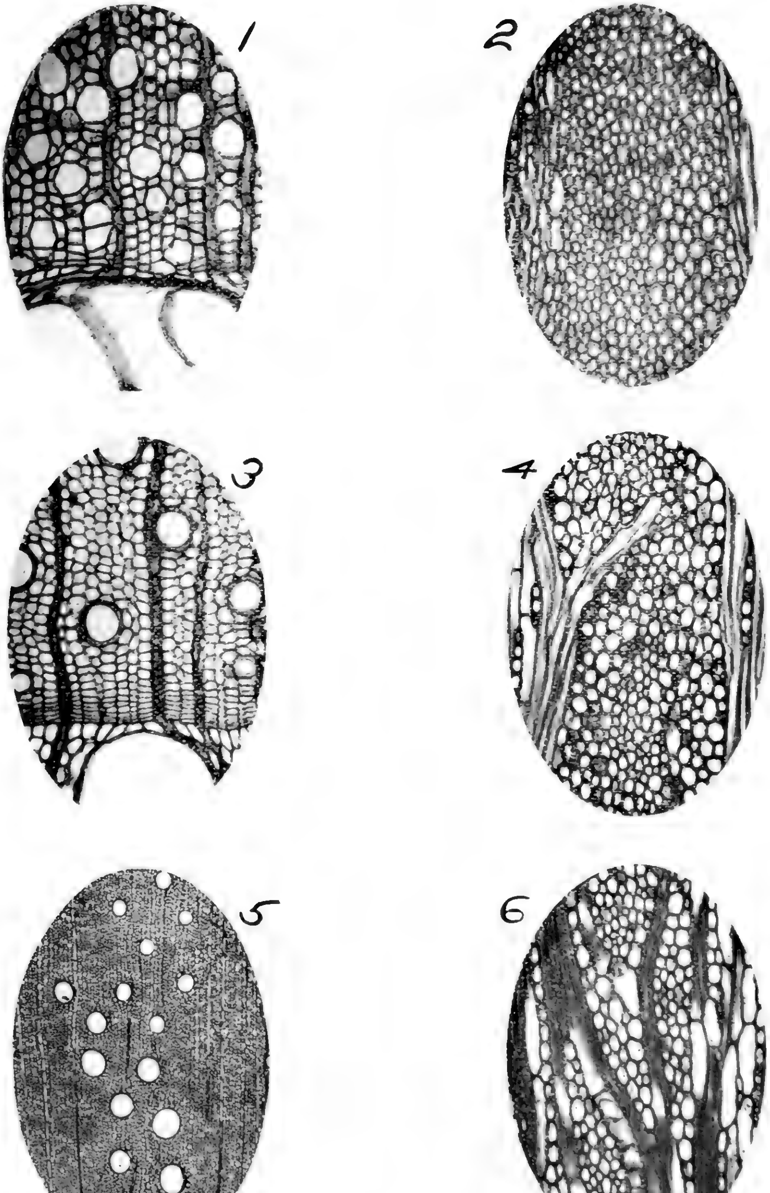
IRVING W. BAILEY, A. B., M. F.

During the last two years the writer has carried on a series of investigations upon the origin and development of the so-called "primary" rays of oak and the so-called "false rays" of the birch family. In carrying out this work a large number of woody specimens of American Fagaceae and Betulaceae have been examined microscopically, and several results of interest secured in addition to the solution of the main problem under consideration. As one phase of a forester's education deals with the origin, development, and uses of woody tissues, it does not seem amiss to summarize in these pages such results as are of general interest to foresters as well as to botanists.

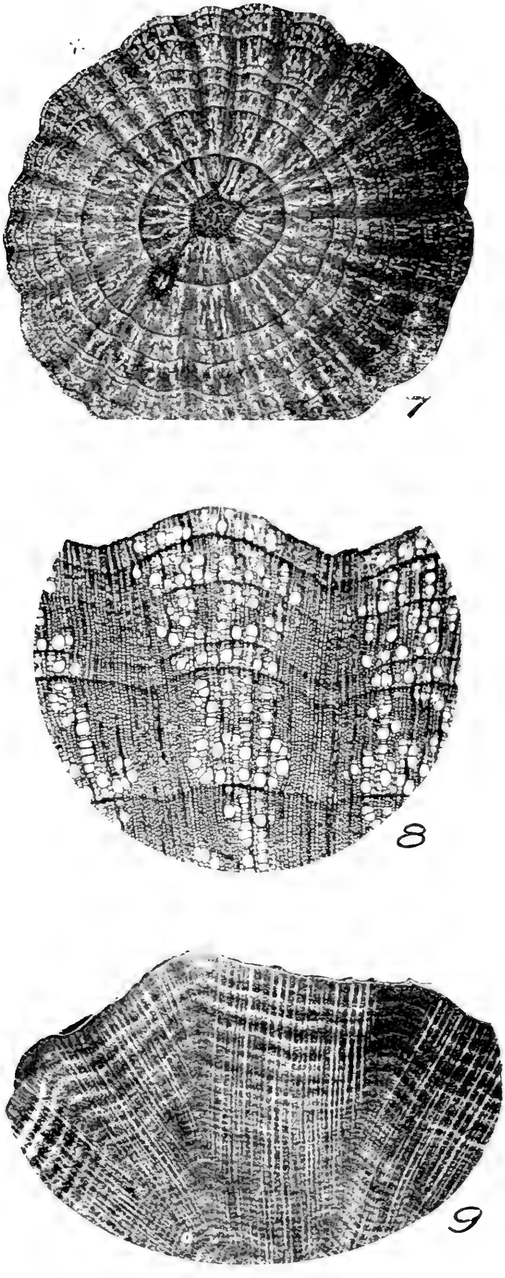
"Primary" and "False Rays."

European and American writers since the publication of Sach's classic *Lehrbuch der Botanik* have considered that the primary medullary ray originates as an inclusion of fundamental tissue or ground parenchyma between the so-called primary fibro-vascular bundles, and that its radial extension in secondary growth is secured by the activity of a so-called interfascicular cambium. In contrast to the imagined primary ray the secondary medullary ray is supposed to originate with secondary growth. The "false rays" of the Betulaceae are bands of aggregated secondary rays and have not been known to have any relation to the so-called primary rays of the Fagaceae.

The "primary" ray is conspicuously developed in the oaks, *Fig. 2,* and strongly contrasted in this genus to the small uniseriate "secondary" rays, *Fig. 1.* In fact in the oaks the primary rays are so broad and so strongly developed that they form the most distinctive feature of the wood, the well known "silver grain" which is of great beauty and of consequent economic value in quarter



Wood Structure of Betulaceae and Fagaceae



WOOD STRUCTURE OF BETULACEAE AND FAGACEAE.

sawn oak lumber. As may be seen in *Figs. 2* and *4* these rays are composed of homogeneous masses of ray parenchyma, and are the important food storage system of the plant. In marked contrast to this type of ray which occurs in oaks with deciduous foliage are the rays which occur in most species of American live oaks. In the latter the ray, *Fig. 6,* consists of a compounding mass of smaller rays, resembling the aggregating ray tissue found in the Betulaceae and commonly designated as "false rays." This fact led to the conclusion that the so-called primary rays of oak have been "built up" by an aggregation and fusion of numerous small uniseriate or small secondary rays. The writer has shown in two articles soon to appear that abundant evidence exists among the Betulaceae and Fagaceae showing conclusively that the large so-called primary rays are the result of a compounding process, in which numerous small rays have been fused together into a solid mass of ray tissue. Thus in living species of alder a complete series of stages occur in this compounding process. Starting with alders in which only small non-aggregated uniseriate rays occur, every step may be found in the development of large compound rays, homologous to the rays of oaks with deciduous foliage. In like manner the transformation process may be traced clearly among species of American live oaks. Furthermore my friend and co-worker Arthur Eames has shown that in seedling oaks, in accordance with the law of recapitulation, a similar series of stages occur. The earliest formed oak wood, like the adult wood of chestnut, possesses only small uniseriate rays, but with the formation of subsequent annual layers of wood the broad rays are developed by means of a compounding process. This fact combined with the structure of fossil ancestral oaks from the American Miocene shows that primitive oak wood possessed only the so-called secondary rays. With the development of unequal seasonal temperatures and the necessity for the storage of food the modern large ray has been built up by a compounding process. It follows that the extant live oaks of the United States possess a less highly organized type of ray structure for the storage of

---

Relation of the leaf trace to the formation of compound rays in certain Dicotyledons. Annals of Botany *Ined.*

Reversionary characters of traumatic oak woods. Botanical Gazette *Ined.*

A. J. Eames. On the origin of the broad ray in Quercus. Botanical Gazette, 49, pp. 161-167. March, 1910.

food than the American oaks with deciduous foliage, since in the former even in the adult wood the compounding process in the ray is ordinarily still incomplete.

We thus see that the large rays of oak are in their origin in no way related to inclusions of fundamental tissue or ground parenchyma between so-called primary fibro-vascular bundles, but have been built up from an aggregation and fusion of numerous secondary rays. The so-called "false rays" of the Betulaceae are rays which have as yet developed only preliminary stages of the compounding process. Further on evolutionary grounds the term *compound* may be advantageously substituted for primary in designating the large rays of the Betulaceae and Fagaceae.

Origin of the Fluted Stem of Carpinus Caroliniana.

The large so-called primary rays of oak, or as we prefer to designate them compound rays, are the important food reservoirs of the plant, and it seems highly probable that the flourishing condition of this genus may be largely due to the possession of these extensive systems. In addition to their physiological importance these rays have other important relations to the development and properties of oak wood. Thus all foresters are familiar with the difficulties produced by these rays in seasoning oak lumber, and with the decorative effects of the "silver grain" of the wood. It is further to be emphasized that the compound ray has a marked effect on the growth and development of the stem. As may be seen in *Fig. 8,* which represents the wood of the Blue Beech, there is a strong dipping in of the annual ring in the region of the compound rays. In other words the compound ray is a modifying factor in the growth of the stem, and constitutes ordinarily a depressed band of tissue which produces a distinct sag in the outline of the annual rings. In the Betulaceae and Fagaceae numerous compound rays produce in the periphery of the stem a series of depressions and elevations corresponding to compound rays and to areas where they are absent. In certain genera and species (e. g. *Betula pumila* and *Carpinus*) the dipping in of the annual rings is very strongly developed, and well marked depressions are produced in the outline of the stem. When the bark is removed from a small stem of Carpinus it will be observed that the compound rays produce a deeply furrowed stem which in cross section, *Fig. 7,* appears strongly crenulated. These depressions are seen in *Fig. 7* to correspond to bands of compounding tissue. *Fig. 8* shows a small portion of the stem more highly magnified to bring out the exact relation between the compounding and the depressions in the stem. On the upper left hand corner of the section shown in *Fig 7* (marked x) may be seen three somewhat closely approximated rays which have together produced a general depression in the outline of the stem. In fact in many species of the Betulaceae and Fagaceae where the compound rays are grouped or closely packed a general depression in the growth of the stem is produced by the concentrated pulling in of the compound rays. This condition is most strikingly and diagramatically shown in the case of the well known Blue Beech or *Carpinus caroliniana* which possesses characteristically a strongly fluted stem. A freshly cut stump of the tree reveals the interesting fact that the striking longitudinal furrows in the stem are produced by bands of aggregations of approximated compound rays, whereas the ridges or ribs in the stem are produced by areas in which few or no compound rays are developed. A small portion of the fluted stem of Blue Beech may be seen in *Fig. 9* which shows the bands of compound rays and corresponding depressions, and the wedge shaped segments, devoid of rays, which are thrust forward between the depressed segments. The stems of oak are frequently fluted in this manner but owing to the thickness of the bark the irregular outline of the stem is obliterated. Similarly fluted stems of alder and hazel may be found which serve to illustrate diagramatically the retarding influence which is ordinarily exerted upon growth by numerous compound rays.

Classification of Oak Woods.

The writer has had occasion to examine the woody structures of a large number of American oaks (45 species) and in doing this work has secured a satisfactory basis for differentiating the wood of the black and the white oaks. It has been customary to differentiate the wood of the two main groups of oaks, Lepidobalanus or white oaks and Erythrobalanus or black oaks, by color, strength, and weight. Although it is possible to use these characters in separating the average specimens of such characteristic species as *Quercus alba* L. and *Quercus rubra* L., one soon becomes confused in differentiating the woods of the other species of the two groups, particularly species from the western and southwestern United States. Thus the writer has in his possession specimens of black oak wood in which the macroscopic characters of color, weight, and strength are similar to those of the wood of white oak and vice versa specimens of white oak which appear externally to be black oak. Furthermore marked variations in silvicultural conditions influence the macroscopic properties of the wood formed by the same specimen. Roth has pointed out* the importance of the number and arrangement of the vessels in the summer wood in separating the woods of black and white oaks. Thus the black oaks are characterized by possessing, in transverse sections of the stem, bands of vessels which are of nearly uniform width throughout the annual ring. In contrast to this in the white oaks the number of vessels in the summer wood is greatly increased, causing the band of vessels to widen out considerably in the last formed portion of the year's growth. Unfortunately this arrangement of the tracheae cannot be depended upon invariably, as white oaks with the vessel arrangement of black oaks exist.

A certain and easy laboratory method for separating the wood of the two main groups of oaks may be arrived at by comparing microscopically transverse sections of *Quercus alba* L. and *Q. rubra* L. In *Fig. 1* is illustrated the cross section of *Quercus alba.* In the summer wood the vessels are seen to be numerous, of small size, *angular* and *distinctly thin walled.* In contrast to this condition of White Oak the cross section of *Q. rubra* seen in *Fig 3* shows scattering larger vessels in the summer wood, vessels with *thick walls* and *circular outlines.* In both groups there is a marked contrast in size between the vessels of the spring and summer wood. In the case of the white oaks this difference in size is more strongly developed than in the black oaks, and the transition from one type to the other more abrupt. Portions of the large spring vessels may be seen at the base of the sections in *Figs. 1* and *3.* Owing to the thickness of the walls tyloses are rarely developed in the summer vessels of the black oaks, but occur frequently in the thin-walled vessels of the white oaks. In the large vessels tyloses may or may not be abundantly developed

---

*Timber. Bulletin No. 10, U. S. Forestry Service, p. 68.

in both groups. Similarly gelatinous fibers and crystals bearing wood parenchyma cells occur in both groups.

Upon the marked difference of the walls in the summer wood the writer has been able to separate with certainty the wood of the following species of American oaks:

LEPIDOBALANUS.	ERYTHROBALANUS.
Quercus alba L.	*Quercus rubra* L.
macrocarpa Michx.	*coccinea* Muenchh.
minor Sarg.	*velutina* Lam.
lobata Née.	*texana* Buckl.
lyrata Walt.	*nigra* L.
platanoides Sudw.	*georgiana* Curtis
gambelii Nutt.	*californica* Coop.
durandii Buckl.	*catesbaei* Michx.
michauxii Nutt	*digitata* Sudw.
garryana Dougl.	*marilandica* Muenchh.
acuminata Houba.	*phellos* L.
macdonaldi Greene.	*laurifolia* Michx.
prinus L.	*imbricaria* Michx.

The live oaks, which have not been included in this classification are more closely allied anatomically to the black oaks than to the white oak group. Thus the live oaks examined possessed *scattering thick walled circular vessels* in the summer wood. However the majority of the live oaks are distinct from black oaks in possessing primitive stages of compounding in the big rays, *Fig. 6,* in being diffuse rather than ring porous, *Fig. 5,* and in possessing usually no tyloses in the vessels. The following species examined belong to this group to which we may give the subgeneric name Biotobalanus.

BIOTOBALANUS.

Quercus tomentella Engelm.	*Quercus chrysolepis* Liebm.
myrtifolia Willd.	*dumosa* Nutt
chrysolepis palmeri Engelm.	*virginiana* Mill.
agrifolia Née.	*emoryi* Torr.
densiflora Hook & Arm.	*hypoleuca* Engelm.
engelmanni Greene.	*arizonica* Sarg.

Among the species *emoryi* and *hypoleuca* possess rays with highly organized compound rays, and in *Engelmanni* numerous thick-walled tyloses occur. In other words the more highly organized live oaks grade anatomically into the black oaks.

The development of the compound ray in oaks, backed by paleontological and seedling evidence, shows conclusively that the live oaks are anatomically the most primitive members of the genus Quercus. Modern white oaks are highly specialized in possessing well compounded rays, well marked ring porous vessels, numerous, small, thin-walled vessels in the summer wood, and abundant tyloses. Certain white oaks (e. g., *prinus* and *macdonaldi*) although retaining distinctly the thin walled summer vessels of the white oak possess the vessel arrangement which is characteristic of the black oaks. The black oaks in places grade into the live oaks, but are usually characterized by more perfectly compounded rays, by tyloses, and by ring porous vessels.

We thus see that in the genus Quercus the white oaks are clearly and sharply marked off anatomically from the other groups of American oaks. Similarly the majority of live oaks are clearly marked off from the majority of the black oaks, but a few species exist which represent transitional steps between the two groups. From this we come to the conclusion that as in the case of Pinus (where the internal anatomy of the wood and leaf has been successfully used by Sargent, Masters, Engelmann, and others in securing a natural classification) the internal anatomy of oaks is of great value in arriving at a natural classification of our American species. The external foliar and floral characters as in the case of Pinus are so variable and subject to such rapid modification that botanists have encountered considerable difficulty in constructing classifications of American oaks which are not subject to disconcerting exceptions. The differences which exist in the classifications of oaks presented by Sargent, Sudworth, and Britton well illustrate this fact. Internal anatomy particularly of woody plants is extremely conservative and is modified very slowly. For this reason it is useful in studying relationships of plants and in securing generic, subgeneric, and other broad differences, but owing to its extreme conservatism can only be used with great caution in securing specific differences. In other words internal anatomical characters combined with the most salient external characters may be advantageously used in disclosing the main natural groups of oaks, but in separating species in the various groups, external characters must usually be depended upon. However the study of internal anatomy and an appreciation of the conservatism of internal characters should serve as an excellent brake upon certain botanists who have developed a mania for naming new species upon slight external differences.

EXPLANATION OF PLATES.

FIG. 1. *Quercus alba:* transverse section, showing numerous, small angular, thin-walled vessels in the summer wood, uniseriate or so-called secondary medullary rays, and portion of large spring vessel at the base of the section. X 120.

FIG. 2. The same: tangential section, showing the highly specialized compound ray or so-called primary ray. The ray is seen to consist of a homogenous mass of ray parenchyma. X 120.

FIG. 3. *Quercus rubra:* transverse section, showing scattering thick-walled summer vessels with circular outlines. A portion of a large vessel may be seen at the base of the section. X 120.

FIG. 4. The same: tangential section, showing compound ray with an included fiber, evidence of a fusion process. X 120.

FIG. 5. *Quercus virginiana:* transverse section, showing the characteristic gradation in the size of the vessels in passing from the spring to the summer wood, the black oak type of vessel, and the absence of tyloses. X 80.

FIG. 6. The same: tangential section, showing the compounding and fusing mass of small rays found in the live oaks. X 120.

FIG. 7. *Carpinus caroliniana:* transverse section of twig, showing the crenulated outline of the stem produced by the retarding influence of the compound or so-called false rays upon growth. (x) Group of three compound rays which together produce a general depression in the outline of the stem. X 10.

FIG. 8. The same: more highly magnified to show the dipping in of the annual rings in the band of compounding tissue. X 80.

FIG. 9. The same: transverse section of a small portion of the fluted stem, showing the bands of approximated compound rays which produce the longitudinal furrows and the wedge shaped segments without rays which form the ridges or ribs. Natural size.

FORESTRY IN THE AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.*

SAMUEL B. GREEN.

There is much interest of a general nature taken in forestry and there is a demand for thorough education along this line. What is needed to properly supplement the magnificent work which has been done by the Forest Service is to get correct ideas in regard to forestry into the minds of the common people. Every state and territory has an agricultural college and experiment station, which receives or will shortly receive for education and experimentation not less than $80,000 per year from the National Government. As a rule, these institutions are well equipped to handle all matters that pertain to rural life, and generally they are in close touch with the rural population and are popular with all classes of citizens. These institutions have done almost nothing for forestry, and yet they are the best equipped class of institutions in the whole country to advance the forestry movement.

I would have every agricultural college and every experiment station well equipped under government supervision to undertake educational and experimental work in forestry. This can be added to the present courses of study at a low cost, and if the educational lines already in vogue in them relating to forestry are co-related and supplemented by one teacher of forestry, they can offer excellent courses in this subject. I do not think it desirable, at present at least, to have all these institutions attempt to establish professional schools of forestry. I think it would be rather unfortunate and that they would fall far short of their purpose, and it is something of a question if there would be a demand for such a large number of graduates as these institutions might turn out; but they should confine their work largely to the teaching of farm forestry, which work should be supplemented by plenty of demonstrations and experimental work. The class room, unless well supplemented by field work, will not be as efficient as it should be

* Read at the Conference of Forest Schools, Washington, D. C., December 30, 1909.

in the teaching of this subject, and will partake too much of the nature of what might be called "sidewalk forestry."

However, I am not afraid of our having too many well trained professional foresters, and believe it will be a happy time for the forestry situation in this country when we have a larger number of young men properly trained in forestry than can be satisfactorily absorbed by the forestry situation. A few states will naturally lead others in the attention they pay to this subject, and will establish professional schools of forestry; but the states should be expected to entirely care for the support of professional schools of this kind. Where there is not sufficient interest in a state to take hold of such work and put it upon a professional basis, it had better remain a good course in silviculture, teaching it much the same as subjects of general agriculture or horticulture, and no special forestry degree should be given.

Who should teach Forestry? In my opinion, it is not desirable to load up the Professor of Horticulture or Agriculture in these institutions with the subject of forestry. They already have all that they can do, and with the close specializing which is coming from year to year in all of these subjects the constant tendency for them is to divide up their work. In my opinion, then, each of these institutions should have a Professor of Forestry, or he may be made an Assistant Professor, and his salary should be about two thousand dollars per year. He should have charge not only of the teaching of the students, but of the experiment work and demonstration grounds, which he should aim to work into and make a part of his instructional work.

It might possibly be well to combine the subjects of landscape gardening and forestry in some of the schools where but little attention is paid to either. These subjects can often be taught together to advantage, and there are many good openings for those who are well trained in both branches.

Courses of Instruction. The courses of instruction given in institutions of this kind should consist of about three class room hours of six laboratory hours per week for one year, with perhaps fifteen half days devoted to excursions or field work. I want to lay special emphasis upon the fifteen half days of field work. I believe it extremely important that the Professor of Forestry in these institutions be able to take the students into the field and show them how to do the actual work. I also think that excursions to nurseries and to nearby forests of different types are especially helpful and desirable for students of this kind. I would have the Professor of Forestry a man full of forestry, with a desire to get in close touch with actual growing things; a man who can make things grow and do things on the land. Half of the time devoted to this subject should be put on the subject of identifying trees, learning their uses and the conditions under which they grow. I would give enough forestry mathematics in this course so that the student will have a clear idea of the customary way of measuring standing and cut timber. Some attention should be put upon the effect of forest vegetation in preventing erosion and the effects of forests on water supplies. The growing of seedlings and their care and management in the nursery should come in for much attention and practical work. Enough of the subject of protection should be given so that students will understand how to deal with the principal enemies of our forests, including fires, insect pests and fungous diseases.

My ideal teacher would not divide this work under special heads, but the work in all lines should be continued throughout the year, so as to make a full round of the season in the subject of the uses of trees and in general silviculture. For instance, if the work begins at the middle of the second semester in the northern states, the habits of the trees may be studied as they appear in that season, and the methods of identifying them; and this may be continued throughout the year. As soon as nursery work begins in the spring, the student should be taught seed sowing, transplanting and cultivation, and later seed collecting and general nursery work. Thus in one year, I believe, can be given a good course in silviculture, which is all that is desirable in our agricultural colleges.

Forestry in the Agricultural High Schools. In the agricultural high schools there can be but a very limited place for the subject of forestry, and yet we should see to it that at least one semester's work in this subject is provided for. My experience seems to show that about one semester's work is all that can be used to advantage for forestry in this class of schools. I think this work should consist almost entirely of the study of trees adapted to the locality, together with their habits of growth, uses and methods of propagation. In addition to this, some little instruction should be given in the subjects of nursery practice and mensuration. An experience of over twenty years in this kind of forestry teaching shows me that when this class of students has once acquired such an outline of the general subject of forestry as could be included in one semester's work, as stated, those especially interested in the subject will begin to experiment in a small way, and soon acquire considerable skill in general silviculture.

Short Courses. Most of our agricultural colleges are giving, or soon will give, short summer courses of a popular nature, and in these courses there is an excellent opportunity to introduce some forestry instruction to advantage. Many of these courses are attended by teachers and county superintendents, and if they can be interested in forestry and be given the right point of view, they are sure to carry the ideas thus obtained to the children in the schools over which they have charge.

In my own case, in connection with our regular forestry work held in Itasca Park, we have a summer school of forestry, and last year there were twenty-five students in attendance, of whom perhaps something over one-third were teachers in our public schools. The work given them was of a popular nature, with enough forestry flavor to give them the right point of view. I think this an important line of forestry work at the present stage of development of forestry education in this country. In this course, lectures and field work were given in surveying, silviculture, forest mensuration, general geology and soils, and botany. More than half of the instruction was given in the form of excursions. The teachers attending expressed themselves as much pleased with the course, and felt that they had gotten a good deal out of it. They certainly went home to their work in autumn with a very different idea of what forestry is than they had when they came to us.

The teacher of forestry will naturally become identified with the forestry movement in his state, and will be of great assistance in directing public sentiment into practical methods of conservation.

If the establishment of these forestry courses is to be left to state initiative it will be a long time before they are put on a satisfactory basis in more than a few of the states. If, however, the matter is taken hold of in a strong, sensible way, and Congress would make an appropriation of, say, five thousand dollars a year for establishing courses in forestry and forestry demonstration in each agricultural college, it would be but a short time before there would be a wonderful change in the standpoint from which the general public regards forestry.

All of these forestry courses should be co-ordinated with the U. S. Forest Service, and the appropriation made by Congress should require a certain degree of efficiency to be acquired on the part of each state in order to insure its continuance. The agricultural colleges are now receiving national appropriations based on similar requirements and supervision by the U. S. Department of Agriculture, and such extra supervision as required by such a measure could easily be given them.

The formation of the vast reserves in the West, and the desire for them in the East, needs the support it would receive from an educational movement of this kind. It would require but a small appropriation to make this effective, and the leaders in forestry education in this country ought to take hold of this measure with a strong hand and push it to a successful issue.

THE PLACE OF FORESTRY IN GENERAL EDUCATION.*

HERBERT A. SMITH.

The now widely awakened interest in forestry is leading to the introduction of some sort of teaching about it, sometimes as a distinct course either in forestry or in the conservation of natural resources, sometimes as a part of older courses of study, into the curriculum both of schools and of colleges and universities in connection with general as distinguished from vocational education. This has not gone far as yet, but it reaches into every stage of education from the nature-study work of the primary schools to the elective courses of the student approaching his degree. Whether we like it or not, forestry is taking a place in general education. It is important that the teaching of it should be rightly guided and properly co-ordinated with educational work generally.

I presume that I shall seem, to most of you, to take a strange position when I say that I think forestry is a cultural subject. To make clear why I hold this I am going to ask you to let me pass very briefly in review certain recent changes in educational ideals which have been illustrated in the content of secondary education.

As we all know, secondary education has been in a state of more or less confusion during some years. It has lacked certainty both as to what ends it should aim at and what methods it should use. First of all the sciences, with the modern languages as their allies, successfully disputed the exclusive claims of the old classical course studies. This they did largely on the plea of their own superior practical value. We had reached, we were told, a scientific age. The task of education should be to teach us to think scientifically and to conquer the material world. The study of the "humanities," the ideal of "culture" in education, gave way before the pedagogic outfit of the laboratory and the experimental method and before the spirit of investigation in pursuit of objective

* Read at the Conference of Forest Schools, Washington, D. C., December 30 and 31, 1909.

truth. In short, the new education may be said to have worshipped at the shrine of Science-as-an-end-in-itself.

Presently, however, a new controversy began. In the ranks of the scientists themselves schism arose. While some of them laid main insistence on rigorous training in method, with disciplined scientific thinking and power of independent research as their objective, others held to the belief that the pupil should be taught to know as much as possible about the world with which he comes in actual contact, and that knowledge, and useful knowledge to boot, should be the first aim rather than drill. Pedagogics on the one hand, with its enunciation of the principle that education should begin with the familiar, not the unfamiliar, and should deal with what is real to the pupil, and philosophic thought on the other hand, with its flat denial of the right of science to call its world more than one aspect of reality and its insistence that the vital thing in life is experience, not an abstract from experience, supported the schismatics. And then came the demands of vocational education. The outcome was the pretty complete discomfiture of the party which would have turned our high schools into incubators of fledgling scientists, trained in methods of research and thirsting for scientific discovery for pure love of truth. There is no great crowd of pedagogues now who worship at the shrine of Science-as-an-end-in-itself.

Culture, disciplined scientific power, useful knowledge, economic efficiency—all these educational ideals aim primarily at the good of the individual. And, as a rule, the education which aims at them is not likely to consider moral training an integral part of its work. But our system of public education at public expense justifies itself only on the ground that the education given served the public welfare; and this again leads naturally, if not inevitably, to the conclusion that at least one purpose of such education should be to train in good citizenship. Surely this kind of education means moral education.

Now I am ready to begin to build up my argument for the right of forestry to a place in general education.

Dr. C. F. Hodge of Clark University published a little pamphlet a few months ago under the title of "Civic Biology." This somewhat cryptic title stands for a conception of the function of science teaching, and of education generally, fundamentally different from the conceptions ordinarily held. His conception is, I think, well worth my bringing to the attention of this conference.

In a word, he holds that the school teaching of biology should be not only practical, as distinguished from purely scientific, but also, civic, as distinguished from merely economic. "Civic Biology" is neither biology taught in order to broaden out the the mind to a well-rounded intelligence, nor biology which seeks knowledge of the laws of life as an end in itself, nor biology which seeks to instruct the individual concerning the life history of such organisms as are likely to affect his personal welfare, nor biology adapted to the service of some special occupation; but biology applied to community interests. Necessarily such a treatment of any branch of ordered knowledge is rooted not in science but in morals. Every conclusion is an ethical one. By providing meeting-places and putting food for birds we increase the yield of fruit in our neighborhood. By cutting noxious weeds at the proper season we help control a pest. By cleaning up the breeding-places of mosquitoes and flies we improve the public health. How much better it is, thinks Professor Hodge, to aim in our teaching of biology at good citizenship than at individual attainment or advantage for the final result.

But in one respect I should modify Professor Hodge's idea. "Civic Biology" seems to me a somewhat too restricted term. I should substitute for it another, first suggested by my colleague, Mr. Cleveland: Civic Geography.

Almost exactly a year ago I attended some of the meetings of the Association of American Geographers, held as a part of the Baltimore meeting of the National Association for the Advancement of Science. I went there primarily because they wished to learn something about what the Forest Service is doing with the National Forests. The very fact that they wished such a paper to have a place on their program is significant. I do not know how many of you have observed what ground the subject of geography now covers, or what its development as a subject of instruction has been. Certainly it is very different from what it was in the days of my own school and college education.

I remember very vividly with what surprise I learned from one of my friends just returned from his graduate studies abroad, some fifteen years ago, that geography was held in the German higher institutions of learning to be a subject deserving of separate university chairs and courses. Shortly after that our own universities began to take the subject up. First, I think, came commercial geography. Now it is hard to say what has not come in. The general impression which I gathered from reading the program of the Baltimore meeting and from the papers which I heard there was that the field of geography includes the greater part of human knowledge, and perhaps the greater part of what is now human ignorance; and that biology, botany, zoology, geology, history, economics, and I know not how many other subjects have surrendered their independent standing and are now no more than side shows to the main educational performance run by the geographers.

Very likely you know that the geographers make much of what they call "geographic controls." Human history and human institutions, they point out, are largely the result of environmental influences. The locations of great cities are of course determined by natural causes; the alternation of growing and non-growing seasons, with the subsequent need for a stored food supply, has doubtless played an important part in the development of property rights. To the study of these geographic controls of man geographic science is now giving a great amount of attention.

But there is a geographic control by man as well as a geographic control of man. Human life causes geographic phenomena as well as displays them. When wolves are driven from their native habitat, or erosion from a great mountain region is accelerated, or soil fertility is reduced, or an improved variety of wheat is bred, man becomes the control.

In the past man's conquest of nature—in other words, man's advance in material civilization—has been mainly that of the individual seeking his own betterment through the exercise of intelligence to make nature serve his own ends. But a still larger exercise of intelligence is possible if men will seek to shape their collective action along the lines that will make the earth most habitable and most responsive to human needs. Here is the same underlying idea which Professor Hodge's pamphlet presents. You will see now why I think "Civic Geography" a better term than his.

Already several of our universities are giving courses in conservation. At Yale such a course is given by one of the professors of economics. What department it is regarded as falling under is, to my mind, relatively unimportant. But surely it is important that our students who are preparing for life and for citizenship, whether that preparation is in the college course or in the high school course, should at least have the chance to find out how different possible courses in our use of forests and of other natural resources will affect the public welfare. I think myself this is putting it far too mildly. I have already said that I believe a proper preparation for citizenship necessarily involves training to the right attitude on these questions. If this is true, it is the business of education, secondary education and higher education, to give the training.

And it must be a *moral* training. It must recognize and make clear the duty of the individual, and the responsibility that rests upon the community in matters of public welfare, as well as the effect on the public welfare of certain courses of action. The fact is that our ethics have not caught up with the situation. Old conceptions encumber the path. There is much that has not yet been thought out clearly. Yet with the rising tide of national consciousness, with the awakening of public conscience, with the demand for the moralization of business, with the growing appeal of ideals, interest in humanity, and eagerness for service that seems to be taking hold upon our people, and especially upon our young people, may we not believe that a new forward movement in civilization is possible? May we not believe that the public welfare is to be sought as never before through collective action in man's relation to the earth upon which he lives?

Now I do not believe that forestry, as such, should necessarily be made a separate course, either in schools or in colleges. But I do believe that from the first stages up—from the nature-study in the lowest grades to the courses of the university—provision should be made for teaching the conceptions which are really involved in forestry and which we have reached as a result of our national forest work. And I believe it is the duty of those who are engaged in the work of forestry education to do everything that they can both to put into pedagogic form the material which forestry furnishes and to promote the introduction of courses which shall give the general student what I hope you will let me call, with a right understanding of what I mean, the cultural—that is the whole-man-developing value of forestry.

NOTES OF A CIVIL ENGINEER ON A FORESTER'S EDUCATION.

F. B. Knapp.

Mr. R. E. Clark says in the March Forestry Quarterly, "Our technical assistants come into the field fresh with knowledge of a character derived from years of college training, and in nine cases out of ten, are entirely ignorant of any of the practical knowledge derived from years of field work." Many attacks are made on the college educated men, and employers find fault with the results of their work. There is much truth in these criticisms often mixed with considerable misconception. It is not education that does the harm but the lack, too often found, of other essential qualities.

A forester, more than most men, is thrown on his own responsibility and is sure to have new and unexpected emergencies to meet. He therefore especially needs to be broadly fitted for his work, and anything that helps to so fit him comes up properly for consideration. He needs a good general education, thoroughness and power of application in his technical training, good character, physical dexterity, power of leadership, a spirit of helpfulness and loyalty, and a development of the finer side of his character. These should be simultaneously developed through his course and considered essential parts of his education. The Rhodes scholarships, civil service examinations, and selection of men for positions of trust show that many of these qualities are practically weighed at present. All of them could well be considered in entrance requirements, promotions and graduation.

While the scholastic part of the preparation should not be reduced, field work ought to go hand in hand with it and form a continuation of the nature work of the lower schools. High school students have the power of taking up many of the simpler forestry problems and, when a college course comes before the technical school, much can be done in this direction. This can be accomplished without undue strain and would merely take the place in a very satisfactory way of some of the present athletics and recreation. The ordinary work of high school and college usually occupies from 1400 to 1800 hours a year, whereas the young man who goes into a shop does from 2000 to 2700 hours or even more. In at least some cases the practical work should extend over a longer period than a summer's vacation.

Not all men engaged in scientific forestry should be expected to have an equally high education. There are needed at least three well defined grades with corresponding titles or degrees: (1) The man well fitted to fill a position like that of Forest Assistant; (2) One of deeper technical and general education and of more experience, capable of filling a position of considerable responsibility; (3) The specialist who has done advanced work in the post graduate school.

Many of the strongest men for their part of the professional work are not naturally students and the first of these grades prepares them well for their life work, while others with the same training will find later that they can return to advantage for further study. The attitude of the technical schools with reference to qualities often considered outside of their province and to the requirements for the different degrees must play an important part in determining the future of the profession.

GROWTH OF THE FOREST SERVICE LIBRARY.

HELEN E. STOCKBRIDGE.

The library of the Forest Service contains at present 13,500 books and pamphlets, or four and one-half times as many as in the spring of 1902, when the library of the Department of Agriculture transferred about 3,000 of its books to the Division of Forestry. Besides a practically complete set of the publications of the Department of Agriculture, and a few works on general and forest botany, this collection contained all of the books classed under the general subject of forestry in the Department Library's scheme of classification, including the library of the late Professor F. A. G. von Baur, formerly Professor of Forestry in the University of Munich, and editor of Forstwissenchaftliches Centralblatt. Professor von Baur's library, which consisted of about 1,700 books on forestry in the German language, was purchased by the Department in 1897, at the suggestion of Mr. B. E. Fernow, then Chief of the Division of Forestry for $400.00.

Additions to the library are made in two ways, either through the Department Library by purchase or otherwise, or by gifts or exchanges received directly by the Forest Service. Requests for new books are made to the librarian, who issues an order on the Department Library, if it is a book to be purchased, or writes to the publishers for it, if it is a free publication. The Department Library not only sends to the Forest Service the books for which it receives orders, but all books on forestry are sent there as they are acquired.

In the fall of 1904 a large number of bound forestry periodicals dating back to 1890 were transferred to the Forest Service, as these were not included in the first transfer of books from the Department. The library continues to take these periodicals regularly, as well as several new ones which have been published since then. There are now 30 current forestry journals received by the Service, in seven different languages.

Only about one-half of the books in the present library are works on technical forestry. The Forest Service has expanded in so many directions that it has been necessary to procure books on a variety of subjects to meet the demands of the various offices. For instance, the Office of Dendrology uses a great many botanical and dendrological works. The library has, therefore, acquired from time to time books of this character, amounting to about 600 at the present time. The Office of Law has about 800 volumes of law books purchased from a special fund appropriated for the purpose, which are catalogued as part of the library though filed in that office. Small collections of books have been procured from time to time, as the need arose, for the use of the Offices of Engineering, Wood Chemistry, Wood Preservation, Education, and others. The library takes 37 trade journals, including two from Canada and one from Great Britain, for the use of the Office of Products, and of other members of the Service whose work deals with the subject of lumbering.

Besides the publications of the Department of Agriculture, the library has a large number of other government publications, including the reports of the General Land Office, the Census Office reports, many of the publications of the Geological Survey, and others. The books and periodicals on forestry, however, which form the main bulk of the library, are used principally by the Branch of Silviculture, where practically all of the technical forestry work of the Service is done. In extending this part of the library, it has been the aim of the Service to secure all forestry works written in English, whatever phases of the subject they may cover. As there are more books on this subject in foreign languages, however, than in English, the library necessarily has a majority of foreign books, especially German ones. In buying new books in foreign languages, care is taken to get only those for which there is some special need, or standard works on the various branches of forestry. For instance, Germany, which has the most extensive forestry literature of any country in the world, has given us a number of comprehensive works on the subjects of silviculture, forest utilization, forest policy, forest protection, and general forestry. All such standard works are in the Forest Service library.

In January, 1906, branch libraries were started in the offices of Forest Supervisors on the National Forests. There are now 137 such libraries, containing an average of 65 books each. These books are duplicates of those in the Washington library, and are of a character suited to the needs of the forest officers in their work. In December, 1908, when the six District Offices were established in the West, branch libraries were provided for them also. These libraries are much larger than the Supervisors' libraries, containing an average of 450 books apiece.

Additions are made to all field libraries on the recommendations of the District Foresters, with the approval of the Library Committee in the Washington Office. The books are purchased in Washington from an allotment of 3,000 set aside for this purpose, and are numbered, recorded and set out from the Service library. Card indexes of the books in the six District Offices are also prepared in the library, and are sent out with the books.

SOME EUROPEAN FOREST NOTES.

CHARLES E. BESSEY.

These stray notes were gathered on a journey made in 1903. In southern Holland where the land is low and apparently wet, the seedling pines (*Pinus sylvestris*) are grown in long narrow beds having ditches between them. Each bed is not more than four or five feet in width, and is much rounded up in the middle so that the field looks as though it had been "ridged." The trees occupied about two-thirds of the rounded surface of each bed, and it was noticeable that the best growth was in the central, higher portions. Somewhat similar nursery beds were observed in Germany, where of course the land is not so wet, and the need for ridging is not so evident. Apparently pine seedlings can be grown in Northern Europe without the necessity of shading by slats or brush, as is so commonly the case in this country. This difference is no doubt owing to the fact that the sunshine is so much more continuous in this country as compared with the much more cloudy skies of northern Europe. This is why they need not protect their pine seedlings, and why we must do so. Our clear skies have some disadvantages when it comes to growing pine seedlings.

German Forests.

In central Germany forest plantations are very abundant, and as one crosses the country in any direction he finds great areas covered with trees of all ages. Southwestward from Berlin towards the city of Halle there are many such forests, especially wherever the soil is sandy. The trees are from slender seedlings a year or two old, to those that must be from seventy-five to a hundred years old, and having a diameter of fully eighteen inches. The plan here is to plant but one kind of tree in a block. Thus on a block of pines only pines are found, while on a block of spruces only spruces are found. There is no mixing of different species. Moreover, the blocks are planted in succession, so that in many places there are continuous blocks of younger and younger trees, grading down from tall trees, seventy-five or more feet in height to those only a foot or two high.

The trees which are usually planted in these forest blocks are mostly pines (*Pinus sylvestris*), although spruces and birches, also, are planted somewhat. In some places the birches are planted in a belt a few rods wide along the sides of the railways, so as to lessen the danger of fires. These forests are treated differently for different purposes. Where poles are wanted the trees are planted very close together, so that they grow up into straight, slender stems which can very easily be trimmed into excellent poles after cutting. In other cases the trees are grown further apart, and the well developed side branches are pruned off for fuel. The amount of fuel obtained in this way from these forests is very large, and must be regarded as one of the most valuable of the forest products for the people of the neighborhood. The pruned trees when large enough are cut for lumber, and this is now being done on some of the oldest blocks of trees.*

In some places the blocks of trees were grown from seed sown directly in the prepared soil. This seems to be true of many of the blocks covered with pines. In other cases the trees are first started in the nursery, and then transplanted to the blocks. When so transplanted they are set in rows a yard or two apart, and gradually thinned down to three or more yards apart.

East of Berlin there is a repetition of the planted forests just described. Here it is noticeable that wherever there is a section of sandy soil, pine plantations have been made upon it. Thus as one travels over the country he finds these forests at irregular intervals, dependent upon the nature of the soil. Apparently the effort has been to avoid taking the good farming lands for forestry purposes; only the sandier lands which are comparatively useless for ordinary crops, have been used for tree growing. The policy of forest planting has been followed for a long time, as is shown by the considerable size of the trees in many of the forests, some of which were fully eighty feet in height. It is a pretty sight when one has before him a forest consisting of blocks of trees of different ages. Here may be a block of ten to twenty acres of trees all, say ten feet in height. Next to it

---

* It must not be assumed that these observations apply generally.—Ed.

may be another block of about the same area whose trees are all fifteen feet high, another with trees twenty-five or thirty feet, and so on up to the tallest (and oldest). At a distance these successive blocks of trees are like gigantic green steps in the landscape. These are the successive crops which will mature their lumber-yielding trees in a succession of years. They are to be likened to the crops which the farmer grows, only they require from sixty to one hundred years from the planting of the seed to the maturing of the crop.

The Doelauer Forest.

Before leaving Germany I should speak of the Doelauer Forest near the city of Halle. It covers an area of about 1,600 acres lying about two miles northwest from the center of the old city. Originally much of it must have been a barren series of sandy and rocky hills, mostly unfit for cultivation and too barren to yield good pasturage for cattle. In other words, this tract must have been well nigh worthless. Now it is covered with a good growth of forest trees averaging about seventy years of age. The trees are not all of the same age, but the block system of planting has not been followed here. The trees in many places are in rows six to seven feet apart, and this appears to have been the original plan of the planting. In some places it is evident that there have been at least two successive plantings, and possibly more. Thus in one portion of the forest there are scattered trees of much larger size, and close examination shows that these older trees are remnants of an earlier plantation in which the trees were in rows. The rest of the surface is covered with much younger trees set irregularly without any attempt at arrangement in rows. The trees in this forest are almost entirely pines (*Pinus sylvestris*), and some are large enough to be cut into logs from 12 to 15 inches in diameter.

Here and there are found oaks mixed with the prevailing pines, and where the forest is traversed by a public road the oaks are much more abundant by the roadside. This appears to be a protective device, there being more danger from fire where the pines closely border the road.

We were much interested in examining an outbreak of a fatal disease which had attacked the trees over an area of five or six acres near the center of the forest. Every tree on the affected area had been cut and removed, and even the stumps had been dug out. The work of eradication was not yet complete at the time of our visit, but it was very clearly the intention of the foresters to burn up every root so as to rid the soil of the harmful fungi. That the parasitic cause of the disease is the toadstool *Agaricus melleus* was indicated by several specimens which we found growing from the roots of the few remaining dead and dying trees near the edge of the clearing. Apparently the fungus creeps through the soil, passing in this way from tree to tree, and eventually destroying every one infected. The trained foresters are able to detect the diseased trees, and shortly before our visit they had gone through the forest and "blazed" all which showed signs of disease. Such treese were to be cut and removed from the forest so that they should not become further sources of infection. Many trees were affected, also, with the pine bark beetle, but this is probably an accompaniment of the fungous disease just alluded to.

Polish Forests.

In the comparatively level country east of Warsaw, in Russian Poland, there are many large plantations of pines on the sandy tracts which occur at intervals of a few miles. Here the trees are started directly from the seeds, and apparently are not transplanted. At least this appears to be the rule. At first the young trees are very close together, but as they grow larger they are carefully thinned and pruned, as in the similar plantations in Germany. The block system of planting is followed here, also, and it was no uncommon thing to find on the various blocks of a forest, trees of all sizes from a foot in height to seventy or seventy-five feet. Here too, as the trees become larger the side branches are pruned off, and used for fuel.

The utilization of the sandy stretches has gone so far that even where the sand is so light as to blow up in naked dunes of considerable size, plantations of pines are made with success. It is noteworthy that on the sandy tracts the borders adjacent to the farms, where the soil is less and less sandy, are planted with birch trees instead of pines. Along the sides of the railways which cross the plantations there are five guards to protect the forests from fires which might be started by sparks from the engines. These fire-guards consist of perfectly bare ridges of sand two to four yards wide at the edge of the forest, and distant from the track about fifty or sixty feet. These ridges are usually about a foot to eighteen inches high, and are thrown up by digging a shallow ditch on each side. It is evidently the duty of some one to keep the fire guards free from weeds or rubbish, and apparently this is an efficient means of protection.

Russian Forests.

Passing into Russia proper on the route leading to Moscow, while the general plan of utilizing the sandy stretches is continued, the trees are not planted in rows, but appear to have sprung from seed sown broadcast. There is more water in the soil, and in places it is quite wet. Some of the mixed birch and pine plantations on these wetter lands look neglected, and remind one of the "tree claims" which used to be so common on our own plains, in Kansas, Nebraska, and the Dakotas. Here a poplar, probably *Populus nigra,* looking almost exactly like our Cottonwood, is often intermingled with the Birch in the forests, and often planted about the houses exactly as the Cottonwood is upon the Great Plains. I saw some indications of the spontaneous spreading of the pines from the edge of the plantations. Here and there I saw seedlings springing up in the fields nearest to the forest plantations. Approaching Moscow from the west one finds forests which are quite certainly natural (not planted), and here they consist largely of birch and spruce.

South of Moscow for some distance (one to two hundred miles) there are pine forests, but these rapidly diminish, giving way to birches, poplars, elms, etc., and finally leaving the general surface free of forest growth as we enter the great steppes. Here the trees occur as narrow fringes along the streams, and none at all occur on the higher lands except were planted. There are as yet no considerable plantations of trees in that portion of the steppes which I saw, namely, that between Moscow and Rostof-on-Don. As on our American prairies, the farmers sometimes plant the white willow for windbrakes. Along the railway the Elm is extensively planted to serve as a snow-fence, and with it is planted an *Elaeagnus*, to make the barrier more complete by filling in the spaces between the trunks of the taller growing elm trees. In places a *Caragana* is used to replace the *Elaeagnus*, and sometimes the Ash replaces the Elm. The country with its gently undulating surface, its black soil, its low rainfall, and its original treelessness, together with the kinds of trees planted, all remind one of the prairies of Iowa thirty to forty years ago, and the Great Plains of Nebraska and Kansas some years later.

The North Caucasian Forests.

On the northerly side of the Caucasus Mountains the forests are now very scanty: I say *now*, for there is reason for believing that the present treelessness is due to deforestation within comparatively recent times. In fact, I was assured by General Sipaillo that the forests were burned off during the long period (50-60 years) of figthing between the Russians and the mountain tribes. However, this may be, the fact is that the northerly slope of the Caucasus Mountains is generally treeless, such trees as occur being almost entirely confined to the sides of some of the narrow valleys. In many places even the valleys are treeless. On the other hand some of the outlying foothills are fairly well covered with trees. Moreover, there are fewer and fewer trees as one goes eastward, and this holds on the southerly as well as the northerly side of the mountain chain.

In the vicinity of the famous watering place, Kislovodsk, where the "Narzan" spring sends forth its immense volume of mineral water, there are considerable belts of forests, consisting principally of oaks, elms, and ashes. As the trees are still young, none being more than forty to fifty years old, I suspect that they have been planted. The probability that this is the case is increased by the fact that mingled with these trees are large numbers of the American Black Locust trees (*Robinia pseudacacia*), which in places make up the greater part of the forests. Above Kislovodsk in the gorges and canyons are scattered birch trees, all, however, small and not exceeding twenty to thirty feet in height. In travelling from the valley to the summit of Mt. Bermamut, a distance of twenty-five to thirty miles, no forests at all were found, and indeed very few individual trees were to be seen. Everywhere the surface is bare of trees. One finds only grassy slopes, grassy hills, grassy valleys. If there were forests here once, they have been most thoroughly eradicated.

Some distance eastward in the lower valley of the Ardon River the almost level country is treeless except for the locusts (*Robinia pseudacacia*). In the narrower valley which penetrates the mountains are elms, ashes, beeches, alders, maples, birches, willows, lindens, etc. Now and then these constitute small and fairly dense forests, but for the most part they are growing in quite "open order," and do not fully shade the ground. Further up the valley pine trees (*Pinus sylvestris*) appear on the steep sides of the canyon, but even these do not form solid forests, and few of the trees are either large enough, or well enough grown to have much value for timber. Still further up the valley the trees completely disappear, and the whole mountain surface where not rocky, or snow covered, is clothed with a grassy vegetation.

Still further eastward, on the northerly side of the mountains, in the valley of the Terek River, are many trees of the locust (*Robinia pseudacacia*) with some elms and ashes, and occasionally a walnut (*Juglans regia*). On the low foot hills dwarf oaks which remind one of the shrubby oaks (*Quercus gambeli*) of our own Rocky Mountain foothills. Following up the valley into the mountains, one finds some pines with the elms, oaks and ashes, but those nowhere form dense forests. In some places they give one the impression that they are now slowly moving up the valley, but I am by no means certain that this is what their appearance signifies. In the heart of the mountains there are very few trees. Here and there are a few birches, and poplars (*Populus nigra*).

The Southern Caucasian Forests.

On the southerly side of the mountain range for more than half its length one finds dense forests of pines, spruces and firs. On the northeast shores of the Black Sea these forests come down to the water's edge and extend upward eight or nine thousand feet on the mountain sides, and eastward a hundred miles or more, to and beyond the valley of the Rion River. Here is a magnificent forest covering from 8,000 to 10,000 square miles, which appears to have escaped the destruction which swept the trees from the remainder of the mountains. In driving through this fine forest as I found it along the upper portions of the Rion Valley, I found it to be as densely studded with large trees of spruces and firs as any I have ever seen in the eastern United States. The forest appears to be actually primitive, and the hand of man has not yet affected it in any way. It is true that much timber has been taken out of it, but this has been by the removal of occasional trees, and not by the destruction of the forest.

While this great forest is largely made up of conifers, in which spruce (*Picca orientalis*) and fir (*Abics nordmanniana*) predominate in the higher portions, and pine (*Pinus sylvestris*) at somewhat lower levels, there is ofen a considerable admixture of deciduous trees, the latter sometimes of large size. Thus I noted beech, two species of maples, elm, ash, chestnut, poplars, birch, and some oak. Still lower in the valley the forests have been largely cut away in order to make room for the farms, but the rougher lands and the hills are still covered, the trees here being quite predominately oaks. Since the latter are but twenty to twenty-five feet in height they have probably sprung up within the last half century. I was interested in noting that in the parks in the city of Kutais, the ancient capital of Colchis, two American trees were very commonly planted, namely, the locust (*Robinia pseudacacia*) and the honey locust (*Gleditsia triacanthos*).

Armenian Forests.

Passing out of the valley of the Rion River, to that of the Kura River, which lies eastward, one finds a much drier climate with a corresponding decrease in the forest growth. The "divide" which separates the two valleys is well covered with forests on the westerly side, but as soon as one crosses to the easterly side the forests rapidly disappear from the valley and are to be seen only on the bordering hills and montains, and there, too, in diminishing abundance. Indeed, the hill country bordering the Kura Valley, and southward in upper Armenia, is notable for its scanty forest growth. Whether there were forests here ages ago can not now be determined. Man has occupied this country for so many thousands of years, and so many armies have traversed this region that any forests that may have once grown here must have disappeared ages ago. Here again I noticed the American locust (*Robinia pseudacacia*), thorny locust (*Gleditisia triacanthos*) and the box elder (*Acer negundo*) in parks and other plantations. These trees appear to be well adapted to the peculiar climatic conditions which prevail in this region. The annual rainfall ranges from 10 to 20 inches, and the soil in many places is dry and gravelly.

Crimean Forests.

The peninsula of the Crimea is remarkable for the great differences in climate which it exhibits. The southeasterly coast has a fair amount of rainfall, and is sheltered from the northerly winds by the lofty range of the Yaila Mountains, whose crest is not more than five or six miles distant from the sea shore, while their sloping sides run down to the water's edge. On this narrow strip vegetation of all kinds is abundant, and here the forests are also in their glory. There are still preserved considerable tracts of oak forests with some admixture of ash, walnut, hornbeam and other deciduous trees. In the Acclimatization Gardens at Nikita there are fine specimens of *Thuja gigantea, Sequoia gigantea, Quercus suber, Magnolia grandiflora, Cupressus pyramidalis, Cryptomeria japonica, Biota orientalis, Diospyros kaki, Olea europea, Juglans regia, Laurus nobilis, Bambusa* sp. besides many other common trees from western Europe, and North America. On the emperor's estate at Livadia, is a fine tree of *Juglans nigra* fully two feet in diameter, besides most of those mentioned above.

Crossing the mountain range the climate changes abruptly, and with it is an equally abrupt change in the forest growth. While the southeasterly slopes are covered with forests, the surface is generally bare of forests on the westerly and northwesterly side. Here again we have brought very forcibly to our attention the fact that natural forests depend upon favorable climatic conditions. A sufficient rainfall and some protection from sweeping north winds will insure a forest growth, the absence of these generally results in a deficient or reduced forest growth, or in extreme cases, in complete treelessness.

A SUPERVISORS' MEETING.

At Portland, Oregon, during the week begining March 21, was held a conference of Forest Supervisors and District Office men from District 6, comprising Oregon, Washington, and Alaska. This meeting was for the discussion of National Forest policy and procedure.

Water Powers.

District Engineer W. E. Herring's paper on water power dwelt upon the fact that power is the vital element in our industrial development. The two sources available are steam power and water power. Coal, wood, and oil are the fuels used in the generation of steam power and all are becoming more scarce each year. That the price of fuel is advancing is well illustrated on the Pacific Coast where the cost of fuel oil has advanced from 25 cents a barrel, equivalent to about $1 per ton for coal, to $1 a barrel in the past five years. Water power is undoubtedly cheaper than steam power, and as competition becomes more acute the value of water power over steam becomes greater. Advances which have already been made in the distance to which electrical energy can be carried as well as the advances which are sure to come in the near future will tend largely to further increase the value of such power over steam power. The greatest initial incentive for the development of hydro-electric plants in the Northwest has been the existing high cost of fuel. The entire country west of the Cascade Range is particularly well adapted to such developments owing to the heavy rainfall and its distribution, the large number of glaciers which act as regulators of the stream flow, and the very rapid descent in the streams. The greatest activity has been displayed in the past two years in the acquisition of power sites on the different streams, and practically all of the more important streams have been covered with power filings and surveys made on them for proposed water power plants. The possibilities of such plants have steadily grown and the most desirable sites have all been taken.

Up to the present time there has not been such economical and general development of water power as includes the storage of water on a scale at all commensurate with the advantages to be gained. Experience however, with the existing plants in this section of the country has proved conclusively the value of such work, and in all of the proposed large developments it plays a most important part. Two reasons are given for the neglect of this feature in the past. (1) Poor judgment of the stream flow owing to a lack of continuous records of the flow, and (2), the desire for immediate and large returns on the investment. The operating plants failed signally to provide for storage to tide them over the low water period in the streams, and a majority of them failed further to provide even a small equalizing reservoir or forebay which could be utilized during their peak load. Lacking either of these it has been found necessary to install and maintain auxiliary steam plants. This is done at a great expense and in many cases could certainly have been obviated had the necessary precautions been taken in the initial construction.

The Puget Sound country is the largest market for electrical power in the Northwest. The increase in the amount of power consumed has been remarkably large, particularly in the past few years.

In Oregon, west of the Cascades, it is not thought that there will be any large demand for additional power in the next ten years unless the installation of electro-chemical or electro-metallurgical works is made. It is estimated that 20,000 horse power additional will supply the needs for the next ten years outside of the Portland market. In Oregon the operating plans have a total installation of 42,703 horse power.

A market for electrical power which up to the present time has received scant attention in this portion of the country is to be found on each side of the Cascade range and in the use of electricity for pumping purposes. There are hundreds of thousands of acres of land that need only water to make them as valuable and productive as similar lands more advantageously located for irrigation purposes. The use of electricity for pumping water on to such lands has been demonstrated as practicable at several points with good results. It is thought also that parts of the Willamette Valley and of western Oregon south of the Willamette Valley can be irrigated to good advantage by the same means. This matter is being thoroughly investigated at the present time by different parties and it is certain that within a very short time, possibly during the present season, one or more plants will be constructed principally to supply markets of this kind.

Another market which has not been utilized is the use of electricity in sawmills and in logging operations. Owing to the elimination of fire risks and freedom from water troubles in the woods and the saving of a friction loss of from 40 to 70 per cent. in the drives in the mill, careful attention is being given to it by different lumber interests. If found to be practicable many operators will undoubtedly construct small water power plants of their own on or near the scene of their logging operations, and it would seem that construction of small plants where power can not be had from commercial companies will revolutionize to a certain extent the present methods of logging. It would seem that on the larger tracts of timber, where water power could be developed, stumpage would have an increased value over that on similar tracts where water power is not available.

The power companies claim that the Forest Service charge is a charge for water; this is not true. It is merely a charge for the use of lands based upon the special value of the lands for the particular purpose to which they are put. The appropriation and use of water are regulated solely by the States. If part of the works appurtenant to the proposed development are outside the boundaries of the National Forests a deduction from the regular charge is made.

Organization.

Tuesday's session was given over to papers on the "Organization of the National Forest Force," by C. H. Flory, and the "Conduct of Timber Sales," by F. E. Ames. Mr. Flory's paper gave a detailed history of the development of the organization at present in force in the Forest Service. He pointed out the necessity for broad adminstrative ability on the part of Forest Supervisors and the tendency of the administrative officers of the Forest Service to detail routine matters to Supervisors, and they, in turn, to turn over as large a part of the field as possible to Forest Rangers and Guards. He cautioned the supervisors to select their Forest force from among men who are capable of accepting responsibility.

Mr. Ames discussed, at some length, the policy of the Service with respect to the sale of timber on National Forests, and the methods to be pursued by Supervisors in the disposal of timber on their Forests. He called attention to the fact that the Supervisor must take a broad outlook of the problems he has to face. He is entrusted with the supervision of a large estate which involves many intricate problems in its administration. The supervisor often has no precedent and no one upon whom to rely. We must plan to care for and harvest a crop which takes years for its maturity. We must take complete account of the stock we have on hand, its condition, accessibility, distribution, and prospective markets. Experiments in planting must be undertaken to show how to replenish our stock. In a few years the timber sale business of the National Forests will assume large proportions. The estimate of timber on National Forests is 390 billion feet B. M., of which district 6 alone has 287 billion feet. Last year, the sales in this district, which comprises Oregon, Washington, and Alaska, were less than ten per cent of those made from all National Forests. There are large areas of mature timber ready for the saw. In many cases, these are now inaccessible and the timber can not now be removed on account of transportation difficulties. However, we should make every effort to make such sales as are advisable from a silvical standpoint. Mature timber is now decreasing in value and the rapid deterioration will soon make it unmerchantable. The quantity of timber sold in the first half of the fiscal year 1910 is approximately four times as great as in a similar period during 1909. Several very large sales are now being negotiated.

Timber Sale and Silviculture.

Wednesday's session was given over to papers by B. P. Kirkland, Supervisor of the Snoqualmie National Forest, and M. L. Erickson, Supervisor on the Crater National Forest. Mr. Kirkland discussed the reconnaissance work and plans for management of Forests with relation to the future removal of timber west of the Cascade Mountains. A definite record of the age-classes and the condition of all timber on the Snoqualmie National Forest has been obtained. The Supervisor is now in possession of facts which will permit him to arrange a program of sales to insure a perpetual supply of timber from that Forest.

The income to the State of Washington, last year, from the National Forests was $16,000. If all the Forests of Washington were being cut up to their safe cutting limit, they would probably yield an annual crop of about 1,000,000,000 ft. This, under present conditions, could be sold at about $2 per thousand feet on the average, thus yielding $2,000,000 per annum, 25 per cent. of which going to the State would mean an income of $500,000 yearly to the counties in which the Forests are situated. The receipt of such an income as this would, at once, allay adverse crticicism of the Forest Service policy, on the ground that they retard development and withhhold revenue from the State.

Mr. Erickson's paper outlined a plan for reconnaissance work and the management of the Forests with relation to the future removal of timber east of the Cascades. The type of Forest on the east side of the mountains being so distinctive, from a silvicultural standpoint, from those on the west side, it is necessary that they be handled in an entirely different manner in order to guarantee a rotating crop.

Reproduction in the Yellow Pine forests is especially abundant, and many will maintain that seedlings spring up without silvical treatment, but this is not an invariable condition. Soil, ground cover, moisture and locality factors often preclude Yellow Pine reproduction entirely. Some of the important natural factors influencing reproduction are: 1. Ground cover. 2. Moisture—soil moisture, air, evaporation. 3. Temperature—wind, exposure, aspect. 4. Soil itself—erosion, porosity and drainage. 5. Light conditions.

During the course of this discussion it was brought out that Yellow Pine seed often germinates best in localities where sheep have grazed over the area of reproduction. Pine seeds to grow must reach the mineral soil and must have sufficient moisture. The cultivation or harrowing of the ground by the hoofs of grazing animals furnishes the necessary conditions of germination. However, it was specifically stated that continued grazing would result in the tramping down of the young seedlings, and, therefore, sheep should not be permitted on the area after the seeds are harrowed in until the young growth is strong enough to resist the trampling of the sheep or cattle. With the grass removed by the sheep or cattle grazing over it, the danger from fire is minimized.

The morning session of Thursday was occupied by T. T. Munger, who read a paper on "Silvical Problems of Immediate Importance in the Northwest." The fact was emphasized that at present we know very little concerning proper methods of brush disposal, in their relation to reproduction and fire protection. Particularly in the fog belt on the West Coast there is considerable protest on the part of lumbermen against the dictum of the Washington Fire Warden that slashings should be burned, it being claimed that since in this region the fire season is short and the decay of logging debris very rapid, the burning of logged-off land is unnecessary. Failure to burn results also in saving a great deal of "advance" reproduction and many small trees. Along the foothills of the Cascades burning of slashings is certainly the wisest procedure, but may not be in the fog belt, where for many reasons the selection system seems preferable to a clear-cutting system.

Private Forestry.

At the evening session E. T. Allen, Forester for the Western Forestry and Conservation Association, spoke of the progress of private forestry in the Northwest and its relations to government work. He showed that this should be a matter of keen interest to the Forest Service because the latter's success depends very largely upon public understanding of forestry principles in general without reference to any particular areas or authorities. Thorough understanding of the subject by the people, lumbermen, and especially the State Legislature and officials, will remove most of the opposition now encountered by the Service. For this reason Government Forest Officers should make every effort to improve State forest laws and help in their enforcement. The best thing for the Northwest is hearty co-operation between the Government, the State, and the private timber land owner, all working to the common end of the best forest protection and the highest production of material for the consumer. No one of these agencies can do its best work alone.

Mr. Allen predicted much more favorable conditions for the practice of forestry by private owners. At present the fire hazard and system of taxing cut-over lands are discouraging. Nevertheless, lumbermen are becoming greatly interested and may be counted upon to do all that conditions will permit. In some parts of the United States, lumbermen have been somewhat opposed to reforms in forest management and have done little more to improve their methods than they were compelled to do by popular agitation. In the Northwest the situation is reversed and lumbermen are the real leaders of reform. This is largely because natural conditions here are peculiarly favorable for private forestry. As soon as the public realizes that we have here in the Northwest the great field of production for the rest of the United States and can with little effort perpetuate an industry bringing great revenue, both sentiment and legislation will encourage the owner of forest land to make the best use of it.

In this connection Mr. Allen pointed out that the government's policy of selling National Forest timber may be made either to help or retard private forestry. While it should not withhold government timber from use or keep prices so high that they assist monopoly, neither should it ever sell such large quantities at so low a price that the lumber market falls low enough to prevent private owners from applying improved methods or discourage them from reforestation. Such a result might benefit the consumer of to-day temporarily but would inevitably injure the consumer of the future by greatly reducing the second crop.

In closing, Mr. Allen explained the character and objects of the Western Forestry and Conservation Association. This is a sort of grand lodge of all local associations in Montana, Idaho, Oregon, Washington, and California having for their purpose better care of natural resources. Mr. Allen serves as its forester, giving technical and practical advice to its members along all forestry lines. The movement is receiving strong support by lumbermen as well as by the public conservation associations. Idaho and Washington already have several very effective forest fire associations in which timber owners pro rate the cost of patrol on an average basis. During the past few months similar associations have been organized in Montana and California, and it is expected that Oregon will be well in line before the coming dry season.

Forest Products.

On Friday Mr. J. B. Knapp, of the Portland office, discussed "The Relation of Products work to National Forests." Mr. Knapp's address dealt with the possibilities of the future development of the timber resources of the Pacific Northwest and the relation of present manufacturing demands to the future management of Forest land, both privately and publicly owned. Mr. Knapp stated that fully 12 per cent. of all the timber used in the United States to-day was represented by the Douglas Fir which is produced in the States of Oregon and Washington. As a source of the timber supply of the United States, these two States will rapidly increase in importance. He outlined a plan of procedure whereby the prospective future demand for the purchase of National Forest timber may be obtained. He stated that this plan was now being put into effect. He advocated the immediate sale of all timber on National Forest areas which has been killed by forest fires in recent years, stating that this timber rapidly deteriorates and, in the course of 6 to 8 years, becomes absolutely unsalable. The Portland office of the Forest Service made an investigation of the burned timber areas on the west side of the Cascade Mountains during the summer of 1909 which proves conclusively that burned timber is quite satisfactory for use in the manufacture of lumber and other forest products provided it is logged before the sixth year after the fire has passed through it, and that the only injury to the timber at this time, is the decay of the sapwood. Many bodies of burned timber are now standing within the National Forests and are rapidly deteriorating. This timber should be sold wherever possible, because its usefulness will soon be entirely destroyed and the sale of it will save for other use equal amounts of green growing timber.

Forest Service statistics show that the principal wood-destroying agencies, in the order of their importance, are decay, fire, insects, and abrasion, which destroy large amounts yearly. If a general preservative treatment were adopted for all such timbers as are used in structures where a preservative treatment is applicable, the amount saved would be equivalent to the annual growth on 20 million acres of such timberland as is found in the States of Oregon and Washington.

Range Problems.

Following Mr. Knapp's discussion was a paper by H. K. O'Brien, on "Range Improvement and Water Development." Mr. O'Brien stated that the Forest Service has been carrying on experimental work for the past three years for the purpose of studying various range problems with a view of bringing about such utilization of National Forest lands as will result in the largest returns possible to stock owners without injury to the growth of the Forests or the forage on the lands grazed. He pointed out that the purpose of the experimental studies was to investigate the possibilities of a rotation system of grazing whereby the range grazed may be allowed to reseed naturally in order to maintain a permanent forage crop of high efficiency without depriving stockmen of the use of the forage of any area. The possibility of increasing the amount of forage or of bettering its quality by means of artificial reseeding with cultivated forage plants was also tried. Methods for the development of the economical use of grazing land and the best means of handling stock, especially sheep, were also taken up in connection with this investigation. Poisonous plants have always been a source of much loss to stockmen in the past, and remedies for overcoming such loss are being tried out. Perhaps the most important work from a grazing point of view, which the Department of Agriculture has ever undertaken has been the coyote proof pasture on the Wallowa National Forest. The real object of this study was to collect information which would make it possible to do away with the unnecessary destruction of forage by herding and trampling. Such a test required a coyote proof fence. In selecting the area to be fenced, which has an elevation of from 4,800 to 5,400 feet, it was necessary to have one which would provide summer grazing for sheep and would be a suitable site for a test against wild animals. The work was started in 1907; in 1908 the experiments were very satisfactory, the fence being entirely successful as a protection against coyotes. The report for 1909 which is now being prepared in the Portland office will again prove the worth of the construction of this fence, the efficiency of the fence as a protection against predatory animals, especially coyotes, and the favorable results from the grazing of sheep where they are unmolested in the pasture. The effect of such a systm of grazing upon the sheep and upon the carrying capacity of the range will show its practicability, and the factors which bring about the weight of sheep and the increase in the carrying capacity of the range will be shown to result from a good management which can be practiced on selected areas where the animals are protected from outside disturbances. The record of the hunter who was employed to protect this experimental pasture shows that 166 coyotes came to the fence during the year 1909 but all were turned away. Seven coyotes were killed by the hunter. The effectiveness of the fence in preventing the entrance of coyotes is, therefore, conclusively proven. The results obtained in the operation of this experimental pasture show that with proper handling of the sheep one herder could care for a band of from 8,000 to 10,000 sheep. It is interesting also to note that the weight of the pasture lambs as compared with six bands herded on areas adjoining the pasture was considerably greater. The average pasture lamb weighed 75.5 pounds and the average range lamb weighed about 10 pounds less.

At the Saturday session Mr. Henry Ireland discussed "The Handling of Stock on the Range." Mr. Ireland discussed at some length the past practice in handling cattle and sheep on the public range, and showed how improper use of the range had resulted in reducing the forage crop and also preventing the natural reproduction of that range. He stated that over-grazing had for many years proceeded arm in arm with improper methods of handling the stock and the combination has caused grazing areas throughout the northwest to depreciate in carrying capacity from 10 to 90 per cent. The grazing areas now under administration are still being injured by overgrazing and improper handling of stock, and this condition will continue until such time as all public grazing areas are placed under proper administration. The frequent failure of the owners of sheep and cattle to supply properly informed herders for the care of their stock results in a condition which is bound ultimately to work a hardship on the grazing industry. A proper appreciation of the results of overgrazing on the part of herders would result in a perpetual range of much greater carrying capacity than is now available. The result of improper methods of handling sheep are in evidence almost throughout the grazing sections of the northwest. Many areas that at one time produced a heavy crop of excellent forage have been reduced to dust-beds by the constant trample in the grand scramble that took place every season prior to the date of administration by the Forest Service, and it will require years of careful handling to restore the range to its former condition. For this reason it is necessary in many instances to reduce the number of stock grazed, and obtain a thorough coöperation between the sheepmen and the Forest Service in the handling of stock on the public lands. Under present regulations each permittee is allowed a specific area upon which to graze his flocks during the season and is required to keep within such area and is not permitted to encroach upon his neighbor's. This sytsem of administration has confined each permittee to his allotted areas and thereby done away with the surging back and forth over the range which results in the trampling down of more feed than is consumed. It also reduces to a minimum the repeated driving of sheep over the areas from which the forage crop has been taken. Promiscuous driving of sheep from one point to another in search of forage is not only injurious to the grazing lands over which they pass but also results in the loss of weight to the sheep and makes them less desirable for sale in the market.

At the present time on many of the Forests the plan of bedding the sheep on the range as near as possible where night overtakes them instead of driving them into camp is being practiced with excellent results. Previously it was common practice to bed the sheep at a specified place each night, now it is proposed to bed the sheep at any point near the locality in which they have grazed during the day.

Fire Fighting.

During the afternoon session, Mr. S. C. Bartrum, Supervisor of the Umpqua National Forest, presented a paper on the protection of the Forests from fire. This paper dealt particularly with the necessity for the construction of proper trails within the Forests in order to make it possible to bring a fire-fighting force into action as early after the discovery of a fire as possible. He called to the minds of the Supervisors the great annual waste in green timber which results from Forest fires carelessly set by campers and originating from other unnecessary sources. Mr. Bartrum spoke particularly of the necessity for active coöperation between the Forest Service and the private owners of forest lands outside the National Forests. Systems of fire patrol have already been put into effect by numerous large timber holders and their coöperation with the Forest Service on previous occasions has resulted in a mutual good.

The necessity for the enactment and enforcement of satisfactory fire laws within the State of Oregon was dwelt upon at considerable length. At the present time the State itself appropriates $250 annually for the protection of the greatest natural resources which it possesses. This resource is the basis of the present development of the State, and the lumber industry is more important to the future development of Oregon than all other single resources in combination. The Forest Service is expending vast sums of money annually in protection of the timber lands of the State which is included within National Forests. The State itself has taken no interest whatever in protecting the industry upon which a vast portion of its population is directly dependent for its livelihood.

The discussion which followed the presentation of Mr. Bartrum's paper brought out the fact that the annual decrease in the destruction of timber from fires within National Forests fully justifies the expenditure which the Government is making in protecting this resource. Previous to the establishment of the National Forests the destruction of timber by forest fires resulted in losses equivalent to the total output of lumber by the manufacturing industries of the State. Now the fires are very largely confined to areas which have previously been burned over and where the hazard is greatest. These are generally extinguished before the green growing timber is seriously affected.

CURRENT LITERATURE.

HENRY S. GRAVES, *in Charge.*

Report of the Maryland State Board of Forestry for 1908 and 1909. By F. W. Besley. Baltimore, Md. 1909. Pp. 45.

This report shows an encouraging progress since the foundation of the Board in 1906. The forest mapping and detailed study of forest conditions, county by county, has proceeded steadily till now 18 of the 23 counties are completed. Since the last report 39 woodlots aggregating 4,122 acres and representing a farm acreage of 11,549 acres have been personally examined on application, and advice to the owners given. In addition, two planting plans for 45 acres have been prepared for examined lands. Other coöperative work was the installation of a small timber treating plant in conjunction with the U. S. Forest Service and State Experiment Station. 1,000 posts were set in fence lines after treatment and will be kept inspected for comparison with adjacent similar untreated posts, to relate cost of treatment to increased length of life. The Board is also making a study of the wood-using industries of the State, and experiments in growing Loblolly Pine on certain sand lands, in coöperation with the Forest Service.

Eighty-three fires were reported in 1909, burning over 21,217 acres and causing damage to the extent of $72,080. Of these 39 per cent. were set by engines (transportation and logging), 14 per cent. each, by hunters and brush burning, and 29 per cent. unknown. The main defects in the protection system are the insufficiency of the number of wardens, their lack of authority to enforce assistance, lack of prompt payment for fire-fighting and absence of fire lines and patrol along railway lines.

The average annual expenditure for the last two years has been less than $3,900 or one-fifth of one cent per acre of woodland in the state—certainly a meagre appropriation.

The report closes with appended Forestry Leaflets 7, 8, 9. Leaflet 7 has been reviewed in F. Q. VII. p. 161. Leaflets 8 and 9 deal specifically with the forests of two counties.

J. H. W.

Forest Products of Canada: 1908. By H. R. MacMillan and G. A. Gutches. Bulletin No. 8, Forestry Branch, Ottawa, Canada. 1910. Pp. 18.

This bulletin contains the results of the first attempt of the federal Forestry Branch to gather annually detailed statistics of the forest production by correspondence with lumbermen, railway, telephone and telegraph companies, etc. Being a new venture the returns are more or less incomplete, but furnish some interesting facts.

Tables based upon returns from 1,400 lumbermen are given, showing the quantity and value of lumber, shingles and lath for each province by species. These show a total cut for 1908 of 3,348,176M. bd. ft. of lumber worth 54 million dollars—an average value of $16.27. The distribution of the cut was: Ontario 1,294,794 M bd. ft. (39 per cent.), Quebec 690,135 (21 per cent.), British Columbia 647,977 (19 per cent.), New Brunswick 308,400 (9 per cent.), Nova Scotia 216,875 (6 per cent.), and prairie provinces 189,995, M bd. ft. The cut by species was: White Pine 29 per cent. (Ontario about three-quarters, and Quebec about one-third of a billion feet; spruce 26 per cent. (of which 80 per cent. eastern spruce); Douglas Fir 11 per cent.; Eastern Hemlock 7 per cent.; Red Pine 4 per cent.

The shingle cut was 1,499,396 M worth $3,101,996, and lath 671,562 M worth $1,487,125—an average value of $2.07 and $2.21 respectively. Of the shingle production British Columbia supplied 48 per cent., Quebec 27 per cent. and Ontario 15 per cent.; of the lath, Ontario 39 per cent. and New Brunswick 20 per cent.

The table of cross-ties purchased is based upon the reports of 47 steam railways with 25,772 miles of track and 32 electric railways with 818 miles. These purchased 13,738,157 and 240,259 ties, respectively, at an average cost of 38 cents. The species used were cedar 39 per cent. hemlock 16 per cent. and larch 15 per cent. Forty-seven per cent. of the ties were hewed.

The tables of poles purchased are on reports of 66,544 miles of line requiring 2,433,245 poles. In all 185,807 poles were bought, worth $284,549 at the point of purchase. Of these, 87 per cent. were cedar and 11 per cent. larch. The average price paid for cedar poles ranging from 20 to 40 feet was $1.11, $2.06, $3.30 and $4.06 by 5-foot classes.

The figures on pulp manufacture are incomplete, only 45 mills reporting out of 70. These reports give 363,079 tons of pulp manufactured in Canada, from 482,777 cords of wood, valued at $2,931,653. Of this Quebec manufactured 53 per cent., Ontario 32, New Brunswick 11, and Nova Scotia 4, per cent. The reduction was 64 per cent. mechanical and 35 per cent. by the sulphite process. The species used were spruce 87 per cent., balsam 12 per cent. and poplar 1 per cent. The value of spruce as derived from the tables shows regionally quite a variation: Ontario $7.19, Quebec $5.77, New Brunswick $4.92, Nova Scotia $4.39, per cord. Although the above figures of home manufacture are below the facts, they are significant when contrasted with an export of 250,000 tons of pulp valued at $17.27 per ton and 794,896 cords of pulpwood valued at $5.48 per cord. (Official figures issued from United States give nearly 100,000 cords less.) The importance of the pulpwood industry may be realized when one considers that the value of the spruce cordwood nearly equals that of spruce lumber in Eastern Canada.

The bulletin, though incomplete, will be much appreciated as meeting a much-felt want. One would wish for more discussion of the statistics, however. Tables of figures are not perused by the public in general: the conclusions to be deduced from them must be separated and presented in accordance with the purposes for which the statistical information is issued. Graphical representation of some of the leading facts would give them more weight.

J. H. W.

Sammlung von Abhandlungen über Abgase und Rauchschaden. Herausgegeben von Prof. Dr. Wislicenus. Tharandt, 1909.

So general has the necessity for appraising damage by fumes from smelters and other industrial establishments become in Germany, that a periodic collection of the literature on the subject appears desirable, which the well-known expert in this field, Dr. Wislicenus of the forest academy at Tharandt, has begun.

So far, three fascicles have been published. The first, by the editor, discusses the basis for technical and legal measures against smoke damage and gives a clear exposé of the present status of the problem.

In discussing the conditions which influence the degree of damage it is stated that at the time of leafing the danger is greatest; that conifers are more sensitive to sulfurous acid than broad-leaved trees; that relatively dry air, wind mantles of deciduous trees, favorable location with reference to winds reduce the danger. The distance to which the damage may extend cannot yet be stated, topography and winds varying too much. Change in chemical processes to prevent acid production, absorption by basic materials (lime), leeching with water are possible only in exceptional cases. High chimneys are too expensive and do not necessarily prevent damage at greater distances. It is not centralization but distribution of the volume of smoke, gases over many small chimneys that should be attempted. Dilution by artificial draft produced with ventilators is often promising.

The necessity of completing legal prescriptions into an organic aerial law, to make clear the position of industrial concerns is accentuated.

The second fascicle by Schröder discusses in detail the sources of damage in Saxony and the influence on forest management. He comes to the conclusion that in the forest no preventive measures can be introduced; the prevention must be applied to the industrial establishments. The damage consists not only in lessening of increment, but increase of insects, fungi, windfall, raw humus formation, soil deterioration, increase of cost in soil cultivation, etc.

Gerlach furnishes a discussion of the method employed for determining the acid contents of the air, which we have reviewed in the Forestry Quarterly, vol. V. P. 334.

B. E. F.

Forest Fire Law and Instructions to Patrolmen and Supervisors. Forest, Fish and Game Commission, State of New York. Albany, N. Y. 1909. Pp. 21.

This booklet contains the new 1909 fire law by which the old town warden and the district warden system have been abandoned and in its place has been substituted a paid fire service. The Adirondacks are divided into three and the Catskills into one district, each under the charge of a superintendent of fires for each district. These districts are further divided into smaller sections and placed in charge of men who are designated fire patrolmen. The scheme is further strengthened by observation or lookout stations on mountains, which are in communication by telephone with the patrolmen. The patrolman system is sufficiently elastic in that it may be increased when in the judgment of the Commissioner it is desirable to do so, by appointing men temporarily or by appointing so called special patrolmen, who are located at various points, and have all the authority of the regular patrolman, but do not secure pay except when actually employed.

The Town Supervisor is also a part of this system and has the authority to warn out men to fight fire, etc. The pay for services in fighting fire was heretofore fixed by each town and the State would reimburse any town one-half ($\frac{1}{2}$) for reasonable bills expended in this section, provided that not more than $2.00 per day was paid for such services. Under the new law, the rate of wage for fighting fire is fixed at 15 cents per hour, and the law states that any male person over 18 years of age may be summoned to fight fire, and prescribes a penalty for the failure of a person so summoned to attend such fire.

Another very desirable change made by this law is that those employed in fighting fire are paid cash for their services. This is done through the regular patrolmen and the State advances the money. Then at the end of the season the bills are handed over to the various towns that they may rebate to the State one-half ($\frac{1}{2}$) of the expenses of the actual fire fighting. The State expends all of the money for the regular force such as observation stations, superintendents of fires, and regular patrolmen.

Another regulation requires the lopping of tops of all coniferous trees within the forest preserve counties, under a penalty of $25 fine and $2 for each neglected tree.

J. H. W.

The Forest Club Annual, Volume II. The University of Nebraska. Lincoln, Nebraska. 1910. Pp. 114.

This is an unusually good production for a student organization and of a type of which there are far too few. The annual was founded by the forestry students of the University of Nebraska as a medium for the publication of articles on technical and practical forestry, written by students and alumni.

The present volume contains ten articles all of them distinctly of interest and value to foresters. As examples, one might mention the titles of some: Boundary Survey in Kootenai National Forest, describing the method in full detail with statistics; A Northern Idaho Lumbering Operation, useful for its figures of cost; Sample Plots for Forest Studies, in which the writer suggests a code for studies, with a view to obtaining definite results of uniform character; Nebraska Forest Fungi, a discussion of the general nature and development of fungi as an introduction to a future series dealing with the local fungus flora, with keys, descriptions and illustrations.

A list of the papers read before the club at their bi-weekly meetings during the academic session indicates a live, enthusiastic forestry spirit. Some titles are: Grading Lumber in Idaho, Methods of Brush Disposal, Wholesaling and Retailing Lumber in Nebraska, Reproduction Studies in Arizona, Twenty Years Forest Nursery Work, etc.

We congratulate the Forest Club.

J. H. W.

The Care of Trees in Lawn, Street and Park. By B. E. Fernow. New York, 1910. Pp. 396, 8°. Price $2.50.

The volume with the above title is one of the American Nature Series published by Henry Holt and Company and its object is to set forth as briefly as possible what an amateur planter, or an owner should know about his trees. Depending upon the fact that a knowledge of the nature of trees is necessary in order to care for them properly, the author begins the book with a discussion of their structure and of their physiological and ecological requirements. After discussing the nature of disease and death in general, the writer passes to the diagnosis and treatment of physiological diseases, of mechanical injuries, of the attacks of insects and fungi. The chapters on pruning, trimming and repairing, on insecticides and fungicides will be of especial value to the tree protector through their wealth of illustration of apparatus as well as through their clear cut statements of fact.

The topics outlined above occupy six chapters. They are followed by a chapter on the planting of trees and by one on woodland park forestry. The ninth chapter which comprises one-third of the volume, tells the amateur what trees and shrubs to plant according to the climatic and soil conditions and according to the object of the planter. The chapter contains brief descriptions of the desirable trees and shrubs. The characteristics of many exotics are shown by illustrations.

For the owner or protector of ornamental trees, the volume meets a very definite need, in that it is a concise and non-technical compilation of data from many sources, guided into proper place and form by an experienced observer. While the book is primarily written for the tree warden, yet it contains much information of interest to the forester.

C. D. H.

Report of the Russian Forest Department for 1908. St. Petersburg, 1910.

The Forest Department of Russia has just issued its report for 1908 which contains, as usual, a very detailed statement of all the activities of the Department. Of all countries, the character of the forests and of the practice of forestry in Russia come closest to those of the United States. A comparison, therefore, of the two countries may be of especial interest to American foresters. By the end of 1908, the Forest Department had control of over 957,075,000 acres. This forest area has been divided into 1,261 administrative units, or what we call Forests. The total number of persons employed by the Forest Department, including the teaching staff of the Imperial Forest Institute, was 3,789. This did not include the forest rangers and guards, who numbered 30,783. Of the 3,789 employed by the Forest Department, 3,275 received a forestry education in the highest schools, while 266 were without special education. The personnel of the Central Forest Administration in St. Petersburg, which corresponds to the personnel of the Forest Service in Washington, was 856, while the local Forest Officers, who correspond to the Forest Officers in the District offices and to the Supervisors was 2,933. The Forest Department supports the Imperial Forest Institute. The teaching staff consists of 42 persons. Toward the end of 1908 there were in all 533 students at the Institute. Of these, 58 graduated and 106 entered the school. The Forest Department spends $243,048 for the up-keep of the Institute. Outside of the Imperial Forest Institute, which is an institution of high standing, the Forest Department supports 33 lower forest schools with 460 students. The Forest Department spent $84,134 for the maintenance of these schools.

The amount of timber which the Forest Department designated for cutting was 5,542,898,865 cubic feet, while the actual amount cut was only 2,014,608,785 cubic feet. The amount of timber sold from the Government Forests does not show any noticeable increase as may be seen from the following table:

1904, ...	1,915,609,724	cubic	feet.
1905, ...	1,901,067,210	"	"
1906, ...	2,279,225,396	"	"
1907, ...	2,005,862,285	"	"
1908, ...	1,927,729,972	"	"

Besides this, in 1908 there was cut 600,818,694 cubic feet of dead timber. This timber was sold for $26,007,426. There was also given away or sold at a reduced price, 294,233,975 cubic feet of timber at a total value of $2,020,106.

The other sources of revenue amounted to $481,948. Of these, grazing brought $150,460. Other uses for which the Forest Department received revenue are for leasing fields and cut-over areas for temporary agricultural use, and for selling seed.

During the year the Forest Department has placed under regular forest management 824,405 acres. There were reconnoitered 14,539,173 acres. On 1,002,731 acres the plan of management has been revised.

The Forest Department has spent $579,464 for planting, assisting natural reproduction, and care for reproduction. It planted over 3,915 acres and filled in fail places over an area of 3,051 acres. Natural reproduction has been assisted on over 213,300 acres.

The Forest Department collected in Government forests 2,050,-054 pounds of seed. Of this there were 56,735 pine seed, and of other conifers 9,944 pounds; oak acorns, 1,687,880 pounds, and of other broadleaf species 76,114 pounds. The collection of the seed cost the Government $30,723. In addition the Forest Department bought 179,891 pounds of seed of different tree species for $12,915.

The Forest Department owned 261 drying establishments, and 226 storage houses for seed.

The Forest Department estimated the loss of timber through fire, insects, water, snow, wind, and other causes at $290,939. Of this $257,433 was from forest fires; insects caused damage to the extent of $7,229, while the damage from windfall amounted to $16,818. R. Z.

OTHER CURRENT LITERATURE.

Forest Conditions in the Crow's Nest Valley, Alberta. By H. R. Macmillan. Bulletin 5, Forestry Branch. Ottawa, Canada. 1909. Pp. 22, maps 2. Illustrated.

(1) *Forest Resources and Forest Conditions of Prince George's County.* (2) *Forests and Forest Management in Kent County.* (3) *Forest Resources and Forest Management in Harford County.* By F. W. Besley. Forestry Leaflets, Nos. 8, 9, 10. Maryland State Board of Forestry. Baltimore, Md.

Notes on Forest and Ornamental Trees. By H. Ness. Bulletin 105, Texas Agricultural Experiment Station. College Station, Texas. 1908. Illustrated.

Notes as to success of trees planted on the grounds of the Agricultural and Mechanical College of Texas.

Hail Injury on Forest Trees. By F. J. Phillips. Transactions of the Academy of Science of St. Louis, Vol. XIX, No. 3. March, 1910. Pp. 8, pls. 7.

Studies of the Needs of Rhode Island Soils. Bulletin 139, Agricultural Experiment Station. Kingston, Rhode Island. 1910. Pp. 103.

Coyote-proof Pasture Experiment: 1908. Circular 160, U. S. Forest Service. Washington, D. C. 1909. Pp. 40.

Forest Planting in Western Kansas. Circular 161, U. S. Forest Service. Washington, D. C. 1909. Pp. 51.

Practical Assistance to Owners of Forest Land and to Tree Planters. Circular 165, U. S. Forest Service. Washington, D. C. 1909. Pp. 7.

Commercial Importance of the White Mountain Forests. Circular 168, U. S. Forest Service. Washington, D. C. 1909. Pp. 32.

The Forests of the United States: Their use. Circular 171, U. S. Forest Service. Washington, D. C. 1909. Pp. 25.

Methods of Increasing Forest Productivity. Circular 172, U. S. Forest Service. Washington, D. C. 1909. Pp. 16.

Reproduction of Western Yellow Pine in the Southwest. Circular 174, U. S. Forest Service. Washington, D. C. 1910. Pp. 16.

Surface Conditions and Stream Flow. Circular 176, U. S. Forest Service. Washington, D. C. 1910. Pp. 16.

Imports of Farm and Forest Products, 1906-1908. (By countries from which consigned.) Bulletin 76, Bureau of Statistics. Washington, D. C. 1909. Pp. 65.

Exports of Farm and Forest Products, 1906-1908 (by countries to which consigned). Bulletin 77, Bureau of Statistics. Washington, D. C. 1910. Pp. 91.

Annual Report upon State Forest Administration in South Australia for 1908-09. Adelaide, S. Australia. 1909. Pp. 12. Illustrated.

Trees and Shrubs of San Antonio and Vicinity. By B. Mackensen. San Antonio, Texas. 1909. Pp. 51. Plates 12.

Record of Wholesale Prices of Lumber for January, February and March, 1910. U. S. Forest Service. Washington, D. C. 1910.

The Weeks Bill (text). Bulletin 3, American Forestry Association. Washington, D. C. 1910. Pp. 4.

Annual Report of the Director of Forestry of the Philippine Islands for 1908-09. Manila, P. I. 1909. Pp. 20.

Annual Report of the Minister of Lands and Forests of Quebec for 1908-09. Quebec, Que. 1909. Pp. 202.

Outline for Lectures on Forestry. Bulletin 5, Forest, Fish, and Game Commission, New York State. Albany, N. Y. 1910. Pp. 12.

Fourth Annual Report of the Commission of Forestry for Rhode Island. Providence, R. I. 1910. Pp. 29. Illustrated.

Twenty-second Annual Report of the Experimental Farms, Canada. Department of Agriculture, Ottawa, Canada. 1909. Pp. 432.

A Critical Revision of the Genus Eucalyptus: Vol. 1, Index; Vol. II, Part 1. By J. H. Maiden. Sydney, New South Wales. 1910. Pp. 12+59. Plates 4.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Black Forest Conditions.

At the meeting of the German Foresters Association in Heidelberg, Prof. Siefert described the conditions of this celebrated forest country in Baden. In the State at large, government forests occupy only 17%, corporation forests 47%, large private holdings comprise 11%, leaving 25% for small holdings. The corporation forests have been under State management since 1833, and have been subjected to a strictly conservative treatment, similar to the State forests. Site conditions are very favorable with a rainfall varying from 32 inches at the foot of the Black Forest up to 72 inches in the mountains.

As regards composition, mixed forest prevails, with conifers occupying 52%, broad leaved forest 48%. Five sections of country are topographically and climatically differentiated.

The mountain country of the Black Forest, with the Feldberg (5,000 feet) its highest point, is divided into a southern, middle and northern section. It reaches up not quite to timberline, but the highest altitudes are occupied by moors with birch and mountain ash. The soil is for more than half the area gneiss and granite, 29% sandstone, 18% limestone. Two thirds of the forest is coniferous, mostly spruce and fir; pine occupies only 9%, together with oak, in the deeper valleys on the south and west; the higher altitudes of these exposures, which exhibit rather rapid slopes, is occupied by beech and fir, while on the southeast and east slopes the spruce prevails.

Timber forest management is found on 88%, leaving 9% to coppice with standards and 2% to coppice. The timber forest is to the extent of three-quarters managed under natural regeneration, 16% in clear cutting, which prevails in the pure pine and spruce forest, 30% in nurse tree method, 40% under slow removal, but only 1.5% under pure selection system, which has only local significance.

The rotation in the State forests is for 60% of the area, 120 years, for 26%, 100 years, for 9%, 90, and for 3%, 80 years; in the corporation forests for 73%, 100 to 130 years; for 9%, 90; for 17%, 80 years. The tendency in the last 40 years has been to increase the rotations, and yet revenues have increased.

The actual age class conditions show a surplus of old age classes up to 170 years, which is justified by the fact that under the management they received these old stands show an increment of 85 to 112 cubic feet of wood of high value. The best of this wood brings 20 to 28 cents per cubic foot. Ordinary wood brings from 18 cents to 12 cents for the different classes from I to V.

In the Black Forest, a large portion of the area (58%) is managed in a slow removal system, a compromise between selection forest and nurse tree system, which makes it necessary to operate over 30 to 40% of the area simultaneously. The aim is to secure uneven-aged, mixed forest adapted to the locality, as far as possible by natural regeneration, and to utilize the increased increment due to open position during a long period of the rotation; thereby securing the highest sustained yield. A careful thinning practice with selective choice of trees to be cut is practiced. In the younger stands every 10 years about 700 cubic feet are taken out. From the 80th year the thinnings are made partly with reference to the needs of the young growth, partly with regard to volume and value increment. It is not always correct to remove the stoutest members, for suppressed poorly crowned trees do not utilize the light advantageously. Different degrees of opening up favor the reproduction of different species. Usually the best reproduction of one species is found under nurse trees of another species. In pure stands the success is less obvious. Damage from removals can to some extent be avoided by pruning before felling, and by careful immediate moving of logs, which costs 8% of the total logging cost. The reporter thinks that this system of slow regeneration is commendable as adapted to site, species, character of stands, and permits freedom of movement and eventual combination with other methods of regeneration.

In the Württemberg portion of the Black Forest, Prof. Graner reports that a similar method is practised, but the regeneration period is reduced to 20—25 years, and the spruce, advantageous on account of its wider usefulness, is favored by such reduction as against the fir. "Natural regeneration has become fashionable, but artificial regeneration has its right and often brings quicker and surer results."

The deficiencies in the age classes of 80-100 in Württemberg are explained by the fact that 100 years ago there was an effort made to regenerate only naturally. Since artificial means have again been adopted better success has followed.

Another speaker pointed out that the much better soil and more humid climate of the Baden forest favor this kind of natural regeneration with long periods.

Die Hauptversammlung des deutschen Forstvereins. Forstwissenschaftliches Centralblatt. February, 1910. Pp. 92-96.
Zeitschrift für Forst-u. Jagdwesen. December, 1909. Pp. 808-819.

Forest Conditions in Uruguay.

With considerable hnmor, Forstassessor Müller, who acts as professor of forestry at the Agricultural College at Montevideo, reports on the conditions of this republic on the La Plata. It is a hilly plains country without any forest growth except along the rivers, especially near the Brazilian frontier, and a few small colonies which are found in rocky coves (*grutas*). The tree forms in the southern river valleys are *Celtis tala and Celtis Sellowiana, Schinus dependens, Ocotea, Salix*. In the northern valleys, besides palms, some 20 good timber trees of Brazilian derivation are found with a host of shrubs, in a growth appearing like coppice with standards. These river forests are exploited, mainly for firewood, in the crudest manner.

In 1877, a law, similar to some of our tree planting laws, offered prizes for plantations; whoever could show a 4-year old plantation of 10,000 pines (*maritima, insignus, canariensis, halepensis*) spaced 12 feet, was to have a gold medal and $3,200 cash, $75 per acre! for 5,000 pines under the same conditions $750; for 2,500, $375. Again for 100,000 broadleaf trees of certain kinds, a medal and $11,000; for 50,000, $3,000; and for 25,000, $1,500. Besides a few of the smaller prizes, last year the highest was called for, there being three competitors, who all were wise enough to reduce the spacing to 6 feet. The plantings are mostly near the capital. The writer criticizes the law and the execution of it.

The main object of the attempts at planting seems to be to secure windbreaks for the protection of the sheep. Amusing references to the position of the writer, and the uselessness of his attempt to educate foresters finish the article.

Die forstlichen Verhältnisse Uruguays. Zeitschrift für Forst-u. Jagdwesen. January, 1910. Pp. 27-37.

Lumbering in Paraguay.

The forests of this country cover large areas; much of which has not been explored. Lumbering operations have usually extended back only as far as an ox-cart can haul, but in a few cases short railroads of one-half meter gauge have been established. The quebracho, cedro, lapacho, guayacan and ybiraro are the principal species in use at present. Most of the timber is hewed and large quantities are shipped to Buenos Aires and Montevideo for sawing. In a mill cutting 300 tons per day, which is equal to 250 cubic meters or 150,000 board feet, 6,000 oxen are used. Sixteen oxen are used for each truck or cart.

Hardwood Record, October 10, 1909. Pp. 27-28.

Timber Resources of Argentine.

The principal timber belts of Argentine Republic lie in the northern, northeastern and northwestern parts of the country in the valleys of the Parana, Paraguay, Pilcomayo, and Bermejo rivers. Most of the timberland is 500 to 4,000 feet above sea level. There is not a large amount of timber but it is of the finest kind. Large districts are entirely unexplored.

Most of the forest is a mixture of a large number of species. Quebracho, urendel, cedro, quina, cevil, mora and others are sound, while palo amarillo and palo blanco are rotten when overgrown. Wind-falls of quebracho, urendel, mora, guayacan and lapacho rot very slowly. Forest fires are almost unknown. Cedro is the only species that floats and hence all operations require railroads. Underbrush is heavy and vines common.

Exploitation is crude and simple. The main logging is done by oxen and a peculiar, local, two wheel cart. In many places the logs are loaded on cars by hand or by using oxen. Most of the laborers are Indians or of Spanish descent and the principal market is local. American sawmill machinery has been a failure in this region, but French, German and English machinery has succeeded because the makers understood the nature of the wood and local conditions. A list of common names of the most important commercial trees is appended, with brief, general descriptions of the wood.

American Lumberman. November 13, 1909. P. 47.

Philippine Conditions.

Mr. W. Klemme, chief of the administrative section, and next to Major Ahern longest in service in the Philippine Forestry Bureau, gives a concise and clear description of forest conditions in the Philippine islands.

The whole forest area of about 40 million acres, almost entirely government property, is divided into three districts each placed under an American as chief with an American assistant and a number of Filipino foresters, underforesters and guards.

Sale of wood, which is so far the principal operation, is made by license to cut over a limited section for a definite quantity in one or more years. Special limitation either in quantity or in lowest diameter is made with regard to certain rarer species, or. in certain regions by their entire exclusion from sale. Altogether a lowest diameter limit is determined for most species. The price paid is for actual wood cut, namely 3.3 cents per cubic foot for the woods of the first group; 2.5 cents for those of the second: and two-thirds of one cent for those of the third group.

The first group comprises fine furniture woods, mostly of the Leguminosae, and one of the Verbenaceae, Molave. Teak, although it occurs, is too rare to be of significance. The better class of building woods form the second group, Eugenias and a species of Shorea of the Dipterocarps belonging here. The third group, economically the most important, is formed by Dipterocarpaceae. A fourth group consisting of soft woods is also made up of Dipterocarps, and *Pinus insularis,* of which extensive tracts are found in the mountains of northern Luzon, at elevations of 600 to 1800 m.

This species, a hard yellow pine, attains an average diameter of 28 inch, up to 3 feet, and heights up to 120 feet. It is located so far too distant from markets.

The Spaniards who had a forestry bureau and had a similar grouping system recognized only 800 species as against 2,000 determined by American foresters and botanists.

The less valuable species were formerly by law permitted to be cut anywhere for home use, free of charge, but in order to allow better control, definite areas of 250 to 750 acres are now set aside as quasi-communal forests, where such cutting is allowed under supervision.

The free settlement of land, 40 acres to a settler, is also controlled by the forestry bureau.

The mapping of the forest districts of Luzon and Mindoro has been completed.

Reference to character of scenery, of travel, of population are made. The climate is said to be agreeable and healthy, tropical heat being rarely experienced. In Manila, the hottest place in the islands, the thermometer varies at noon of the hottest months (April, May) between 86° and 95°, to sink in the evening to 70°, and in the mountains of course, lower temperatures prevail.

Allgemeine Forst-u. Jagdzeitung. January, 1910. Pp. 1-4.

BOTANY AND ZOOLOGY.

Branchless Trees.

The Norway Spruce which is generally very liable to variation, develops occasionally without branches, forming a slender rod beset with long thick needles, without lateral buds.

These monstrosities called *monocaulis, monstrosa, aclada,* are very rarely, found in nurseries and sowings in a few localities in Baden and northern Italy. As a rule they die early; one, however, cultivated in a garden on Lago Maggiore has an age of approximately 55 years and is nearly 30 feet high. A specimen was found in Bavaria in an 8-year old regeneration, 1 *m* high like the rest of the growth, but only 1 *cm* in diameter at the base. It was transplanted to the forest garden at Ipsheim where in 1904, when Vogtherr figured and measured it, it had attained a height of 1.8 *m,* the last shoot being 10 inches long, six annual shoots being with foliage of normal appearance, each shoot recognizable by a short bare space.

There are also on record two specimens of branchless White Fir.

Eine astlose Fichte. Forstwissenschaftlisches Cantralblatt. January, 1910. Pp. 59-60.

Frost Splits, Ring Shake, Heart Shake.

Forstassessor Busse adds to the theory of the formation of various kinds of damage to timber by frost. Regarding frost splits —the radial splits starting from the periphery—two theories are current. Hartig explains that by frost a part of the imbibition water of the cell walls is lost, the wood shrinks, and, if the interior layers have not yet been cooled, tangential strains arise which finally result in tearing apart the exterior layers in radial direction. A newer theory leaves the water in the cell walls, and sees the cause of the splits in mere temperature conditions, the difference in cooling of inner and outer layers, when the temperature sinks below 14° F. The observations of the author lead him to doubt that the temperature needs to be so low for he has heard the short reports of frost splits at much higher temperatures. Most splits take place shortly before sunrise i. e. at the time of lowest air and soil temperature; they were never heard to take place at noon, afternoon or evening. This would make low temperature appear as the only and absolute factor. If this were true all trees, at least of species most liable, would show frost splits. Hence other factors must play a role, which the author has found in wind and site.

The influence of the wind is not due to its temperature as has often been asserted, for then frost splits would preferably be found on east, north east, and north exposures, which the author's careful investigations deny, but it is due to the mechanical force. A frost split always occurs between two roots or between the collars of two roots. This was observed on oaks, elms, basswood, cherry, also ash and beech, although the former has little pronounced root collar, and the latter is least liable to frost splits.

A few stems were found where apparently the rule did not apply, but on removing the soil a forking of two large roots was found corresponding to the split. When the tree is swayed by the wind, the roots are counteracting forces, the wood fibres are tested in tension and pressure by the opposing forces; where the roots exercise tension strains most effectively the effect of pressure strains are at a minimum; only where the pressure strains i. e. between two roots, are in excess of the tension can a separation of the fibers result. Hence, when by frost a tension on the entire periphery is established and the wind localizes additional strains the failure occurs.

The stronger tension and pressure, the severer the strains and the oftener failures occur; hence in old stout-rooted, broad-crowned trees frost splits are most frequent. In younger stands it is always the stoutest members of the stand that are found with frost splits, while in quite young stands they are altogether absent, because wind pressure is small. That frost splits are heard to form on windstill days the author explains by his conviction that these are openings of old frost splits where the tension of the frost alone suffices.

As to influence of site the author's observations show that on wet sites splits are most frequent, due to difference of wood structure here, just as difference in wood structure makes different species more or less liable. The better nourished a tree the less liable to frost splits. It is suggested that the reserve materials act protectively, and when they move towards the crown the most dangerous period for frost splits is entered.

The location of frost splits lies rarely above 1 *m* from the ground, mostly at $\frac{1}{2}m$. Near the ground the tree cools the most, here the frost tension is greatest, and probably also the wind pressure.

Ring shake is found similarly located but instead of being found between two roots or root collars, it is found on the collar or root, and always where a narrow and a wide ring join. In this case, too, the wind pressure is adduced for explanation, which exercises the greatest leverage or tension in the direction of the radius in this part of the tree.

Heart shake, which starts from the heart with the broadest opening towards the periphery, resembling inverted frost splits, the author believes to be due to a drying out of the heartwood, possibly accompanied by lack of minerals, but the wind also plays a role.

Frost-Ring-Kernrisse. Forstwissenschaftliches Centralblatt. February, 1910. Pp. 74-84.

Miocene Trees of the Rockies. Fossil remains of Miocene trees secured from the Florissant beds of Colorado are considered by Cockerell to be the only Miocene arborescent forms so far discovered in the Rocky Mountains. An interesting feature of this Florissant flora is its strong resemblance to the arborescent flora of the present day. Species of Pinus, Sequoia, Libocedrus, Ulmus, Liquidambar, Acer, Robinia, Quercus, Populus, etc., occur which are similar to modern forms of these genera. That the climate of the Miocene was both warmer and damper than that of the present day is testified by the presence of Ficus, Diospyros, Persea, Sapindus, Anona, Ailanthus, etc., in the Florissant beds.

Miocene Trees of the Rocky Mountains. The American Naturalist. January, 1910. Pp. 31-47.

Natural Reforestation in Vermont. The reforestation of sand plains in Vermont has been made the subject of a somewhat extended study by Howe. Forty-five permanent sample plots have been established and in addition the character of the vegetation secured by 100 list charts. The result has been to show in detail the succession of vegetation on cut over lands of White Pine and on abandoned fields in this location. On lands of the former class Pitch Pine forms usually the dominant tree of the second generation. With the removal of the Pitch Pine, White Pine gradually works in again except where fire runs over the land periodically. In the last case a dense undergrowth, largely *Pteris* and *Myrica*, excludes tree growth. On abandoned fields, as is the case in other parts of New England, White Pine is gradually regaining the dominance it once possessed by direct seeding and by supplanting White Birch and Pitch Pine.

The Reforestation of Sand Plains in Vermont. Botanical Gazette. February, 1910. Pp. 126-148.

SILVICULTURE, PROTECTION AND EXTENSION.

Conversion of Coppice.

Forstmeister Kirchgessner reports interesting data regarding conversion of coppice into timber forest which has gone on for some years in the city forest of Eberbach on the Neckar. The city owns over 3,000 acres of timber forest, besides 5,000 acres of coppice, on which some 850 of the citizens had rights of user. These rights were exercised by dividing the year's felling area into as many parcels on which the interested citizens could cut the coppice, peel the bark and grow their potatoes—Hackwaldbau!

By and by development of industries, railroad building, etc., made this work unprofitable; bark peeling became unprofitable, and no opposition was made to change the coppice to timber forest, the city paying to the citizens having the right of user a rent such as would accrue if the coppice had remained and been used by them, the calculation being made on the basis of the results of the remaining coppice.

Large areas of this coppice had under the former methods deteriorated into heath and grass (Calamagrostis) and useless brush. Here, fire was used as a means of culture. A thorough burning over in high summer when the ground is thoroughly dry, destroys the felty raw humus and destroys a large number of the old useless stocks. In the ashes of these burnings, pine and spruce are planted without further preparation, and thrive prodigiously. If the burning was not thorough, plats must be cleared for planting, otherwise the weeds would choke out the plantation. For planting, 6,000 pines, 1-2 year old, or 3,000 to 4,000 spruce, 3 year old, are used per acre, planted with spade or hatchet. It is important that the planting succeed from the start, as otherwise weeds, fern and broom, will choke it out. As it is, annual weeding (cutting) for two years becomes necessary, when sheep may be driven over the plantation without harm and keep it in order. On the north exposures, one or two coppice shoots are left and pruned up, the spruce tolerating the shade; not so on south exposures, where pine is planted which does not tolerate shade. Here the sprouts are cut during the sap at breast height when sprouts and stocks die.

This is the only applicable method on deteriorated soils. It produces in shortest time *par force* a good stand but is more expensive than the slower method through the use of the sprouts, which is applicable where the sprout growth is good. Here, at 15 years of age, the first thinning is made for hoop poles, when all that is below 3 inch at base is cut out, but at least the two stoutest sprouts must be left per stock. After two years, such a stand is closed up again. At 20 years, the second thinning takes place, and some of the stands may then be underplanted with fir, spruce, beech, oak, chestnut, maple, either by sowing or planting. Oak coppice is allowed to continue to the 30-50 year and longer, and then perhaps is underplanted with beech.

Finally, there are some few areas from which stones are quarried and in so doing the stocks are destroyed but the soil thoroughly loosened. Here spruce plantations thrive without effort.

Zur Niederwaldumwandlung. Forstwissenschaftliches Centralblatt. April, 1910. Pp. 211-214.

Clean Logging.

In view of the praise for intensive forestry practice which we are wont to see bestowed on German, French and Swiss forestry, it is interesting to note a short anonymous article which shows that matters are not everywhere as well developed as we know them to be in general.

The writer points out that in the Alpine forests of Switzerland the "brush problem" remains unsolved. Here, as with us, distant from markets and population that might utilize this inferior fuel wood, there is no way of disposing profitably of this material. While logging contracts provide that the felling area is to be cleared of debris and openings to be planted, not much is done in this direction.

Objections are raised not so much on account of the fire danger as on account of impeded reproduction.

Under the brushwood, volunteer growth is smothered or impeded, and any new regeneration is made difficult or loses the chance for development; weed growth helps to delay natural regeneration, and ultimately clear cutting and planting become necessities.

The hard, narrow-ringed wood of Alpine trees, especially of spruce decays very slowly, and sometimes, densely covering the ground, the debris makes seeding impossible for years. Fungi

(*Herpotrichia nigra*) and bark beetles thrive in this debris.

Burning the brush is considered too expensive and in addition claimed to be dangerous, hence it is recommended to merely pile the brush in heaps or wind rows (which we would think increases the fire danger). This should be done in summer fellings immediately; in winter fellings with the first melting of snow, while the brush is still green, when it packs better than when dry. Such green brush heaps are supposed to decay more readily than if piled dry.

Schlagräumung. Schweizerische Zeitschrift für Forstwesen. April, 1910. Pp. 112-116.

Storing Seeds.

Dr. Zederbauer of the Austrian Experiment Station reports trials with various methods of wintering seeds. The questions he tries to answer are: How are seeds kept by nature until they germinate, and what life processes take place in the resting seed, which questions are basic to a rational keeping of seed.

The life processes are transpiration and respiration. Respiration is a destructive metabolism; the result of this destruction of organic substance is carbonic acid and water. It is largely dependent on temperature. It increases with the temperature to an optimum, then declines. Transpiration is also dependent on temperature and, in addition, on the humidity of the air. Low temperature reduces both processes. This is an important point for the preservation of seed, and hence ice cellars as used by Haak (see F. Q., vol. VII, p. 328 ff.) are found to be most suitabe for storing seed.

In the experiments some ten different kinds of storage rooms were used. The seed was sowed and the germination noted.

Abies alba and *Pinus peuke,* which shed their seed in the fall, wintering on the ground covered partly by needles and leaves, are here exposed to low temperature and soil moisture, both of which conditions reduce transpiration. Storage conditions similar to these furnished the best results, while low humidity and temperatures above zero (C.) gave poor results. On the other hand *Picea excelsa, Pinus silvestris* and *Larix europaea,* which shed their seed in late winter or spring suffer on moist soil. Low temperature is favorable only in the absence of humidity. Room temperatures, however, did not diminish the germination of *P. silvestris.* Air tight storage of these species is favorable.

Of broadleaved trees only such as shed their seed in the fall were experimented with. They are very sensitive to low humidity. Only the thick-shelled ones like *Juglans nigra* last, but lose a large percentage of germination. On the whole, low temperature and high humidity of air or soil are favorable factors in seed storage.

Versuche über Aufbewahrung von Waldsämereien. Centralblatt f. d. g. Forstwesen. March, 1910. Pp. 116-121.

Seed Supply.

The importance of securing seeds from proper localities is more and more recognized. Lately the German Forstwirtschaftsrat has had the matter under discussion. Especially the Scotch pine seed from Southern France and Southern Hungary are objected to as producing undesirable growth. A commission was appointed to report on the question.

Silva, 1910, No. 13. P. 102.

Forest Fires in the West.

The quarterly meeting of the Oregon Conservation Association was held December ber 21, 1909, in Portland Oregon. A report was given of the co-operation with the U. S. Forest Service in regard to forest fires during 1909. In Oregon there was a total of 413 fires which burned over an area divided as follows: Merchantable timber, 33,137.5 acres; second growth, 5,607.5 acres; cutover lands, 22,292 acres. The estimated loss is given at 191,213.59 thousand board feet of merchantable timber with an estimated value of $366,539.50. An expenditure of $26,164.71 was made by individuals, lumber companies, etc., in fighting fires and maintaining patrols during the fire season. An additional $5,220.84 was expended by the U. S. Forest Service.

In Washington there was a total of 1,309 fires which burned over 27,027 acres of merchantable timber; 12,631 acres of second growth and 25,421 acres of cutover lands. The estimated loss of merchantable timber is reported at 146,809 thousand feet with a stumpage value of $290,489. The cost of figthing fires is $15,-

705.24 expended by the State; $34,308.52 spent by private owners and $11,710.80 spent by the U. S. Forest Service. The cost of the patrol maintained by Washington Forest Fire Association is computed as a part of the private expenditure.

American Lumberman. January 1, 1910. P. 46.

Machines for Soil Preparation.

The planned increase of fellings in Bavarian forests suggest an increased planting program and the necessity of reducing hand labor which is now-a-days difficult to secure and to substitute the use of machinery.

Weinkauff has constructed a deep-going plow with roller which lifts it over roots and stones, with which two horses in one day plow furrows 4 feet apart and 10 to 12 inches deep on 3 to 3½ acres. The saving in cost was 600 to 700 % over the former methods.

For cultivating, for preparing soil to a depth of 5 inches, and especially to aid natural regeneration, the spring harrow was found an ideal utensil, excelling the Danish rolling harrow and the Weber grubber in effectiveness, cheapness of work and original cost. The author calls it the soil machine of the future, that will work miracles in natural regeneration. It should be made heavier than for field use and is applicable wherever a horse can still step on the hillside.

The author advocates the use of better plant material and figures out a financial advantage from using transplants.

Neue Bodenbearbeitungsmethoden und Zukunftswerkzeuge. Fortwissenschaftliches Centralblatt. January, 1910. Pp. 46-48.

Douglas Fir in Switzerland.

In the mild climate of Canton Schwayz at about 2,000 feet elevation there is a pure stand of Douglas Fir (the green form), 26 years old from seed, planted 10 feet apart, about 1½ acres in extent.

The 500 trees remaining vary from 4 to 19 inches in diameter and 35 to 73 feet in height, the average tree is 9 inch, and 51 feet; the total volume of the stand is 4,462 cubic feet of growth, or 172 cubic feet per acre per year. The stand is very dense so that not only volunteer spruce and fir have succumbed, but even moss cannot thrive under the cover; the soil being covered with needles. The wide spacing has resulted in unimpeded branch growth, which has died for half the height, but not at all cleared, hanging on like that of the spruce or White Pine.

Resistance to early frost and snow pressure has been satisfactory. The shading quality of the crown combined with rapid growth fits this species to suppress all neighbors; hence it should be planted in small pure groups.

Zur Frage des Anbaues fremdländischer Holzarten. Schweizerische Zeitschrift für Forstwesen. April, 1910. Pp. 121-126.

Conifer Diseases.

Frömbling notes that fungus diseases have in later years considerably increased. The cause, he thinks, must be due to practices in the silvicultural treatment, which have weakened the power of resistance of the plants and increased the virulence of the parasites. The cause is found especially in the practice of using plant material imported from localities differing from those in which they are used, and to which the importations are not adapted. Hence, constitutional weakness induces more virulent and disastrous attacks of fungi, which in the native habitat were powerless. The importance of seed selection and the return to natural regeneration are accentuated.

Stehen gewisse Nadelholz Krankheiten im ursprünglichen Zusammenhange mit dem Ursprungsorte des Samens.
Forstwissenschaftliches Centralblatt. April, 1910. Pp. 193-200.

Trametes Pini.

A determined war against this destructive fungus which has greatly spread in the German pineries has been carried on for four years in Prussia as a consequence of Dr. Möller's investigations. Some $100,000 have been spent on marking the affected trees and breaking out the stools and painting with "insect lime" the infectious spots. One hundred million cubic feet of affected wood has been cut out. In an extensive article Dr. Möller discusses results and new observations.

Der Kampf gegen den Kiefernbaumschwanem. Zeitschrift für Forst-u. Jagdwesen. March, 1910. Pp. 129-146.

MENSURATION, FINANCE AND MANAGEMENT.

Growth of Oak.

Based upon an investigation of over 4,000 oaks in districts of Alsace-Loraine, interesting tables are published by Usener. To make diameters of 24 inches (60 *cm.*) there are required:

1. On deep, fresh, calcareous alluvial soil, on unusually favorable site, 75 years; on less favorable sites 85 years.
2. On less deep keuper (clay) soils of the hill country; 140 to 160 years.
3. On limestone, 150 years.
4. On standstone, 230 to 300 years.

The first three positions were in coppice with standards the last in timber forest.

The diameter growth was in one district found to be best on west slopes, then follow south slope plateau, east slope, north slope. These differences in the 160 year, e. g., were 46, 45, 42, 38, 36 *cm.*, the average being 40 *cm.*

A finance calculation for one of the sandstone districts developed that, in the decade 1892 to 1902 the average price increase per cent. was 3, for stemwood alone 3.2%, while first class material appreciated in six years at the rate of 4.8%. In another sandstone district the price increment was only 1.8%. The volume and value increment per cents. on the sandstone soils for narrow-ringed but even-grained wood ran as follows:

Age.	*Volume* (*a*)	*Increment Per cent.*	*Value* (*b*)	*a+b*
60	3		.7	3.7
70	2.7		.7	3.4
80	2.5		.7	3.2
90	2.4		.6	3
100	2.3		.6	2.9
110	2.1		.6	2.7
120	1.7		.6	2.3
130	1.3		.6	1.9
140	1		.5	1.5
150	.8		.5	1.3
160	.7		.4	1.1
170	.6		.4	1
180	.5		.3	.8
190	.4		.3	.7
200	.4		.3	.7

Adding the price increment at 3 per cent. a rotation of 170 years would appear permissible, when the average tree would show 18 inch diameter with a value of somewhat over $10, or 13.5 cents per cubic foot.

No calculations were made for the alluvial districts but the statement is made that single trees here bring $250 and more; one case as high as $450.

Zuwachsuntersuchungen an Eichen. Allgemeine Forst-u. Jagdzeitung. January, 1910. Pp. 4-9.

Growth of Scotch Pine.

Similar investigations as for oak were made in the same districts as cited above for Scotch Pine. Here, the three increment per cents., namely, of volume, value, and price were figured as follows:

Age.	*Volume.*	*Value. Increment*	*Price Per cent.*	*Total.*
90	1.4	.6	1.5	3.5
100	1.4	.7	1.5	3.6
110	1.4	.8	1.6	3.8
120	1.3	.9	1.7	3.9
130	1.3	.8	1.6	3.7
140	1.2	.6	1.5	3.3
150	1.	.3	1.4	2.7
160	.8	.1	1.3	2.2

Note the culmination at 120 years!

The prices used were the average of the actual sale results during the period of 1899 to 1905, which scaled from 8.5 cents for the poorest grade logs to 23.5 cents per cubic foot for the best grade. Cordwood split brought 6.5 cents, round billets 4.6 cents, and brushwood as much as 4.1 cents per cubic foot.

The value of trees of various ages figured:

Years:	90	100	120	130	140	170
Value of tree, dollars:	3.60	5.20	6.30	8.85	10.	15.
Value per cu. ft., cents:	10	12	12.5	14	15	16.5

An investigation of the progress of heartwood formation developed the fact that it proceeds somewhat parallel to the diameter development. In the 60 to 180 year old trees an age increase of two years means a progress of heartwood formation of one year at the butt.

Zuwachsuntersuchungen an Kiefern. Allgemeine Forst- u. Jagdzeitung. March, 1910. Pp. 85-87.

Wimmenauer Recording Calipers.

These calipers which record immediately the cross-section area corresponding to the measured diameter were used by Gayer on a valuation survey of some 8,000 acres. The use of the instrument was found easy and less fatiguing than regular calipers, avoiding the calling out of diameters. Only in wet weather the usual friction was experienced. Two men, one measuring, the other marking trees, measured per hour according to conditions, from 410 to 680 trees; the maximum in a 60 year dense pine stand being 760 trees per hour; the average of 68,360 trees was 495 per hour. With the usual calipers it was found that, to do the same, a third man for recording was necessary, the efficiency, therefore, was 1 : 1.5 in favor of the dearer instrument, which, costing $15 (to be had from W. Spoerhase-Giessen), saved its greater cost in 25 days.

To get the volume, since both number of trees and cross-section area are obtained directly, a single multiplication with the form-height derived from a table suffices, and is done in one-fifth to one-tenth the time of the ordinary calculations.

As regards accuracy, when compared with regular calipers, the errors were found in single cases to lie between +2.7 and —4 per cent., but the sum of results at only .01 per cent., differences which are explained by difference in points of measurement.

The author recommends the use of the instrument highly, but points out that where an insight into the distribution of diameter classes is desired, it is not applicable.

Einige Erfahrungen mit der Wimmenauer' schen Kreisflächenzählkluppe. Allgemeine Forst-u. Jagdzeitung. March, 1910. Pp. 80-90.

Financial Sustained Yield Management.

In an illuminating article Prof. Wagner explains the origin of the law enacted in Württemberg in 1905 which provides for a reserve fund in the State forests.

In the legislatures both of Bavaria and Württemberg lately objections were raised against the holding over of old stands which are financially overmature and have no value increment. In Württemberg this overplus in old age classes (partly 150-180 years) is on the average 5%, and in the Black Forest alone nearly 20%. It was, therefore, proposed to cut into this old stock, especially taking care of favorable market, but, instead of accounting the returns as current income, to place the results in a reserve fund from which to eke out incomes during poor years. This would also permit a decrease of cut in poor years and altogether offer the opportunity of freer movement and consideration of market conditions.

It was unanimously agreed by the representatives that it is desirable to change the dead wood capital into a live money capital. The author thinks that every forester must agree to the soundness of this general proposition. As a result of these discussions a plan for 10 years was inaugurated, under which extraordinary fellings of one-third (about 10,000,000 cubic feet) above the regular budget were to be permitted with freedom to consider market conditions in the rapidity of fellings, the returns to be placed in the reserve funds; at the end of the period, if still a surplus of old stock were to be found, new provisions should be made. The reserve fund was considered from the standpoint of general State finance rather than from that of sustained yield forest management.

In arguing the proposition the plan was compared with a similar in vogue for the State railroad administration, where, to even out the irregular financial results, a reserve fund is created. The author points out that the cases are different; that while in railroading continuously ups and downs occur, in the forest administration, a regular lawful rise of income is experienced—from one million in 1880 to over three and a half million dollars, the wood prices having in the last 50 years increased at an annual rate of 2 per cent.

When it came to the execution of the law, which, it was determined, should first take the surplus in the Black Forest, it appeared that great uncertainty existed as to the actual surplus, and provisory felling budgets were made. In two years, however, it was found that not only the total permitted excess for the decade, but some 2 million cubic feet more had been cut due to unforeseen forced fellings, and from the 10 million feet of excess fellings about 1 million dollars was in the reserve fund. A squabble then arose as to where the results of the 2 million excess cut should go, the forest administration claiming it for the reserve fund since it represented part of its stock capital, the legislature desiring to apply to the current budget, because of the financial stringency. A revision of the law has become necessary.

The author points out that the budgets for the II and III period are bound to fall short of the normal budget and that the reserve fund must be kept intact as capital for that emergency, a fund which is to equalize the uneven age class distribution. By such a fund the principle of the sustained yield is removed from the field of volume calculation to that of economic financial calculation. Only the interest on that fund should serve as a balance wheel to the financial management.

A discussion of the propriety of entering as parts of the current budget the results from fellings which occur in reducing the rotation, as is now usually done, leads to the request that such incomes be devoted to intensifying the management by road building etc.

Der Reservefonds der wûrttembergischen Staatsforsten. Forstwissenschaftliches Centralblatt. January, 1910. Pp. 29-36.

Working Plans of Olden Times.

Forstrat Keiper publishes a most interesting account of a forest regulation work or working plan from the year 1787 for the count of Saarbrücken, near the French boundary, a district noted even in those days for its coal mines; then well wooded, now one of the most densely populated regions.

In the early 18th century the iron industry flourished in these parts, supported by an apparently inexhaustible forest resource. One of these works was supplied with 5,000 cords of charcoal wood for about $200, while the coal miners secured their mine props free of charge.

By the middle of the century the insufficiency of wood supplies became apparent; here as elsewhere the possibility of a local timber famine appears, and attempts to introduce coal and to regulate the cutting of wood were the result.

The working plan for the Bexbacher Forest is laid down in a volume of 324 written pages, is accompanied by 11 maps, and contains a full description by compartments. Several extracts exhibit the quaint language of the time and the poor character of the woods. The questions were how long the existing wood supplies could furnish a pre-determined annual requirement, how large the increment in older and younger stands, when and to what amounts the regenerated forest areas could be expected to assist in satisfying these demands.

The necessities of the case led to the adoption of a 50 and 65 year rotation for timber forest, a 35 year rotation for coppice.

Altogether some 40,000 acres were involved, nearly 10,000 in coppice, only 7,000 being old timber, the balance under 40 years, and mostly under 30 years.

In the preface the author of the plan describes in detail the conditions economic and natural, and accentuates the need of forestry as we are doing to-day. "Much of the welfare of a country depends on good forestry, *per contra,* by poor forest management not only are the revenues of the prince depressed, but his subjects are placed in need." He complains of "old oak stands which do not show an eighth of the increment which they would give if regenerated"; of the "open spots that should be planted," and recites some of the sowing he has done, asserting that the fine oak-beech stands of former times "are not there by accident, but have originated by sowings."

"This I state to show that timber planting is not a business invented in modern times but that we derive the greatest benefit from the diligenc of our forefathers." Forest improvement is to be found mostly in sowing and planting, and this must not be left to nature alone, plowing is necessary in many young felling areas and corn may be sowed with the tree seed.

He discusses then the manner of felling. No general rule can be given how many trees to leave at first cutting. In some forests one-third, in others one-quarter is sufficient, in others only the smaller part should be cut. Later on, the number of overholders is stated for given positions. The time for a second felling can also not be laid down by rule. On good soils the young growth will stand the shade of the timber longer than on poor dry soil—a wise observation for the time. As a rule two or three years after the first felling the second should follow, and it is best to remove all timber at once in order to give rest to the young growth. Yet gradual fellings are not as disadvantageous as a long waiting for a full seeding. Other silvicultural questions are discussed at length in a quite modern spirit. Introducing the mathematical part of the plan, the author states: "I do not say, that he who does not know how to calculate a cube could not be a proper forester, but nobody who has to do with wood sales will deny that cubing is quite necessary in forest management." At that time prices were gauged by the span of the hand; an oak of 8 span brought 8 *fl.*, and the author takes pains to show that an oak of 16 span should not be sold at 16 *fl.* because it contained four times the volume of the other.

He determines the stand of the whole forest as 485,918 cords, and places the requirements for seven years with 387,456 cords. After the seven years the increment will be only 1857 cords, and he comes to the conclusion that it is necessary to force the use of coal.

Ein Nassau-Saarbrückisches Forsteinrichtungswerk aus dem Jahre 1787. Forstwissenschaftliches Centralblatt. January, February, 1910. Pp. 1-19; 65-73.

Waterproof Maps.

As a result of experiments with various preparations Kaup finds that for making maps waterproof, Dr. Fr. Schönfelder's (Düsseldorf) water-color-varnish answers best. The varnish is applied with a spraying bottle to the colored parts; to the uncolored, with a soft hair brush. After 2 or 3 hours drying the map is ready for use, and in every respect satisfactory.

To make additions it is only necessary to remove the varnish layer over the respective portions with alcohol, and to reapply the varnish afterwards.

Forstwissenschaftliches Centralblatt. January, 1910. P. 61.

UTILIZATION, MARKET AND TECHNOLOGY.

Odd Lengths.

For several months there has been a long and detailed consideration of the use of odd lengths which the American Lumberman states has brought out more discussion by lumbermen than any other subject has for years. The question is being favored by the National Lumber Manufacturer's Association, several Pacific Coast manufacturers, the American Lumberman, and the U. S. Forest Service while it is being strongly opposed by many retail dealers, especially in the middle west. It is proposed to standardize odd lengths in the grading rules for western species in drop siding, flooring, ceiling, finishing and bevel siding. The standard even lengths range from 6 to 20 feet and odd lengths are already accepted up to 10 feet long, i. e., 5, 7, and 9 feet. The additional lengths, then, would be 11, 13, 15, 17 and 19 feet.

The arguments advanced in favor of the proposition are:

1. Odd lengths would favor forest conservation, allowing the occasional cutting of odd-length logs in the woods and trimming to odd lengths in the mill where even length material is defective or where taper allows boards to be cut from slabs.

2. Increases output of sawmill at a very slight increased cost of milling with no extra cost in stumpage or logging.

3. It has been the custom of many Pacific Coast mills for the last 3 to 9 years to cut odd lengths. A census shows that 119 mills are now following the practice and that the retailers and consumers of this region do not object to the practice.

4. The use of odd lengths has been favored by many associations for years and has been adopted by the National Hardwood Association as shown on page 11 of their grading rules. The practice has been followed very largely in hardwood flooring, especially in basswood, birch and maple cut in Wisconsin. Odd lengths have been widely used and even demanded in New England where 5 foot clapboarding prevails. Cypress dealers quotes material 1 to 3 inches and wider from 12 to 22 inches long in official lists and find a ready sale for it.

5. Odd lengths will not affect more than 4% of the lumber supply since not more than 20% of all drop siding, flooring, ceiling, finishing and bevel siding ordered will be allowed in the odd lengths. Since not more than 20% of the present lumber is clear and only 20% of this amount can go into odd lengths it is estimated that these lengths never can be more than 4%.

In answer to each of the above arguments the following objections are raised:

1. Odd lengths will undoubtedly allow conservation in the woods and at the mill but for the most part it will be at an increased cost to the consumer since the carpenter will waste

more lumber in using odd lengths than he does at present in using even lengths. It is pointed out that odd lengths are obtainable in short pieces and that even lengths will allow the cutting of odd lengths wherever necessary; i. e., 12 foot material will cut into 5 and 7 foot boards or 16 foot material will be cut into 5 and 9 foot, but odd lengths cannot be cut into shorter even lengths or odd lengths, even if it should be desired by the carpenter. It is also held by the retailers that most of the trimming now performed in the mills is due to the desire to raise grades and make more money for the manufacturer than could be made by less strict trimming.

2. The saving to the manufacturer is apparent, but this saving will be more than offset by the increased cost to the retailer in handling and selling. Odd lengths will necessitate more complex book accounts, more bins and sorting stalls in the retail sheds and a larger stock for the same demand. This expense it is claimed will more than offset the saving to the manufacturer and will be at the expense of the retailer and consumer.

3. Odd lengths may be used under local conditions on the Pacific Coast but conditions in the middle west demand a larger per cent. of even lengths. Undoubtedly many odd lengths may be used and have been but a very large per cent. of them would be cut from even lengths in any case.

4. In answer to argument number 4 it is claimed that the Hardwood Association used odd lengths for interior material while the present proposal is for lumber that is largely used for structural purposes. It should be remembered that the hardwood material is end matched and that the hardwood floors are laid on underfloors of another material thus allowing the use of any length of hardwood without a weak joint. It is also claimed that the use of short and odd length cypress and short piece, odd length clapboards are not strong arguments in favor of the species and material which come from the Pacific Coast to the middle west.

5. All architectural plans are usually based on even lengths in the spacing of rafters, joists, etc., so that odd lengths would not be economical even for their respective spans. If it is economic for the kinds of material now under consideration it should be so for all other classes of lumber. More-

over the short pieces in odd lengths, as 5, 7, and 9 feet, are now sold to the retailer at a smaller price per board foot than the even lengths and although there is more profit in handling such material it sells slowly and is much more difficult to handle. In the new arrangement there would not be a decreased cost to the retailer in odd lengths as there is at present.

6. It is aimed to charge for odd lengths the same as though such lengths were one foot longer and belonged to the even foot classes. This is manifestly unfair.

Many tables and exhibits are shown by the various writers to prove their respective sides of the question. There can be little doubt that the use of odd lengths will increase but it does not seem adivisable to insist that a middle west dealer shall accept 20% in odd lengths unless there is a demand for such material and that practice shows the use to be economical.

American Lumberman. Sept., Oct., Nov., Dec., 1909 and Jan. 1910.

Use of Species In Ontario.

Large quantities of Longleaf Pine are being used for structural purposes as a substitute for White Pine and Norway pine while hemlock is coming into much more extensive use because cheaper than northern pine. The use of hardwoods for flooring is more extensive than formerly; oak, maple and birch being used principally. Underfloors are often of southern pine. Cypress is used to some extent for doors and sash in place of White Pine. Spruce from Nova Scotia is also used for floors.

Oak is preferred for high class furniture but owing to high prices and the necessity for importing from the United States greater dependence is being put on the large supplies of native birch. Ash and elm are used where early English style is used. Poplar is the principal wood for piano cases on which veneers of Mahogany, Black Walnut, Circassian Walnut, oak and other cabinet woods are used.

American Lumberman. Dec. 18, 1909. P. 29.

Handling Hardwood Logs at the Mill.

This problem has been rendered simpler by the use of cableways. In times past it was the custom to yard hardwood logs around the mill and haul them by horses when needed. Since recent operations require sawing well into winter it is necessary that the mill have a hot pond to thaw out the logs and wash out grit. The cableway system allows a rapid and cheap transfer of logs from cold pond to hot pond, from yard to hot pond or directly from cars to the log chain of the mill. Since hot ponds fill up rapidly with dirt and bark it has been necessary to shut down the mill, drain the pond and clean by hand once or twice a year. The cableway system allows cleaning of the pond without stopping the mill or draining the pond at a cost of one-fifth the old method. Logs can be decked in the yard to great heights by this system and so save yard space.

Hardwood Record. Oct. 25, 1909. Pp. 24-25.

Mahogany Supplies.

Mahogany, according to Dr. John Gifford, occurs in Florida south of Biscayne Bay and in the Everglades over a territory fully as large as the State of Delaware. The forest types in this region are pineland, hummock and mangrove swamp with the mahogany occurring on the hummucks as a climax forest. The hummock usually is of limestone origin and has a rich, reddish soil while calcareous sandstone which is common in this region is poor in quality and supports Carribean pine largely.

Mahogany is seldom shipped from Florida or the Bahamas because of local demand. No mahogany grows in Porto Rico and little in Jamaica. Cuba and Santo Domingo have most of the supplies, but Cuba's forests are already badly depleted and it is expected that most of the timber will be needed on the island. At present the Cubans are practically trading mahogany for our southern yellow pine. Santo Domingo is the least developed of the islands and contains the largest and best supplies of the species. Even here where the timber is plentiful it costs $30 per thousand to deliver mahogany at the ship's side. Trees can be bought at 25 cents to $1 per tree according to size and location.

The principal exports from Domingo are cedar, mahogany, lignum vitae, lancewood, fustic, greenheart and mora. Most of the timber is dragged by using bulls but the more intelligent operators use a two wheeled cart. Paths have to be cleared and wagon roads are too expensive for small projects.

"Where Mahogany Grows in Florida and the West Indies." Wood Craft. October, 1909. Pp. 19-22.

Forestry and Mining in Germany.

A report of Forstrat Eulefeld to an association of forest owners contains several data of interest on the relation of the mining industry to forest supplies. We learn that in the 70 years since 1837 the output of coal in Germany has increased from 20 million to 2740 million hundred weight, with a corresponding increase in wood consumption, and, in turn, making valuable small dimensions which formerly furnished only cheap fuelwood, and thereby making forestry more profitable in the mining districts.

Substitution of iron has not proved itself practicable, iron being too heavy to handle, too difficult to shape in the mine, and not elastic enough. Durability which formerly controlled the choice of wood for mine timbers does not any more play first role; light weight, cheapness and "Warnfähigkeit," i. e., the property of giving warning of collapse (result of elasticity?) rule the choice now in the extensive rapid operations, when the wood becomes useless before rotting.

Spruce props are the most satisfactory and in good air are as durable as pine, which latter are, however, superior in poor air, the former excels especially in warning quality, but is more expensive on account of competition with pulp wood users.

Oak, formerly almost exclusively used, is now discredited on account of expense, which led to the use of immature sapwood material.

Treated wood is objected to because as stated durability is of secondary importance and the creosote makes it objectionable to handle. Ventilation is the best means to delay decay.

In some of the mines of the Saar district the consumption is about 1.5 cubic feet per ton of coal, which leads to an estimate of a total consumption in Germany of 250 million cubic feet. This wood consumption represents about 12% of the total cost of producing 1 ton of coal. About 80 per cent. of the mine timbers have a middle diameter of less than 7 inches. The extent of the mine timber market was such as to specialize the trade, and in 1904 a trust was formed by 65 of the most extensive dealers, but later, defections and the independent purchases by the mining companies, and Russian importations have kept prices below excess. Large quantities come from the Eastern provinces by rail under reduced freight rates, allowed until 1911 for the timber killed by the "nun."

The Russian trade began in 1906 after the war, and in 1908 amounted to over 10 million cubic feet, the wood being floated to St. Petersburg or Riga and transported by vessel up the Rhine. Apparently a calculation leads to the conclusion that this wood from Russia, two-thirds to three-quarters pine, cannot be laid down at the mine for less than 15 cents per cubic foot, to which the handler should add another cent for profit. Yet, the actual sale price remains below 13 cents, differences in the measure at the mine and in the woods explaining the discrepancy.

The home grown wood costs the handler about 7 cents to deliver and, to make a living, he can not afford to pay more than 5 cents to the forest owner, and make one cent profit, while the author calculates that it costs in the average 4.7 cents to produce a cubic foot at 3% profit.

Some reflections on the possibilities of cheapening the production of wood by return to natural regeneration conclude the interesting article.

Eine Reise ins Grubengebiet Westdeutschlands. Allgemeine Forst- u. Jagdzeitung. January, 1910. Pp. 9-16.

Mangrove as Tan Material.

An article in a journal at Paramaribo brings an interesting reference to the trade which has sprung up with Mangrove bark and extract for tanning. On Dutch Borneo at Pontianak, the Tannadine Company, established in 1903, produces 250 tons extract; the Simpang Co. (1907) 50 tons monthly. On Sumatra, a German firm, in English Borneo three firms are engaged in the same trade. The value of the extract is only about $60 per ton. The extract which is sold in 100 pound packages goes under various names, tannadine, tannoid, saractan, etc., and is specially shipped to England, where it is used for the cheaper grades of sole leather.

Four to five tons of bark makes one ton of extract, the bark containing 25.6% tannin. The bark, if carefully removed, renews itself like that of cork oak.

Allgemeine Forst-u. Jagdzeitung. January, 1910. P. 40.

Wood Quality and Locality.

In a series of investigations by Rudeloff into the technical qualities of wood from different localities spruce from Eastern Prussia, and from the Harz mountains was tested. The conclusion is that what differences there were found could not be assigned to the influence of site conditions, but were due to accidental differences of growth. Certainly the wood from the northeastern locality was found in no way inferior.

Untersuchungen über die Qualität von Fichtenholz aus dem Harz und aus Ostpreussen. Zeitschrift fur Forst-u. Jagdwesen. January, 1910. Pp. 43-48.

Price of Railroad Ties.

Oak ties in the mountains of Kentucky and West Virginia realize 63 cents f. o. b. cars. In northern Indiana, southern Michigan, and Ohio white oak ties bring 8 to 12 cents more, and red oak ties 10 to 15 cents less. This while the market is not brisk. The 63 cents represent about 12½ cents per cubic foot of log material.

American Lumberman. 1910, February 19.

Railroad Ties from the Orient.

The Atchison, Topeka and Santa Fe Railroad is importing railroad ties from Hawaii and Japan under a contract which calls for the delivery of 900,000 ties by January 1, 1910. The ties from Japan are locally known as Japanese white oak and are cut in the northern part of that country while the ties from Hawaii are known as red oak. The railroad officials object to giving exact figures of cost but this has been estimated at 80 cents per tie, which includes unequal cost, freight charges and duty. The present duty of Japanese cross ties is 10 per cent. ad valorem and amounts to 7 cents per tie. This would make the purchase price equal to 35 cents per tie. These ties are to be used as replacements for redwood which is said to be ideal where dry conditions prevail but rots rapidly where there is moderate moisture.

American Lumberman. Nov. 27, 1909. P. 41.

Building Logging Railroads. In the early part of 1906 the American Lumberman compiled statistics which showed there were 1460 logging railroads in the United States with an average length of 20 miles each, or a total of 30,000 miles. The cost was estimated to be somewhere between $5,000 and $10,000 per mile. Where logging roads are constructed through areas which have little or no agricultural value the tendency has been to build them as cheaply as possible. This expense is relatively high since the cost of surveying, grading, bridges, ties has been an entire loss while there is a large loss in remaining equipment. Experience has shown, however, that the logging road should be given more consideration than it has, and that the lumbermen, so far as possible, should try to build these roads so that they will have a permanent value in carrying commodities other than logs. The initial investment will be higher but outside capital will be more easily obtained.

American Lumberman. Nov. 13, 1909. P. 28.

Russian Lumber Exports. Russia's principal export centers are Riga, Windau, Libau, Pernau and Reval. Riga is said to export about one-fifth the total amount and this city is well located for such trade because nine-tenths of the timber received is rafted from the western branch of the Duna. Other centers are compelled to obtain most of their supplies by rail. Water transportation also favors the local timber workers since they can purchase raw material in small amounts. However, Baltic ports are developing rapidly because of better facilities for storing and handling lumber than those of northern Russia. More than half of the lumber exported from the Baltic district goes to Great Britain while Germany. Belgium and Holland also receive supplies in the order named. The principal uses for the export timber are building material, mine lumbers, pulp, coopers staves and oak wood for ceiling. Round spruce logs are exported in large quantities.

American Lumberman. Nov. 27, 1909. P. 41.

Chicago as a Distributing Center. During the past year Chicago has received 2,584,512,000 board feet of lumber which is the record year in the history of this great market. This is an increase of 2.6% over the amount handled in 1908. Approximately 15% of the total receipts came by water while none was distributed by this means. A yearly table is given of the receipts and shipments since 1850 with a monthly table of the amounts of schingles and of lumber handled by water and the principal railroads since 1900.

American Lumberman. Jan. 8, 1910. P. 30-31.

Metal Railroad Ties. It is curious that the metal railroad tie has not been able to find favor in the United States. In Germany in the year 1907 the production of metal ties was 494,000 tons at a value of nearly $15 million, two-thirds of which were used at home. The Mexican railways use a metal tie of 110 lbs. weight. Ninety per cent. of the ties used there have been in the roadbed for 24 years, the dryness of the climate accounting for the long life.

Italy has lately undertaken some trials with 400,000 railroad ties of reinforced concrete. Trials in Hungary with this type of tie do not seem to have been promising and a return to wooden ties has been the result.

Silva, 1910. No. 1, p. 4; No. 4, p. 29.

STATISTICS AND HISTORY.

Swiss Forestry. From the report for 1909 of the federal Department of the Interior, which exercises supervisory powers over public forest administrations, the following data may be of interest.

There are 195 higher grade foresters employed, who require a scientific education. The federal government contributed $52,000 to the salaries of cantonal and municipal forest officers of higher degree (about 25% of the total salaries) and $31,000 (about 15%) to the salaries of underforesters, some 1091.

Some dozen forestry courses of two to eight weeks duration each, and of varying degrees were given in as many places. The total area of forest in Switzerland is reported as 2,220,000 acres, none of which is owned by the federal government. The cut in the public (cantonal and municipal) forests (which represent 71.5%) was 66,682,000 cubic feet, or hardly 43 cubic feet per acre. Some 75,000 were placed under new or revised working plans. Over 700 acres nurseries are in existence. Over 22 million plants were set out. Some $82,000 were spent on roads and wire rope ways, to which the federal government contributed 20 per cent. New forest road projects to the amount of $130,000 were sanctioned, with a similar subvention.

Some $115,000 were spent for reboisement work, to which the federal treasury contributed two thirds, and projects to the amount of $200,000 with a similar subvention were sanctioned. The government pays also a subvention of $1,000 to the Foresters Association, and $200 to the Underforesters' Association.

Silva, 1910. No. 1. P. 4; p. 29.

History of Forest Finance.

Some of our modern foresters are inclined to think that forest finance is a child of modern birth. This could be said perhaps of the methods, but hardly of the operation as is shown by Prof. Hausrath, who relates the details of two finance calculations made in the Palatinate, the one in 1767, the other in 1801.

The first dealt with over 5,000 acres under polewood management in 20 to 50 year rotation, and attempts to determine the forest rent value. To be sure, not only administration and cultural expense, but the value of the stock on hand and its variations from the normal age class conditions were neglected in the calculation.

The interest rate chosen was 5%, but one critic recommended only 4%, and the government counselor proposed to reduce the rent by one-third, to make the calculation safe; the difficulty of choosing a forestal interest rate being even then fully realized.

The 5,500 acres figured a capital value varying from $16 to $32 per acre, making the rent at 5% vary between 80 cents and $1.60.

In the other calculation, the mature and nearly mature stands which could soon (in 5 to 20 years) be utilized wherever natural regeneration appeared possible, were figured together with the soil as capital represented in their sale value, or as the capitalized value of the average increment at felling age. Capitalization here was calculated with 4%.

The following results may be interesting to note.

Management.	*Rotation.*	*Rent Value.*	*Total Value.*
Beech forest	80	42.60	92.40
Beech forest	90	23.80	59.80
Pine forest	50	39.40	50.90
Coppice with standards	35	28.30	47.70
Oak coppice	20	15.60	15.60

Perhaps the first attempt to calculate a stand cost value was made in 1801 in connection with an exchange transaction, when a 12-year old pine forest was valued by allowing 10 lbs. of seed to the acre, charging the harrowing and adding 4 per cent. simple interest for 12 years.

Zur Geschichte der Waldwertrechnung. Allgemeine Forst-u. Jadgzeitung. March, 1910. Pp. 77-79.

POLITICS AND LEGISLATION.

MISCELLANEOUS.

England's Forest Schools.

Besides the University of Oxford, to which the Indian School of Cooper's Hill was transferred in 1905, not less than nine other institutions provide systematic courses. In addition, two Crown Forests are being worked as demonstration areas. This increase in facilities is mainly due to the report of a committee of the Board of Agriculture and Fisheries in 1902 urging provision for systematized instruction in forestry. For a small country, in which the practice of forestry is in its infancy, and almost entirely confined to estate management, this number of educational institutions is astonishing.

Forestry Education in Great Britain. The Journal of the Board of Agriculture. March, 1910. Pp. 969-981.

The mere sale of hunting permits in Prussia netted in 1908-9 over $600,000.

OTHER PERIODICAL LITERATURE.

American Forestry, 1910,—

Forest Problems in the Philippines. Pp. 75-81; 149-154.

An account of the forest conditions and forest problems of these islands, and the work being done by the Bureau of Forestry.

Forestry Beginnings in Vermont. Pp. 82-87.

A discussion of the policy being developed along the lines of fire prevention and educational propaganda.

A New Cypress for Arizona. Pp. 88-90.

A description of *Cupressus glabra,* Sudw.

Grazing Leases in Australasia. Pp. 101-103.

Gives principal features of grazing systems at present in force.

The Effect of the Forest Upon Waters. Pp. 156-173.

An importnat contribution to this much discussed subject.

Checking Floods in the French Alps. Pp. 199-206.

An account of the engineering methods.

The influence of Forests on Climate and Floods. Pp. 209-240.

Critical discussions of Prof. W. L. Moore's report.

Forest Leaves, XII,—

Through What Agencies can the Restoration and Conservation of Our Forests be Secured. Pp. 107-110; 121-124.

Common Insects Destructive to Forest Trees. Pp. 116-119.

Canadian Forestry Journal, VI,—

Meeting of the Commission of Conservation. Pp. 18-27.
Irrigation and Irrigation Development in Canada. Pp. 32-35.

The Indian Forester, 1910,—

The Jequié Manicoba Rubber Tree of Brazil. Pp. 1-9.

The Timbers of Commerce—Present and Possible Future Source of Supply. Pp. 9-25.
A very interesting resumé, by species.

Scottish Afforestation. Pp. 25-34.
Discusses the English afforestation scheme from Scotland's standpoint.

New Fibres for Paper. Pp. 34-46; 102.
A general discussion relating mainly to bamboo and various grasses.

Quarterly Journal of Forestry, 1910,—

Coppice-with-Standards in the North of France. Pp. 93-105.
An account of the management of the forests of St. Amand (8,190 acres) and Raismes (3,500 acres).

Notes on North American Forestry. Pp. 113-119.
Impressions of a brief trip to Canada and the Southern Appalachians, U. S.

The Pulp and Paper Magazine of Canada, 1910,—

Prohibition of Maritime Pulpwood Export. Pp. 83-84; 89.
Recent government news from Nova Scotia, New Brunswick and Quebec.

The Production of Acetates from Esparto and Soda Wood Pulp Liquors. Pp. 86-87.

The Journal of the Board of Agriculture, XVI,—

Distribution of the Larch Sawfly in Great Britain. Pp. 981-991.

Forestry Law in Switzerland. Pp. 1019-1020.

Gives some of the provisions of the Forestry Law of the Canton of Vaud, as an example of the working of the Swiss Federal Law of 1902.

Quarterly Bulletin of the Canadian Mining Institute, No. 9, 1910,—

Protection of Mine Timbers from Fungus. Pp. 25-27.
Advocates the use of common salt.

The Minnesota Forester, III,—

How Italy Does It. Pp. 31.

How Switzerland Does It. Pp. 31-3.
This and the preceding, statistical.

Forestry in Minnesota. Pp. 39-44.
Statistics and policy.

The Philippine Journal of Science: Botany, IV,—

Index to Philippine Botanical Literature. Pp. 677-685.
The fifth of this valuable series.

Studies in the Vegetation of the Philippines: I. The Composition and Volume of the Dipterocarp Forests. Pp. 699-723.

The Ohio Naturalist, X,—

The Bacterial Flora as a Factor in the Unproductiveness of Soils. Pp. 137-145.

The Botanical Gazette, XLIX,—

On the Origin of the Broad Ray in Quercus. Pp. 161-167.
By the compounding of uniseriate rays.

Canada Lumberman, 1910,—

The Forester's Value to the Lumberman. March 15, p. 22; April 1, p. 24; April 15, p. 22.

Queen's Quarterly, XVII,—

The Fixation of Atmospheric Nitrogen and the Food Supply. Pp. 297-304.

NEWS AND NOTES.

The International Committee for the publication of the Bibliography of Forestry, Professor Dr. Buhler, of Tübingen, President, under the auspices of the International Association of Forest Experiment Stations, has arranged with the Swiss Federal Council for the preparation of the manuscripts and the editing of the work at the expense of the Swiss government. Thereby the principal difficulty of the work is overcome.

There are two publications contemplated, namely, a separate catalogue in book from for all publications prior to 1911, running back to 1750; and a current catalogue for all publications subsequent to 1911 on cards by authors and subjects. The title of each paper, journal reference etc. are to be published in the original language, but for articles published in other than English, French or German a translation into one of these three languages is to be furnished.

Subscribers will receive the cards quarterly or oftener. Besides regular subscription to the whole work, yearly subscriptions to single chapters, e. g. silviculture may be had; also the cards referring to any small heading of the classification can be ordered.

The price for the annual subscription will be about $10 for white cards, $8 for brown paper, double for both author and subject classification, assuming that about 3,000 cards are to be issued annually. If less are issued, a corresponding reduction, if more, an increase is provided.

In order to set the work in motion a sufficient number of subscribers must be secured.

An appeal is made to all foresters, libraries, etc. to declare willingness to subscribe.

For the volume, which is estimated to contain 60,000 references and which will cost in the neighborhood of $6,000, in order to keep the sale price within reasonable limits, an appeal for contributions to cover the expected deficit is made to Forestry Associations and other interested circles. It is expected that the preparation of this volume will take five years and hence the contributions, it is suggested, may be distributed over that period.

The interest of our American foresters to help this good work on is strongly urged.

During the coming fiscal year the Secretary of Agriculture is to approve the maximum cut in M. ft. B. M. on each National Forest. This maximum can not be exceeded without special authority and will insure the conservative use of natural resources. Each of the six Districts in the West are in addition engaged in estimating the amount of growing stock now on the ground. While so far only tentative figures are available, yet gradually it is hoped to estimate and map all watersheds and their stock of merchantable Government timber in the West. At the present actual reconnaissance estimating is furthest advanced in District 3, which includes Arizona, New Mexico, Oklahoma, Arkansas, and Florida. On June 1 the merchantable saw-timber on the following Forests will have been estimated: Coconino, one-half of the Sitgreaves, one-sixth of the Apache-Prescott Division of the Prescott; Gallinas Division of the Lincoln, one-third of the Pecos, Manzano, Arkansas, and Choctawhatchee. Reconnaissance was commenced in District 3 during the field season of 1908, and it is expected by the end of the field season of 1912 the sawtimber in the entire District will have been estimated.

During March 1 to 3, there was held at the State Capitol in Harrisburg the third annual convention of Pennsylvania Foresters. The attendance consisted of the State Commissioners of Forestry, the members of State Foresters' Service, representatives of Pennsylvania State College and of the Pennsylvania Railroad, and the interested public. The convention opened with an address by Governor Edwin S. Stuart, who expressed his belief in forestry as an essential feature of good State policy. Papers read by those in charge of the State forests formed the bulk of the proceedings. The discussions aroused by these were of interest and profit.

Ten Pennsylvania State College students of forestry spent the Easter vacation between March 23 and April 6 in the forest plantations of the Pennsylvania Railroad at Conewago and Kinzer, Pa., engaged in pruning the locust trees, which form the overstory in the stands at those places, and in planting red-oak and Scotch-pine seedlings where ground fires had killed these species in the understory. Thirty thousand trees were pruned by the students, working a total of 800 hours at a cost of $120. Eighteen thousand of them had been originally planted 6′ x 6′ in 1905, while

12,000 were set out 10' x 10' in 1904. They now average 1150 and 420 trees per acre, respectively. The former cost to prune $3 per acre, the latter $2, in round figures.

The University of Montana, besides its regular forestry courses, which "are designed to furnish ample instruction in the more fundamental subjects of an education in forestry," provides courses of three months duration for rangers of the Forest Service. The program includes: Dendrology, 2 hours; Silviculture, 2 hours; Surveying and Drafting, 4 hours; Geology, 1 hour; Lumbering, 1 hour; Measurements, 2 hours; Timber Sales and Plantings, 1 hour; Grazing, 1 hour. In addition the District Engineer of the Service is to deliver lectures on the engineering work most frequently required in the administration of forest lands, trails, roads, bridges, telephone lines, etc.

Correspondence Courses for home study in Agriculture, Horticulture, Poultry Culture, Domestic Science and Nature Study are now provided by the South Dakota State College at Brookings, with a view of bringing scientific and practical instruction within the reach of those who cannot attend college, yet are ambitious to gain instruction helpful in their work and life.

Four systematic courses are offered in Horticulture covering the subjects: 1. Vegetable Gardening. 2. Fruit culture. 3. Floriculture. 4. Forestry.

Dr. Schenck's Forest School has spent the first winter season in Germany with Darmstadt as headquarters, making excursions to various parts of southwest Germany. The school returned to the United States on April 9, and it is now located near the former Cornell tract in the Adirondacks.

Mr. Austin Cary has resigned his position as superintendent of State forests under the Forest, Fish and Game Commission of New York, partly on account of ill-health, and Mr. Clifford R. Pettis, F. E., Cornell, 1902, has succeeded to the position.

Mr. G. Morris Homans, who had been Assistant District Forester in charge of Silviculture at the San Francisco office of the U. S. Forest Service, has succeeded Mr. G. B. Lull as State Forester of California. Mr. C. H. Sellers, who was one of Mr. G. B. Lull's assistants while the latter was State Forester of California, has followed him into the service of the North American Hardwood Timber Company, and has charge of its eucalypt nursery at Fruit Ridge, near Sacramento.

Mr. G. W. Peavy, formerly of the U. S. Forest Service, has accepted the chair of forestry in the Oregon Agricultural College. Mr. Peavy is a graduate of the University of Michigan and has been prominently identified with forest planting since he became a member of the Forest Service.

Development in the forest work of New Jersey seems to be evidenced by the advertisement of an examination for the position of Assistant State Forester. Candidates must be professional foresters, with good practical experience; but only $1,000 salary is offered.

In order to succeed in doing on a small scale what lack of men as well as money makes impossible throughout the public forests in the Philippine Islands, the Bureau of Forestry there has undertaken intensive study and careful administration on a tract in Northern Negros and another in Bataan. The operations on these tracts are expected to furnish practical experience in the woods for student-rangers, volume and growth tables, and the silvical data essential to a proper administration of Philippine forests.

On April 24th a prairie fire burned nearly 200 acres of the forest plantation area in the Government planting near Halsey, Nebr. The plantations are everywhere protected by double fire guards approximately 2 rods broad and at least 100 to 300 feet apart. These fire guards are harrowed each season, yet the use of these fire guards and backfiring did not prevent loss. A subsequent fire which occurred during a wind of 30 to 40 miles per hour destroyed the planting at North Platte, Nebr., where the Forest Service and the Nebraska Experiment Station are coöperating. The results of these fires show that adequate fire protection is essential for successful forest growth in the sandhills of Nebraska, and that securing such protection will be difficult and costly. New methods of fire protection are essential and will be tried this season.

The Canadian Provinces this year have been active in amending their timberland administrations. It cannot be said that this was done so much with a view of a conservative treatment as to secure a greater revenue and for other fiscal reasons.

The government of Quebec has copied Ontario's policy of requiring all wood cut on limits, pulpwood included, to be manufactured in Canada; the annual ground rent is made $5, which is not to be increased until Sept. 1, 1910, except for those who do not operate their limits, foreshadowing a possible increase; the transfer bonus is $4 per square mile, the mischievous right not only to transfer but to mortgage the license being recognized by remission of such transfer fee; diameter limits of 13 inch for pine and other trees of 8 inch at 2 feet from ground.

The Nova Scotia government has taken power from the legislature to prohibit export of pulpwood or other crown lands timber, if deemed expedient; also a provision for the establishment of forest reserves and the appointment of a Provincial Land Surveyor to reorganize the survey system which is badly needed. The forest survey begun last year is to be finished this summer.

In New Brunswick the question of preventing export of pulpwood from Crown lands was the subject of a resolution in the legislature which had in view to permit the government to act if it saw fit.

A very important change has taken place in Ontario. The stumpage dues for the old licenses have been increased to $1.50 while those paying $2 now remain unaffected; the ground rents have been changed all round from $3 to $5. At the same time, the government has pledged itself not to increase the dues and ground rent for a period of ten years. Tranfer dues of leases have been increased from $1 to $5 a mile; the dues on square timber from $20 to $50 per M cubic feet.

There is no doubt these changes are justifiable, indeed, greater increases might have been made for a 10-year campaign. The feature of the new regulations, however, which is regrettable is the abandonment of the coöperative fire protection system. Henceforth the limit holders are to range their limits without the government's assistance and pay, even for the inspection service. This is shirking public duty, and since the limit holder can be interested only in the standing merchantable timber, no incentive to protect the slashed areas of young growth existing, the future is left without protection.

The British Columbia Commission instituted to investigate the timber and forestry questions presented an interim report in January, recommending that licenses be renewable from year to year as long as merchantable timber remains on the property, instead of the 21 year limit; but the removal of timber within a fixed time on lands fit for farming.

The most successful forestry convention under the auspices of the Canadian Forestry Association was held in Fredericton, N. B., on Feb. 23 and 24. The presence of a large number of lumbermen and the practical tone of the papers presented were the noteworthy features. Two ilustrated lectures, one by Mr. A. Knechtel, Inspector of Forest Reserves, the other by Mr. James Lawler, Secretary of the Association, were attended by overflowing audiences. The various resolutions calling for an increase of responsibility and of means of protection against forest fires were subsequently ratified by the annual meeting of the Association in Ottawa.

Ontario's total revenue from woods and forests during the ten months ending October 31st, 1909, was $885,892.44 made up as follows: bonus, $285,571.41; Timber Dues, $529,422.50; Ground Rent, $68,528.53; Transfer Fees, $2,370.00. The revenue from timber dues is for ten months only, and, as many of the accounts did not fall due until December 1st, are small as compared with some other years.

The Board of Agriculture and Fisheries of London, England, has been engaged in investigating the extent to which the larch trees of Great Britain have been attacked by Erichson's larch sawfly, which was discerned in Cumberland four years ago. Its attacks cover a large area in northwest England, part of Wales and the southern half of Scotland. As great damage has been done in continental Europe and in America by this pest, the Board has, under the Destructive Insects and Pests Act of 1908, made it compulsory for all occupiers of woods in which the sawfly exists to report its presence to the Board, but owing to ignorance on the part of many owners and occupiers of plantations as to the appearance of the insect, and of the damage it causes, very few reports have been received. The Board, therefore, is issuing a memorandum on the subject, describing the insect and the appearance of infected larch shoots, and explaining in what way reports should be submitted.

The New South Wales Government with the intention of conserving the existing forest reserves and providing for their regeneration and treatment in the interests of natural reafforestation, has passed a Forestry Bill creating a department and extending the principle of issuing licenses. The Government is empowered to grant exclusive rights to work large areas. All sawmills must be licensed, and power is given for the proclamation of comprehensive regulations embracing all phases of forest management. The Government forest reserves in the coastal and central districts make an aggregate of upwards of 7,000,000 acres containing large supplies of magnificent hardwoods and ornamental soft timber.

From a report of the New Zealand Department of Lands it appears that out of a total area of 66,568,876 acres in New Zealand, about 17,074,000 acres are still covered with forest; in 1886 the forest area was estimated at 21,197,000 acres. It is estimated that there is growing within the Crown and State forests, and on private and native freehold lands, a gross total of about 33,000,000,000 sup. ft. of timber that is, or may eventually prove, suitable for commercial requirements. The output of sawn timber for the year 1908 amounted to 413,868,919 sup. ft. and will probably advance to an average of from 450,000,000 to 500,000,000 sup. ft. for the next fifty years.

The stock of trees in the State nurseries and plantations amounted on March 31, 1909, to 47,835,217, of which 6,231,479 had been planted during the previous year. Although a very large proportion of the trees planted out in the various areas will not reach maturity owing to repeated thinning, yet it is expected that a sufficient number will attain full size to produce an appreciable quantity of milling timber in 50 to 60 years from the present time, and that each successive year will produce a further supply to assist in meeting the current demand.

In the Mississaga forest reserve, Ontario, the timber damaged by fires in 1909 is put down as seventy-five million feet. The fire which injured the reserve came up from licensed lands to the south, and it was found impossible to ascertain the cause of the fire or fix the responsibility for it. Small quantities of red and white pine, both crown and private property, on the Temagami reserve were also damaged.

During the coming season the Forestry Branch of the Department of the Interior, Canada, will have six survey parties in the field, each to consist of a forester-in-charge, three assistant foresters and a cook. Of these parties two will be in the railway belt in British Columbia, two on the eastern slope of the Rockies, and two on the route on the Hudson Bay Railway. The work of tree distribution from the Forest Nursery at Indian Head will be continued as in former years. The number of fire rangers will be considerably increased.

A new timber preservative called cresol-calcium has been invented by two Swedish railway engineers. It is claimed to be cheaper than any other preservative and less inflammable.

The Forest Service continues its useful news service. Among the subjects treated we note a history of the naval store industry ending up with reference to the Herty system, under which now one-seventh of the entire output of naval stores is secured; a search for pencil wood, the supplies of red cedar which so far has furnished the 325,000,000 pencils annually is giving out; forest fire statistics for 1908 in the National Forests, amounting to a loss of only $300,000 worth of timber, although the year was drouthy and disastrous fires were the rule elsewhere, the cost of fire fighting besides salaries being $73,283; reference to the more liberal treatment of squatters in National Forests; the development of San Pedro, California, as a lumber shipping port, some 900,000,000 feet, nearly three times as much as Chicago, being hauled; the use of hickory, of which over 330 million feet are consumed worth $12 per M.; an agreement between the Great Northern and Northern Pacific Railroads and the Department of Agriculture for more efficient fire patrol, which includes clearing of the right of way to 200 feet, spark arresters, and close co-operation in fire fighting; manufacture of odd lengths, in which it is shown that in the average of the cases investigated in Oregon and Washington, the loss due to use of even lengths only is over two per cent. which on an output of 750,000,000 feet figures out 15,000,000 loss.

COMMENT.

The notes on a forester's education by the director of the Eric Forest School, at Duxbury, Mass., printed in this issue, are much to the point, namely, in recognizing that various degrees and different kinds of ability are required to build out a practical profession.

This variety may be secured through separate schools of different degree, or it may be supplied in one and the same institution.

We have such varied schools, and at the University of Toronto at least, the three different classes of students referred to by Mr. Knapp, are provided for. Besides the regular four year undergraduate course, there is a six year course, which broadens out not on the forestry side but on the general intellectual development, with a view of giving the men power for advanced work, specialization, and especially for representative positions. There are also admitted Special Students, older men from business and farm life, who without the required academic standing and without aspirations to the academic degree, are specially fitted to fill practical positions in the forest. They are attending the same lectures as the others, but do not need to fully satisfy the requirements for the degree.

The need for some practical work during the academic course in order to bring the theoretical teaching into relation with the practical application can be sufficiently satisfied, as it is in Toronto, by occasional excursions during the academic session, a ten-day sojourn in a lumber camp, and a four-weeks practice work in the woods with instructors, after the academic session, for either two or three seasons. Adding to this summer employment on surveys or other forest work, and the introduction to practice, if not ideal, can be considered satisfactory.

To be sure, "lack of other essential qualities" as in any other profession prevents a certain proportion of students from ever attaining professional value, no matter what the preparation.

FORESTRY QUARTERLY

VOL. VIII] SEPTEMBER, 1910. [NO. 3.

SURVEY METHODS AND COSTS FOR A LARGE AREA.

ELLWOOD WILSON.

The problem before the writer of this article was to map and estimate over 1900 square miles of timberlands at the least expense. The question was considered as to whether it would be better to use a large force and work rapidly or to use a small force and take a longer period, and it was decided that the latter method would offer many advantages. The first cost for equipment would be less, the expense would be spread over a longer period of time, the men would become thoroughly acquainted with the territory, would be more experienced and expert and would take a deeper interest in their work, and would in the end be of permanent use to the owners. The result has amply justified this course. The work has improved steadily from the beginning, much valuable information has been gathered and costs of the work steadily lowered, the cost per square mile having been reduced from $20.00 to $10.279, and a still further reduction is anticipated.

Most of the timber limits involved are under license from the Province of Quebec and lie in practically unsurveyed territory. North of the St. Lawrence River a few townships have been laid out and county lines run for a few miles north of the settlements; a few exploration lines have been run connecting different points in the Province, and the larger rivers have been roughly traversed. No system of triangulation has been attempted, and most of this exploration work has been done with the compass.

When the territory under license was first laid out, the general scheme adopted was to lay out "berths" or "limits," ten miles in length along the rivers and five miles in depth; and where the distance between rivers permitted, rear limits were laid out. The limits are numbered beginning at the mouths of the rivers, Nos. 1, 2, 3, &c., north or south or east or west of a given river. This scheme has proved very convenient and practical as the limits are almost always tributary to the several rivers, the logs naturally go with the watercourses, and the hauls are as short as possible.

These limits were surveyed by the government as they were sold, and rough descriptions given in the licenses. The distance from settlements, the difficulty and cost of transporting men and provisions, the roughness of the country, the deep snow in winter and the black flies and mosquitoes in summer, combined at times with the ignorance or carelessness of the surveyors, made these lines rather inaccurate. The lines, having been run with the compass, are often crooked, and the distances often are wrong by as much as three quarters of a mile in ten miles, and sometimes more. Lines as given on the official maps often do not exist on the ground or are incorrectly shown. Lakes are marked where none exist; very few lakes and none of the smaller streams are shown.

The nearest bases for supplies were from twenty-five to seventy miles, and all suppplies, men and outfit had to be driven in sleighs or wagons as far as the roads went and then by dog sled or canoe.

In making the forest survey, the question of how much information was wanted on the maps was governed by the purposes for which they were to be used. As in this province all logging is done by small jobbers who are given sections to work on, and who locate their own camps and roads, the determination of elevations was not considered necessary; but all streams showing the general lay of the land and the natural outlets for the timber were located. Barometric elevations are not very accurate at best, and to be of any value require more time than it was thought they were worth. Supply or logging roads can be laid out by an experienced man or by a man having engineering training, with a hand level and judgment, and when the necessity for such roads arises one is not likely to consult a map giving barometric elevations. On the other hand, boundaries, lakes, rivers and streams needed to be accurately located so that jobbers could be placed, trespasses detected and prevented, fire rangers could travel, and the location of the Company's timber resources be accurately represented. A thoroughly reliable base for forest maps and working plans was wanted which would always be of value.

The areas in the different types of timber, burns, &c., were considered throughout the work as of paramount importance. In the writer's opinion, average amounts of timber per acre are of little value if one does not know pretty closely the actual sizes of areas to which these averages are to be applied. Maps made by running out strips do very well where good topographical maps of the country are available, as in the United States, but here are much too inaccurate to be of any real or lasting value, and there is little difference in their favor as regards the cost of making them. Our maps show all rivers, streams, creeks; all lakes, ponds, swamps and muskegs; limit, county and exploration lines; summer and winter roads, logging roads, trails, portages, camps and dams; boundaries of burnt areas, windfalls, lumbered areas, timbered areas, Black Spruce swamps, Jack Pine in pure stand, &c. Careful notes of types, reproduction, logging condition, logging waste, &c. are made.

The scale chosen for the several limit maps is one inch to 4000 feet. (Three-quarter miles to one inch.) This gives room for sufficient detail and would give fifty square miles, the usual area of a limit, to each sheet. A large map four miles to one inch is built up by reducing the limit maps as they are completed. The conventional designations adopted by the Dominion Government Forestry Branch are used for showing different kinds of timber, &c.

After a winter of careful experimenting, a small traverse board, 15 x 15 inches, with telescopic alidade having stadia hairs set 1:100 and its ruler graduated 1 inch = 4000 feet, was chosen as the best instrument. All main traverses are run out with this. For rods long balsam poles are used having a ring peeled for alternate feet. Where the brush is very thick, 300-foot steel tapes are used. Folding canvas rods were tried, but were not at all satisfactory. Minor traverses are run with the plane table using shrill whistles for direction in thick brush, and pacing or 300-foot tape for distances. These traverses are closed on and adjusted to the main traverses. Heavy "Unchangeable" drawing board is used for the field sheets. This consists of two sheets of good drawing paper, pasted together with the grain of one sheet at right angles to that of the other, and the resulting sheet mounted on linen. This is unaffected by rain or snow to any appreciable extent and holds hard pencil marks well. A good trough compass is let into each board and two small spirit levels at right angles to the board; these facilitate leveling up, save much time, and permit of more accurate orientation. A sheet of tough tracing paper is kept fastened over the sheet and a hole is cut over the area to be worked on. This keeps the sheet clean, permits of seeing all the work, and protects from rain and snow. The legs of the light tripod have rubber disks, about three inches in diameter, slipped over them about an inch from the points; these allow of setting up the table on a snow shoe track, or in muddy or moist swampy places, and prevent ice and snow from accumulating on the legs when working on frozen lakes.

The main traverses are run on large rivers and lakes, and are from ten to fifteen miles long, closing with an error not to exceed 1 in 300. Areas in timber or burnt land are located by traverses with the plane table, or by resection or offsets. Compass and chain require more time, are more liable to error, must be plotted later, and are less accurate.

Limit lines, where found, are re-blazed, new corner posts and other monuments are set, and where the lines have been destroyed by fire or have not been run originally they are run by using the large staff compass or transit. The lines are well cleared out and all trees within ten feet of the line blazed.

The most economical party has been found to consist of eight or nine men, occasionally ten. This party is made up of the chief, who lays out the work, keeps all the accounts and records, and does most of the plane-table work. His assistant, who helps with the exploration, looks after the moving of the camps and sees that the party is kept in provisions, and when time and opportunity offer runs an extra plane table. Two rodmen give sights, do the chaining, act as canoe men, and, when moving camp, as packers. A cook and three laborers complete the party. As far as possible the provisions are hauled onto the ground in winter. When the party goes to a new section a "main camp" is located as centrally as possible for a month's work. Here all the provisions, surplus outfit, &c., are placed. The party works from this camp until the distance is too great to walk, when a temporary camp is located, and to this the cook's assistant takes each day or every other day, bread, cooked pork and beans, pea soup, and stewed fruits. These are warmed and bacon, rice or oatmeal porridge is cooked by the rodmen. Every effort is made to keep the plane-table party constantly busy. In summer, camp is moved and portaging done by canoe and packing; in winter, dog sleds are used, one dog to each sled. A good dog will pull 100 to 125 pounds on a snowshoe track and two hundred pounds on a logging road. They are fed corn or oatmeal porridge with a little suet cooked with it, at a cost of about three cents per day for each dog. In winter, waterproofed canvas "A" tents are used heated by small sheet-iron stoves. The chief and his assistant have a 7 x 9 tent, the cook a 10 x 12 tent in which he keeps all the supplies and extra duffle, and the men have a tent for themselves. In summer "Baker" tents are used, and the cooking is done out of doors. Aluminum cooking utensils are used as being in the long run much more economical and easier to keep clean, besides being much lighter. Sleeping bags are provided, consisting of a canvas cover with one heavy and two light bags inside. These are warm and very comfortable, much cleaner than blankets, and easier to carry. Canvas-covered canoes have been found to last better than any others. The best length is 15 feet. They weigh, when new, fifty-five pounds each.

The food supplied is plain, but the best obtainable. No canned meat or vegetables are used. They are heavy and difficult to pack, not very satisfying, and not so wholesome. Dried vegetables have been used with great success. The wisdom of this regime is apparent, for in five years we have had no serious illness in camp and the men improve in health while in the woods. Special forms as appended are used for requisitioning provisions and for keeping track of amounts used. An inventory is taken of all stocks at the end of each month. The following list shows the amounts of provisions used for ten men for six months.

Apples, dried,	85 lbs.	Oatmeal,	300 lbs.
Beans,	456 "	Dried onions,	6 "
Bacon,	625 "	Peas,	210 "
Baking powder,	30 "	Prunes,	90 "
Butter,	175 "	Pork, salt,	300 "
Corn meal,	180 "	Pepper,	6 "
Candles,	50 doz.	Potatoes, dessicated,	396 "
Coffee,	21 lbs.	Rice,	85 "
Flour,	1,200 "	Raisins,	78 "
Hardtack,	125 "	Sugar,	500 "
Lard,	120 "	Salt,	75 "
Condensed milk,	132 cans	Soap,	60 bars
Matches,	10 dz. boxes	Tea,	54 lbs.
Macaroni,	40 lbs.	Tapioca, pearl,	24 "

The average cost for provisions per man per day is 17.5 cents.

A daily diary is kept by the chief, describing the work in detail and noting all information about the country and timber which he may think of use. Time sheets are kept in detail showing what each man does each day, where he works, and the kind of work; this enables the office to compile accurate, detailed cost statements which have been a great help in tuning up the party and in keeping down costs. The men are paid by the month of thirty days and do not work on Sundays. A detailed statement of costs for the last six months is given below; the cost of each different kind of work being expressed as a percentage of the total cost.

General mapping,	27.87%	
Burn mapping,	3.49	
Swamp mapping,	1.62	
Jack Pine mapping,	.57	
Total mapping,		33.56%
Exploring,	2.71	
Portaging,	8.54	
Cooking,	7.96	
Cutting out portages and lines,	8.15	
Moving camps,	6.35	
Time lost, rain, sickness,	3.82	
Time lost, Sundays,	10.56	
Camp work,	1.63	
Board, going to and from the woods,	2.41	
Outfit, new outfit for the period, and repairs,	2.48	
Provisions,	8.44	
Traveling to and from the woods,	3.34	

Costs per square mile for different limits.

A	48.33 sq. mis.,	*$6.79	per sq. mi.
B	47.97 "	10.03	"
C	26.06 "	10.12	"
D	28.12 "	15.75	"
E	25.77 "	†18.14	"
F	10.79 "	12.95	"
G	56.99 "	6.74	"

* On A, two plane tables were used for six days, and on G, two plane tables for seventeen days.

† This limit was further away from base, and portaging charges heavier.

The average cost was $10.279 per square mile. The average cost per day for the party was $18.12. The party averaged 2.43 square miles per day. The best day's work, distance in linear miles, was twelve miles in one day in March on a river traverse when the ice had formed a crust on the snow after a thaw.

In the office the plane-table sheets are adjusted and a tracing prepared for each limit, showing everything but the timber. From this blue prints are made for the use of fire-rangers, foremen, etc. Another print is made on which the details of the timber are shown by colored crayons for the use of the management and the logging division. These sheets are also reduced to 1 inch = 4 miles on a large map which shows in color the exact condition of all the Company's holdings. The Dominion Government conventions are used on all maps. All maps are filed, card indexes giving their location in the files and the kind of information shown on each. A vertical file is kept for each limit, in which is placed all information pertaining to it, and these are cross-indexed according to the Dewey Decimal Classification System, using Dr. Fernow's forestry classification. All diaries, accounts, time sheets, reports, etc., are kept on loose leaves and filed in binders.

Part of the territory has been estimated by the strip system, but this has not proved entirely satisfactory, either in accuracy or cost. Some experiments have been tried with the sample plot system with more satisfactory results.

As soon as our base maps are completed the same party will go over the territory in detail to estimate the timber. Enough estimating has been done all over the company's holdings to enable improvements to be made in logging methods, and a working plan is gradually taking shape.

LOGGING OPERATIONS IN THE PROVINCE OF QUEBEC.

B. Winegar.

On the limits of the St. Lawrence River watershed which runs into the St. Lawrence at Three Rivers, six big pulp companies do their cutting. They are the St. Maurice Lumber Company, the Laurentide Paper Company, the Belgo-Canadian Company (representing Belgian capital and having Belgian management), the Union Bag Paper Company, and the Quebec and St. Maurice Industrial Company. Both the latter are American concerns.

Land is divided in the Province of Quebec into limits of different areas, and they are generally numbered from the mouth to the head of the river which they parallel. These limits are sold to purchasers for the timber and do not include the ground. Besides purchasing this timber in a tract the companies pay $3.00 per square mile annual ground rent and Crown dues on each one thousand feet of timber cut, the amount varying with the species. As all cullers (scalers) are really Government employes their scale is taken for the amount of timber cut. Settlement is made by operators once each year. This is apparently an admirable system, inasmuch as it really keeps the title of the timber in Government hands.

Logging is done by the jobber. The various companies have five or six large contractors who divide up the year's cut between them. The Laurentide Paper Company, who annually cut about one and a half million logs (33 million feet), have six jobbers who cut each year from one hundred thousand to five hundred thousand logs, the cut of the average being three hundred thousand. The price paid varies with localities, but an approximation of $5.75 per M. will probably be a fair price.

The big jobber (the head jobber) then divides up his cut into smaller parcels, averaging 6,000 logs, to the smaller jobber at a price of about $5.00 per M. Besides making considerable profit on the season's cut the head jobber sells supplies which yield good returns.

The small jobber commences about the first of September to look over his section and lay out his camp. After locating he proceeds to build; his entire camp outfit consisting of one camp (about 18 by 20 feet) in which he houses his men and horses. He considers this economy, one camp is cheaper than two, and in this men and horses live for the fall and winter. He doesn't concern himself about comfort, he is up there to cut logs, and make a few dollars to put into the farm. His outfit for the camp is crude and consists of a square sheet iron stove (without an oven), a few tin dishes, a frying pan, the inevitable bean-chaudron, the pea soup kettle, and a tea pot. The grind stone, a few axes, two saws, a file, a few wedges, a shovel (not for cleaning snow away from the stumps), and a hay fork complete his working tools. He has a lantern and a lamp, the former seldom in working condition.

Three men to a horse, one man to drive, the other two to saw, is the basis on which the jobber divides the labor. The teamster does the skidding in the fall; he decks on the side of a slope and is able to pile himself. This he does usually with the assistance of but one tool, a hook much like a hay hook, sometimes he uses a peavie. Sawing continues until Christmas, for usually the snow forbids it afterwards. After his trip home, he starts to haul.

The roads which have been widened out in the fall are usually old portages cleaned out. They are not very wide and are not graded at all; the fall of snow is heavy and this will even out the irregularities. Grading would be impossible on account of the rocks. The country is rough, so he hauls with one horse. His sleigh has about four-foot bunks bolted loosely. Stakes hold the logs on the sleigh, chains are never used in this district; he uses a jumper or travoy when he can, but prefers the sleigh when the haul is over half a mile. The country is broken and the grades seem impossible to navigate, but his one horse snakes a load where a team would be unable to gain footing. In driving down hill he frequently drops the lines and lets the horse pick his way. The landing is usually on a lake or the side of a river with a steep bank, hence extra help is not needed to pile the logs. On the landing the logs are stamped, the bark mark having been cut in the woods by the sawyers. The culler comes every two weeks during the hauling season, and after culling the logs gives the jobber a slip showing the amount cut. He is paid in the spring, but some money is advanced about New Year. The amount advanced is not over one-fifth of what his logs represent in the woods. Most logs are cut to a length of 13.5 feet, but the jobber is paid for 13 feet. The six inches are supposed to be lost in the grinding through the rapids and along rocky shores.

The wages paid for labor vary from $26 to $35 and board per month, varying according to the scarcity of labor and to the value of the man. The board, which consists of bread, pork, beans, pea soup and tea, does not cost over twenty-five cents a day. Transportation of supplies is expensive, as the jobber is forced to drag them part way by wagon, part by "marcheda," a travoy for summer use, and part by boat. He may have to load and reload his supplies six or eight times before reaching his destination. He is satisfied if he can get in a distance of thirty miles in three days. It is impossible to figure the cost of his supplies of hay, oats, etc., at camp, as the men are not paid usually till the cutting commences.

What does the small jobber make? If conditions are good, if he can skid to the landing, if the weather is favorable, he makes a small amount. Usually he contents himself coming out even, after allowing himself a fair wage. Most of his supplies are brought in from his farm.

Would there be any money in using teams instead of one horse? Would company logging pay? Would larger camps cut timber cheaper? An experiment was tried in using teams about five years ago. That year there were fifty-five teams killed, all owned by one company. Teams cannot work on the mountain sides as do single horses. The most of the horses were killed on the steep slopes with loads. The Laurentide Paper Company, it is said, annually saves $100,000 on jobbing, over company-run camps. As to the question whether larger camps would not pay, at first glance it would seem practical, but on some limits the timber does not grow dense enough to warrant this. To use a large crew of men successfully, timber must be in sufficient stand to warrant steady working. Changing crews about is expensive. Ice roads are out of the question for hauling.

The advantage of contract logging lies in the following: First, in many sections the company pays little if anything until the contract is completed. Second, it dispenses with a large office force. Third, a foreman and clerk are not necessary. Fourth, there is no investment in supplies and plant for a season's work. Fifth, the responsibility for the season's cut is all in the hands of the head jobber and he must see that the timber is cut. The company uses only a logging superintendent, a bookkeeper and a staff of scalers, who are always kept busy. There is no lost time here.

The disadvantage of the system lies in that, in the past at least, there has been a tendency to log wastefully. Logs were left in the woods, tops were not taken out, trees were left hanging and in general the jobber did what he pleased practically. There was no company man to see that the woods were cleaned up. An immense amount of timber has been wasted in the construction of camps, which are good for about one year where the timber is scattered.

The Government regulations for cutting timber first protected the young growth. Companies are not allowed to have cut on their limits White Spruce under eleven inches, Balsam under nine inches, Black Spruce under 7 inches. This wise law has had a radical effect on the preservation of timber. In general the other regulations insist on the removal of all sound timber except hardwood over the minimum limit.

What Forestry Can Do.

During the past few years a system of fire-ranging has been worked out with very good results. The system is crude at the present time but will work into an excellent fire-fighting machine in the very near future. All fire-guards are appointed as justices of the peace by the Provincial Government, and they have the power both to arrest and fine any one caught setting or leaving fires. The value of this system is proved by the fact that in the month of June of this year fifty-three fires occurred on the Transcontinental Railroad north of La Tuque and on only two of them was it necessary to call outside help; the bill for same being $45. This means that the fire-rangers caught fifty fires before they gained any headway. Fire-rangers are appointed by the Government, but are usually paid by the company whose limits they patrol. The value of an efficient fire-ranging force cannot be overestimated.

The Government has issued a number of regulations for the cutting of timber, part of which has been referred to in the above account. The Laurentide Paper Company sent out inspectors in the fall of 1908 to watch logging jobbers, to see that the Government regulations are complied with and also to cover points over which the Government had no control, i. e., to see that all logs were barked, marked, stamped, and to see that good pulp wood was not used in the construction of camps, roads, etc. That this system was worked out properly cannot be proven, as the service has been discontinued. That this scheme is absolutely necessary under a contract system of logging, becomes apparent on inspection of any timber land so logged. An inspection system can be built up which could easily be made to pay its expenses the first year. That it would be necessary to keep a large force after the first year is a matter of conjecture, but if jobbers are educated to the value of inspection, close surveillance would most likely not be necessary.

WOODS SURVEYING.

JAMES W. SEWALL.

In my woods experience it has been frequently forced upon my attention that the training given foresters in plane surveying for woods work is lamentably deficient. I do not mean so much technical and theoretical deficiency as practical deficiency, connected in the main with the absolute laying down of their work on the ground. Having had what may be called a decidedly practical training myself, I desire to set forth a few points which may be of some little benefit in the work.

In Maine, with the surveys of which I am mostly familiar, woods lines are run for three purposes: (1) That land may be sold; (2) that logging operations may be confined to certain district limits; (3) that explorers may locate stands of timber. The first purpose is of very slight importance in the wild land districts of the State, as few transfers of property are made, and even when made are in fractional parts of an entire part rather than in separate parcels. Still in years to come more transfers will doubtless take place, and the forester or surveyor should consider his work the forerunner of all the later surveys of his territory. At present, however, surveys bear mainly on the two last purposes.

Evidently for both these the main thing to be sought is *plainness of lines and corners and lasting quality.* Here is briefly the method followed by the better land surveyors of our State, with regard to obtaining these results. It goes without saying that straightness of line and accuracy of measurement must also be had, but in those matters the ordinary young forester is proficient, while in the ones I mention he is in nine cases out of ten utterly deficient. I am treating of conditions found in Maine, but which are applicable to many other localities.

Corners—A good corner is the beginning and the end of line work. Seek out cedar posts when you can; if you cannot get cedar take juniper, then spruce, then any kind of softwood, then the hardwoods. But remember that a *small cedar* is worth more that a big post of the other varieties. I have read the markings on a cedar post set in 1797.

Do not be afraid of having your posts large—I do not mean very high, as that causes a falling down tendency—but have them bulky. Let your axeman hew smooth the parts you want to mark, but do not have the lower part hewn; it is needless work and of no benefit. Point the post well, and "snipe" the top into a uniform roof, it looks better and takes little time. Do not peel the bark off till the post is set, as that will make slippery handling. To set, let two or three men, dependent on the size of the post (I have used five), stand about the post, raising it and bringing it down with considerable force a number of times; by working it back and forth a bit, you will find that you can sink it deep and solid in the ground. Then strip the bark away. As a friend of mine remarked, "It looks better and lasts five minutes longer."

Next, stones, if they are to be had, are serviceable. Time and time again I have found an old corner by a ring of stones, the post having been burned or rotted clean away. Don't be afraid of too many or too big ones. Pile the larger ones a little back from the post in a circle, then wedge in the smaller ones; the more they settle the more tightly they hold the post. Personally, I think a good pile of stones around a corner the most important part of it, and I remember bringing stones a half a mile by canoe in one instance.

Witness well! that is, blaze down toward the post the trees encircling it, and mark them with your survey mark and the year. Have your men hew the witness trees from where they can conveniently reach to within a foot of the ground, and have them get into the meat of the tree. The only instance in which I allow the bark alone to be taken from witness trees is on big, tough hardwoods—and then I have to be in a hurry. As with stones, the witness marks will often guide to the corner after the post is gone. Don't be afraid of too many witness trees.

This being done, the corner is complete: You have a "post set with stones, marked and witnessed." It will stand—and that is what you want.

Lines—The great trouble with young surveyors and foresters seems to be a fear of hurting the trees or the feelings of their axemen. Have your axemen make *spots,* not *bark-skins.* Have them get into the meat of the tree and hew off a wide, long spot; then the next man who comes across your line won't mistake it for a hunter's trail. On our own surveys we make spots (partially decided by the size of the tree) from one to two feet long, put on deep.* A line lightly spotted is a poor one—it neither looks nor lasts well.

Then as to the number of spots: Many surveyors seem to think that a line well bushed out, and along which one can see, is all right, whether much spotted or not. This is not the case in woods work. Referring to our reasons for which lines are made, we find that distinctness is extremely necessary. Your chopper cares precious little about hunting a blind line if there is a good spruce handy. Bushing should be as well done as possible, but if expense or time calls it can be shirked. *Never shirk spots.* Have plenty of them, and have them well put on. Bushing grows up in a few years; spots are the permanent marks of the line.

As to the width spots should be put on, opinions vary. Personally I run a line of uniform breadth, either spotting or cutting out all trees within the line. The outer spots of my line are the trees an axeman, standing in the center of the line, can conveniently reach with half his axe.

We use three kinds of spots. For trees through whose center the line passes we use the "double spot," i. e., two spots, one above the other, four in all, on opposite sides of the tree as the line runs. For trees which the line touches but does not center on, the "fair spot," a single spot on both sides of the tree as the line runs. For trees outside the line center, but within half axe reach, the "quarter spot," a spot made wedge-shaped, with the wedge pointing toward the line. This gives a line heavily spotted so that it can easily be seen and followed, and at the same time one with a definite center.

There are other minor points which could be taken up, such as quarter mile stakes, styles of marking, witnessing of roads and streams, treatment of old lines, etc., etc. But if accuracy is combined with thorough work, and the work done with the idea that it is done to last, minor difficulties will be readily met. If a course in surveying which compelled the student to go into actual woods practice could be instituted at our forestry schools, I feel that the poor surveying often at present done by foresters would be largely eliminated. Also there is this to be remembered: estimates of growth and stand, of conditions and remedies, working plans and type sheets, are all changeable. The survey is permanent. It is at the beginning of every development. Do it well.

* This practice, without restriction, would hardly recommend itself to a forester, as liable to invite fungus growth.—Ed.

REPORT OF SUPERVISORS' MEETING AT MISSOULA, MONTANA.

[The following full account of proceedings at the Supervisors' meeting in Missoula, which took place in March, has been kindly prepared by Mr. W. B. Greeley, District Forester. The Editor regrets that a more prompt issue of the report could not be secured, but trusts that the delay does not detract from its permanent value.]

Monday, March 21, Afternoon Session—Supervisor J. B. Seely, Presiding.

The subject "Timber Sales Policy in District 1" was discussed. Assistant District Forester R. Y. Stuart, in charge of Silviculture, gave a paper which is summarized as follows:

In order to control thoroughly the timber sale administration on each Forest, it is essential that detailed data on the timber resources of the Forest be secured as soon as practicable. Having ascertained the timber asset we become qualified to institute methods of forest management,—the data to be secured by a comprehensive and so far as possible, uniform method of reconnaissance.

While at present each Forest, for convenience in administration, constitutes a separate unit, we are approaching the time when the common demand upon groups of neighboring Forests must be met by a contribution from each of them to meet the demand, necessitating full coöperation between Forests in the conduct of timber sales.

On some Forests where the supply of timber is limited and the need of settlers for the timber in home building is great, the adjustment of supply and demand in relation to the limitations of annual cut can only be brought about gradually. It may be necessary for the public good on such Forests to permit the cut to exceed the annual growth for a limited period, but this action must be compensated for by commensurate reduction in cut when the exigency ceases to exist. Reconnaissance work in the near future on these Forests is urgent.

Special provision for reconnaissance work will be made on Forests most in need of it, but this should not deter Forest Supervisors on other Forests from training their Rangers to properly handle reconnaissance projects and conduct the work independently.

In considering the sale of timber from the Forest, the first aim should be the betterment of the stand. We can not, however, justly withstand the demand for timber from Forests by an overzealous desire to secure ideal silvicultural results. Not until complete utilization is possible can we attain the success in silviculture towards which we strive. These standards should, however, be approached as closely as practicable.

The needs of the local community are paramount in the disposition of the timber from the Forest. Sales are particularly desirable in the development and maintenance of local industries. In no case should a sale be made in excess of the annual growth for the unit, unless the public good demands it, or it is occasioned by a desire to have removed from the unit undesirable species, dead, over-mature or diseased trees, or unless a periodic system of cutting is established, in which case the cutting should be confined to periodic growth.

While every effort must be made to prevent speculation, encouragement should be given to prospective purchasers to secure large quantities of Forest timber where it is to the advantage of the Forest that it be sold and the initial investment necessary to conduct the operation makes the purchase of large quantities of timber essential for profit.

Local lumber companies who are subjected to keen competition with larger and heavily capitalized companies, and are unable to secure adequate capital to obtain timber holdings, should be encouraged in the purchase of Forest timber. Where the permanency of their industry is dependent in a great measure upon their ability to secure a constant supply of timber from National Forests, efforts should be made to place their operations on as permanent a basis as is consistent with the rules and regulations of the Department. In such cases the establishment of a period of contract in excess of five years, subject to a revision within a stated period of the salient features in the contract, and the conduct of the sale under an approved system of forest management applicable to the unit in which the sale area lies, seems desirable.

In establishing a stumpage rate, the aim should be to secure the full value of the timber, as well as allow the purchaser a fair profit; for convenience in handling the sale a flat rate is highly desirable. Where the value of the species represented on the sale area, however, varies considerably, it is usually advisable to affix a rate to each species commensurate with its value.

Where timber is for local consumption and is not subject to competition from the general market, the stumpage rate should be reasonable and one which will afford the mill man a fair profit. Where the timber is secured for the general market, the prices offered in the general market should be the prevailing factors in determining the stumpage rate. Since the need for minimum stumpage rates has passed, it is deemed a better practice to establish a standard stumpage rate for each Forest, and on the securing of the necessary data in reconnaissance studies, for each unit of the Forest.

In order that the best marking possible may be secured and that the system of marking inaugurated may continue throughout the progress of the sale rather than be subject to the variance in opinion of successive Forest officers in charge of the sale, the need for a Marking Board is felt. This Marking Board should consist of representatives of the Forest and the District Office. The action taken by them in adopting a system of marking for a sale should be binding upon the Forest officer placed in charge of the sale. No change can be made in the marking system adopted by the Board without the approval of the Board.

The silvicultural needs of the Forest are paramount. If there be a conflict between silvicultural principles and financial returns, the former must be given the preference. For this reason the betterment of the Forest may prevent the securing of standard stumpage rates, although in fixing standard stumpage rates the necessity for cutting under approved silvicultural methods should be considered and anticipated so far as possible.

The sale of adjacent timber should not be prejudiced through a limited sale at present, unless an excellent opportunity is thereby afforded of selling the timber under especially favorable silvicultural conditions.

The extent to which timber cut should be utilized should be covered so far as possible in the contract. As given in the contract, "merchantable" applies to the material which according to class or size has a market value, but the merchantableness of any individual log or piece of material must be left to the judgment of the officer in charge. In general, where the merchantableness of any given material is not specified in the contract, the material should not be considered merchantable if it will not yield a sufficient quantity of salable product to pay for its transportation to the mill.

Since in the general administration of sales much must necessarily be left to the judgment of the officer in charge, it is due this officer that his work be supervised by his superior officers as often as practicable and that he be given the benefit to be derived from their suggestions and criticisms.

Check scaling by lumbermen on National Forests is as much to benefit the man whose work is being checked as to secure a good line-up for the Supervisor and the District office on the efficiency of the men assigned to scaling work.

Supervisor W. G. Weigle, of the Coeur d'Alène National Forest, discussed a number of points in the administration of timber sales in the field, the organization of scaling, preparation of estimates, marking and supervising of logging. He described in some detail the methods of marking used in White Pine stands in the Coeur d'Alène National Forest. In the sale to J. L. Kennedy, selection marking in White Pine has given excellent results, from five to seven thousand feet of the younger and thriftier White Pine being left per acre and the other species occurring in mixture heavily cut out. This was a stand of uneven-aged White Pine, adapted to selection cutting and so protected by its location in a series of deep gulches as to be comparatively safe from wind throw.

In the general discussion following, several Supervisors emphasized the necessity of approving timber sale contracts for a longer period than five years in cases where bodies of wholly inaccessible timber are being opened up and an exceptional investment for logging improvements is necessary. Supervisor Fenn emphasized this point in connection with his efforts to make a sale of pulp timber on the middle fork of Clearwater River to a Michigan concern which is contemplating the installation of a pulp and paper plant at Kooskia, Idaho. Mr. Fenn stated that to a concern opening a virgin territory of this character, a five years' contract did not offer sufficient inducement to justify the initial expense required. The District Forester stated that the Washington Office of Silviculture had indicated its readiness to present a specific case to the Secretary, recommending a timber sale contract for a period of ten years with the provision for a revision of stumpage prices and utilization clauses at the end of the first five years. It is hoped that a specific case can be prepared for submission to the Secretary covering this question during the ensuing summer, and that it will be possible to secure sufficient flexibility in this matter to handle such cases as that cited by Major Fenn.

Supervisor Seely described the plan initiated by him on the Jefferson National Forest in which the complete reconnaissance of a watershed of Lodgepole Pine will be made with a view to effecting a series of small sales to supply local timber users. Following the reconnaissance, a definite system of marking will be worked out and a plan made for cutting a certain portion of the timber under this scheme of marking each year. Mr. Seely requested a general discussion of methods of marking applicable to Lodgepole Pine. Supervisor Preston, of the Beartooth National Forest, described the method of marking which he proposed to follow in a sale of Lodgepole mining timber, some ten million feet, in one of the main watersheds on the Beartooth. Owing to the density and even-aged character of the stand, Preston did not think it advisable to attempt selection cutting. He proposed to cut the bottoms and lower slopes clean, leaving the higher and more exposed stands on the upper slopes up to timber line intact. Following the burning of slash, he feels reasonably certain that good reseeding of Lodgepole Pine will take place naturally. Supervisor Hall, of the Deerlodge National Forest, described a system of marking which has been in effect on the Allen sale since January, 1909. Under this method the bottoms and lower slopes are cut clean and solid bodies of timber are left intact on the ridges, knolls and higher ground generally, or the areas where the timber runs younger and thriftier than in the average. The bodies so left constitute approximately one-third of the entire stand. Mr. Hall stated that this system is apparently working well, and will, in his judgment, meet the conditions necessary on this sale, viz: satisfactory reseeding with a minimum loss from wind throw.

A general discussion followed on methods of marking in individual sales on various National Forests. Supervisor Preston suggested that steps be taken by the District Office to inform the Supervisors generally of the methods of marking applied in various types and their results. The District Forester stated that this would be done. The District Forester emphasized that marking and good silvicultural management should be given the first consideration in the sales business and the other conditions of the sale, particularly stumpage prices, adjusted so as to make it possible to carry out the method of marking which is adapted to the needs of the forest. He emphasized also the necessity of making the terms of the contract clear to the purchaser on the ground before a sale is consummated, in reference especially to the methods of marking which will be employed.

The question was raised by several Supervisors as to the basis for figuring stumpage prices in cases where the timber is in demand within the same market for two different uses, as in the case of timber in central Montana which is in demand for both stulls and saw logs, the price for stull timber being higher than for saw timber. After considerable discussion, the District Forester stated that while in general the stumpage price set upon timber should be determined by the use to which the timber is to be put by the Supervisor, in cases where it is clear that the same timber is in demand for two different uses, the stumpage price, based upon the manufactured product of the higher value, should be required.

Wednesday, March 23, Afternoon Session—Supervisor C. C. Hall, Presiding.

The subject "Reconnaissance and Working Plans in District 1" was discussed. Assistant District Forester D. T. Mason opened the discussion with an outline of the plan of the district for reconnaissance and working plans during the ensuing year. He emphasized that a working plan for the management of a National Forest should be complete, including not only all essential data on the timber but also the information necessary to properly establish the work and policy in connection with grazing, settlement, permanent improvement and planting. A complete working plan should include full data as to the extent, density and character of young growth and reproduction since this information is necessary to properly estimate the future timber resources of the forest. In connection with the data on the actual occurrence of young growth, it is necessary to secure as soon as practicable yield tables showing the amount of timber which will be produced within given periods from young growth of various kinds and densities and on different classes of soil. These yield tables will also be found of great value in determining the forest value of land as against its agricultural value, the present value of immature growth destroyed by fire and the like. As the development of all resources of the forest becomes more intensive, yield tables will be increasingly necessary in order to determine for what purpose various types of lands are best adapted, on what areas, for example, planting will be justified as against the continuance of grazing.

Mr. Mason stated that young growth should be considered on the basis of its future yield as timber, rather than simply classed as cord wood. In connection with the estimate of merchantable timber, its accessibility to market and its condition with reference to maturity and deterioration, are of special importance to determine. This will enable the Service to remove first the stands which are over-mature and make no use of their producing power.

Reconnaissance work will be directly under the Supervisors, the District Office furnishing the general plan which should be followed and necessary assistance in men and funds in the most urgent cases. In order that results may be uniform on all forests in the district, the preparation of a standard plan which has been furnished to the Supervisors for conducting work has seemed advisable. All reconnaissance work done in accordance with this standard plan can then be considered as complete for, at least, our present scheme of management, and duplication of work by re-estimating areas at frequent intervals will be avoided. It is proposed to have the estimates checked as far as practicable by lumbermen to standardize their accuracy. The standard plan calls for an estimate of each forty-acre tract, with a topographic and type map on a large scale, showing all stands of young growth as well as the areas of merchantable timber. The descriptive data recorded in connection with the map will show the age and density of all of the immature stands. Separate estimates will be made of each species of timber on a forty, and a general estimate of merchantable dead timber, all estimates being based on timber measured breast high and the number of merchantable logs. The estimator will determine the percentage of the timber on each forty which because of maturity or defects should be cut within ten years to prevent deterioration; also the percentage which should be cut within twenty-five years for the same reason, and the percentage which should be cut in case a sale involving the area is made. The reconnaissance of the forest will be followed as soon as practicable by the preparation of yield tables to be used in determining the value of various types of soil for forest production and the annual growth upon which the maximum annual cut must be based.

Supervisor W. N. Millar, of the Kaniksu National Forest, outlined the plan of reconnaissance work which has been developed on his forest. Steps were taken in 1908 to begin the reconnaissance of the Idaho Division by sketching the course of the streams in unsurveyed territory and determining the approximate location of the divides and the main bodies of timber. The Rangers were required to submit periodical reports of timber estimates made by them as part of their regular duties in accordance with detailed instructions and a demonstration in the field. Each Ranger was provided with a reconnoissance book, Form 321, with sample page showing both map and estimate sheet. The timber was mapped by rough age classes.

It has been Supervisor Millar's intention to extend this reconnaissance over the entire Kaniksu as rapidly as practicable. His aim has been to secure the information needed for a silvicultural working plan rather than a working plan based on annual yield, on account of the enormous stand of mature and decayed timber which should be cut over as soon as practicable. The annual yield is so far in excess of the annual cut to date that that factor can be disregarded for the present and the aim of the working plan made simply to put each stand in better silvicultural condition as soon as practicable. Supervisor Millar suggested that the duties of the proposed Marking Board be extended to include the supervision of reconnaissance work on the various forests and the determination of the general policy of management for each forest, the fixing of the annual cut, determining the silvicultural system adaptable to each forest, and the like. He advocated also more co-operation between Supervisors either directly or through the District Office in exchanging ideas and the results of methods worked out. He suggested a quarterly publication from the District Office, devoted exclusively to National Forest interests and serving as a medium for the interchange of ideas.

Supervisor C. A. Ballinger, of the Sioux National Forest, outlined the conditions on his forest and the reconnaissance work which has been conducted. The Sioux Forest contains approximately fifty-eight million feet, board measure, of saw timber and is the sole local supply for a tract of country containing about one hundred and seventy-five square miles which at an early date will have a population of ten to fifteen thousand people. The present annual cut in sales and free use has been equivalent to five per cent. of the total stand of timber on the forest. The inadequate supply of timber and the extensive demand have made it essential that the reconnaissance of the forest be made as soon as possible. This plan should include the restriction of the annual cut of timber to the annual yield, with extensive planting operations wherever justified by soil condition. Two-thirds of the Sioux Forest has been covered by reconnaissance work and the remainder will be finished this season. The work included a detailed estimate of each forty-acre tract with full notes on the conditions and maturity of the timber and the extent, density and composition of young growth. Exclusive of transporting men to the forest headquarters from Missoula and return, the cost of the work previously done, although conducted under adverse climatic conditions during November, December, January and February, averaged twenty-eight mills per acre. It is believed that the remaining areas can be covered at a cost of twenty mills per acre.

Supervisor Skeels, of the Kootenai National Forest, outlined the plan devised by him for estimating during the current season the timber on Yahk basin, one of the main natural bodies of timber on his forest. This area being unsurveyed, he plans to run a transit base line up the bottom of the valley, furnishing tie points by which each natural logging unit could be definitely located and the base line on which the estimating strips could be used. He believes that much of this work can be done by concentrating temporary guards and student employes in this district during the summer and fall.

Supervisor Preston, of the Beartooth National Forest, outlined a similar plan for estimating one of the more important watersheds on his forest. He proposes to run a base line up the main stream, with side transverse lines around the bodies of timber. For purposes of estimating, Mr. Preston plans to split up the timber on the slopes on either side of the base line into blocks, laid out by locating approximately where the section lines, when the area is surveyed, will cross the base lines following the stream. This will furnish a rough system of blocks a mile in width for use in estimating. Preston considers some such method as this advisable in order to have the territory estimated split up in definite units, each of which can be located and checked.

A sharp debate ensued on the question of surveys in connection with estimates in unsurveyed areas. Supervisors Fenn, R. Bushnell, Skeels, Ring and Preston advocated transverse surveys following the topographical lines in unsurveyed townships rather than attempting to anticipate the public lands survey and determine even approximately the location of the forty-acre subdivisions. Other Supervisors and members of the District Office advocated the use of the forty-acre system just as far as practicable, in order to furnish definite units, ascertainable on the ground, which can be used in checking estimates. The point was also raised that in much of this district the status of some of the unsurveyed lands, specifically in areas included in the Northern

Pacific grant, unsurveyed school sections on which no timber is to be cut under the present policy of the Service, and areas in which scrip has been located, makes it necessary to locate the section lines in all reconnaissance work.

The District Forester summarized the matter, stating that, in his judgment, transverse surveys were preferable in reconnaissance work where no alienations are involved. Where unsurveyed railroad lands, school sections or scrip filings are involved, an approximate location of the section lines seems unavoidable.

Supervisors Kinney and Fenn urged that the Service make a strong effort to secure the survey of the railroad areas because of the many administrative difficulties involved in their present unsurveyed condition. Superisor Fenn stated that the maximum price allowed for surveys makes it impossible to have this work done under the contract system in many of the mountainous districts. Supervisors Kinney and Ralph Bushnell urged that authority be secured for Forest Officers to make official surveys, in compliance with certain standards which the Land Office might require. Supervisor Bushnell advocated especially that this authority be secured in connection with the survey of homestead claims secured under the act of June 11, 1906. He stated that the Surveyor General in each State could deputize any competent man of his selection as an official deputy surveyor authorized to make surveys of such claims and urged that this authority be secured for Forest Officers. Nearly all of the Supervisors present advocated this plan, emphasizing especially the cost which the settler on a metes and bounds claim must often incur for survey when he applies for patent.

In concluding the discussion of reconnaissance, the District Forester emphasized that it should be of a broad character, including complete information of all the factors necessary for the best management of the Forest. In addition to the merchantable timber, areas of young growth and their future contribution to the merchantable stand, areas of possible agricultural land, and areas which should be planted, reconnaissance work should include, if practicable, a classification of the grazing areas, showing at least the more important types of grazing land with reference to the best handling of the grazing work on the Forest. The reconnaissance outline has been prepared in order to standardize the work on each Forest and secure uniform accuracy. The details of the work should be adapted to the conditions of each Forest. The District Office expects the reconnaissance work on each Forest to come up to the standard as to thoroughness and accuracy, but lays down no inflexible system as to the work that must be done. While special crews of men with special allotments will be furnished for reconnaissance on the Forests where it seems most urgent, the District Office desires the Supervisors to take up this work independently on their own resources just as far as possible.

The District Forester also stated his purpose to make the duties of the Marking Board to include the points suggested by Supervisor Millar, and also to work out some system for keeping Supervisors more fully in touch with the technical work done on each Forest, and provide an easy medium for interchanging ideas.

Wednesday, March 23, Morning Session—Supervisor Elers Koch, presiding.

The subject "Forest Planting in District I" was discussed:

E. C. Clifford, District Chief of Planting, opened the discussion. He stated that the policy of the District is to centralize seed collection upon the Forests where this work can be done to the greatest advantage and that it is hoped to collect 12,250 pounds in the Fall of 1910. He emphasized the necessity for making careful reports upon the seed crop in order to enable the District Office to plan and locate the work of collection to the best advantage. The policy of the Service in this District will be to extensively try out direct seeding, centralizing this work upon a few Forests which contain areas typical of conditions throughout the District. The two principal methods to be used are broadcasting and planting with a hand corn planter at different seasons in order to demonstrate fully the conditions which will produce the best results. Exclusive of the cost of seed, broadcasting should not cost over 75 cents per acre and corn planting, $1.50 per acre.

Nursery work will for the present be confined to comparatively large nurseries on Helena and Lolo National Forests and will be conducted on comparatively limited scale until the possibilities of direct seeding are fully determined. The actual management of planting work will be placed upon the Supervisors with general supervision from the District Office and it is proposed to push this work as aggressively and on as extended a scale as available funds will permit.

Supervisor C. W. Hudson, of the Madison National Forest, followed with a discussion of planting conditions in Southwest Montana. He stated that Douglas Fir areas, after heavy fires, usually restocked with Lodgepole Pine which seems to be the most aggressive species in reforestation in that portion of the District. Where a second heavy burn occurs, usually no reforestation follows. Such areas remain open tracts and can be reforested only by artificial methods. Supervisor Hudson attributes the lack of reforestation of the open tracts not to grazing but to lack of moisture during the period when the young seedlings are developing their rooting system.

He advocated the perfecting of fire protection facilities for any given area before attempting its reforestation, since otherwise money spent in planting seed is apt to be wasted.

In the spring of 1909, six acres on the Madison National Forest were seeded with Lodgepole Pine under various methods at an average cost of $10.46 per acre, $7.32 of this amount being charged to cost of seed. Five acres were seeded to Douglas Fir at an average cost of $11.60, of which $8.00 is charged to seed. One acre was seeded with Yellow Pine at a cost of $10.23. Excellent results were obtained from all of these experiments with the exception of broadcasting on snow and broadcasting on unprepared soil.

In the same spring, 1200 Yellow Pine seedlings, three years old, were planted in five different localities at a cost of $15.00 per acre (excessive on account of travel from one site to another). Only 30% of these trees survived the season, due probably to the excessive drought. In the fall of 1909, 335.83 acres were seeded, using 358 pounds of all species. On Parrot Creek, 90 acres were seeded with Yellow Pine. Twelve and one-half acres were broadcasted without preparation of the soil, at an average cost of 93 cents per acre. Seventeen acres were seeded in furrows, two-thirds with corn planters, and the remainder by broadcasting at an average cost of $2.48 per acre. Sixty acres were seeded with the corn planter in seed spots without preparation of the soil at an average cost of $1.29 per acre. On Wisconsin Creek, fifty-two acres were seeded with Yellow Pine and Douglas Fir, the average cost under the various methods ranging from $2.00 to $4.15 per acre. On Horse Creek, 130 acres were seeded to Douglas Fir at an average cost of $1.31 and approximately 64 acres to Lodgepole Pine at an average cost of $3.24 per acre. The difference in price being due to the greater cost of the Lodgepole Pine seed.

Mr. Hudson stated that the striking difference between the cost of the fall and spring work was due, in his judgment, to the much larger scale on which the fall work was done, also to the use of a less amount of seed. An examination made on March 14, showed that 90% of the seed sown the previous fall have blighted or decayed. Further examination showed that the same blight or decay has occurred in the seed dropped naturally where the seed used in the fall sowing were collected. Mr. Hudson attributed this fact to the long period during which the seed is in contact with the soil between the time of seeding in the fall and the natural time of germination in the spring, and in the excessive moisture prevailing during that period. He suggested that this might account for the replacing of Douglas Fir by Lodgepole Pine, since Douglas Fir seeds exclusively during September, October and November, whereas, Lodgepole Pine is dropping seed at all seasons of the year. Lodgepole Pine is thus able to take advantage of any conditions favorable to germination while Douglas Fir is able to propagate only in years favorable to that species.

Mr. Hudson did not consider the fall work a failure since the small percentage of seed still in good condition were shown to be swollen, and a few were sprouting. The experience on the Madison Forest, however, indicates that spring sowing immediately after the snow goes off and the ground thaws is the most favorable season for direct seeding.

Mr. Hudson believes that the Service should be prepared to plant extensively with nursery stock areas where it is demonstrated that trees cannot be grown by direct seeding and advocates that each Forest maintain a Nursery of its own of sufficient size to supply its own needs. This is especially desirable since the seedlings could then be grown under climatic and soil conditions similar to those in which they will later be set out.

The results from planting on the Madison Forest have as yet been unsatisfactory. Yellow Pine seedlings shipped from Halsey, although arriving in good condition and transplanted at once, very largely died, though it is possible that this was due to the stock being set out too late in the season. On the Indian Creek area, the seedlings planted under sage brush lived while those in the open were dead. Similar conditions were noted on the Wisconsin Creek area. Because of these experiences, Mr. Hudson advocated that seedlings be supplied during early periods with some cover, wherever possible, which can often be secured by utilizing sage brush or other brush species on the area planted.

Supervisor Bushnell followed with a discussion of planting work on the Helena National Forest. He stated that the Boulder Nursery was in excellent condition with over two million seedlings on hand. About 600,000 of these will be transplanted this spring.

Some little field sowing was done on the Helena Forest last year, covering a variety of experiments and on nearly all of the areas fairly good results were obtained, especially where the corn planter was used. Mr. Bushnell attributed this to the fact that seeds were planted deeper and given better protection from squirrels and birds, and by being in contact with most soil had better chance for germination. Broadcast sowing gave practically no results whatever.

A few hundred transplants of the 1907 nursery sowing were planted in the open ground on the Forest, and the count made in October, 1909, showed a stand of 90 per cent. These were planted on an eastern or southeastern exposure, on an old burn. One thousand three-year-old transplants, received from Halsey, were set out in heavy sod. A count made in September indicated that only 45% had survived, and the partial failure of this area is attributed to the heavy sod which must draw largely on the soil moisture and nutrition. Mr. Bushnell advocated that in planting heavily sodded areas, the sod be removed for a space of sixteen or eighteen inches square around each seedling.

In the discussion that followed, the following points were brought out:

Supervisor Hall, of the Deerlodge National Forest, stated that the planting of Yellow Pine seedlings in the French Gulch, at an altitude of 7,000 feet, had brought good results, from 90 to 95% of the transplants being alive in the fall of 1909. On the Toll Mountain area he had no success whatever in seeding, and poor success in planting, the gophers apparently destroying all of the seed sown. Mr. Hall stated that, in his judgment, Yellow Pine will grow at an altitude of 8,000 feet on his Forest and stated the extremely interesting fact that this species seems to be immune from damage by smelter fumes.

Supervisor Kinney, of the Missoula National Forest, stated that 1200 Yellow Pine transplants on his Forest, at an altitude of 3200 feet, at a cost of approximately two cents per tree, had been planted, and that, as yet, only two per cent. had died. This was on an area so heavily cut over that no reforestation had taken place naturally.

Mr. Clifford stated that the only seeding in the District which he considered successful was that by the corn-planter method and that on very dry of rocky situations he believed it would be necessary to resort to the use of nursery stock. Supervisor Kinney differed with Mr. Clifford in this respect, stating that in the fall of 1909, fifteen pounds of Yellow Pine seed had been broadcasted on three acres on a south exposure of a timber sale area. An examination this spring, although snow prevented the securing of reliable figures, showed that a good many trees were coming up. A portion of this area was harrowed and the remainder merely broadcasted without preparation of the soil. Since no seed crop of Yellow Pine occurred in this vicinity last fall, Mr. Kinney is confident that the seedlings now appearing are entirely from the seed sown. Mr. Kinney advocated the continuance of broadcasting experiments. Mr. Clifford stated that it was not his purpose to advocate the discontinuance of broadcasting and admitted that many years' experiments must be continued before conclusive results could be secured.

Supervisor Skeels, of the Kootenai National Forest, emphasized the large number of factors influencing the success or failure in the experiments, time of planting and origin of seed having a great deal of weight as well as slope and exposure. He advocated cutting up each area into a large number of small plots and conducting small experiments under as many different conditions as possible in order to be sure of methods before extensive reforestation work is undertaken.

Assistant District Forester D. T. Mason described the successful seeding done on the Black Hills National Forest and stated that, while small experiments must be conducted on many

Forests in order to ascertain the best methods, on such areas as the Black Hills the proposition of direct seeding has passed the experimental stage. On such areas, he advocated conducting direct seeding on a large scale with centralized operations in order to reduce the cost. There was quite a sharp debate on this subject, Supervisor Skeels arguing that a large number of experiments under varying conditions should be tried before extensive reforestation could be justified from the standpoint of cost. Mr. Mason admitted that the work as a whole is still in the experimental stage and that experiments must be continued for a great many years. He contended at the same time, however, that where there is a likelihood of success, and initial experiments have given fairly good results, there is no reason why the Service should not go right after seeding on a large scale. Assistant District Forester Stuart spoke in the same vein and stated that we have every reason to be optimistic on the results of direct seeding, although in each locality broad methods must be developed by experimental work. Mr. Clifford stated that many of the failures have been due to the destruction of the seed by birds and rodents rather than by the failure of the seed to germinate or of the seedlings to properly establish themselves and stated that this point of the protection of seed should be given special consideration. In this connection, Supervisor Ralph Bushnell, of the Cabinet National Forest, stated that squirrels had followed seed from bed to bed on his Forest, destroying most of the seed of six different varieties. Aside from the loss of seed due to squirrels, he had secured good results in direct seeding. Mr. Clifford stated that the directions for the treating of seed by poison to protect them from the squirrels were now being prepared.

Supervisor Koch, of the Lolo National Forest, stated that broadcast sowing on land originally forested had been tested on his Forest, and had been a total failure.

Supervisor Fenn, of the Clearwater National Forest, suggested that in seeding with Lodgepole Pine, an experiment be tried in burning the surface cover first and then broadcasting the seed in the ashes. He believes this to be the natural method under which the pure stands of Lodgepole Pine in this region have usually occurred. Supervisor Marshall, of the Minnesota National Forest, described the successful re-seeding of cut over areas, where 5 per cent. of the original stand of pine was left in cutting.

On many of these areas a splendid stand of Norway Pine seedlings has now established itself. He attributed the successful reforestation in part to the burning of slash but stated that the best reforestation had been secured on an area burned clean from a fire which got beyond control.

In summing up the discussion of sowing and planting, Mr. Clifford emphasized the policy which should be followed of testing all methods thoroughly until conclusive results are secured. Associate District Forester Silcox emphasized this same point, stating that broadcast sowing especially should be thoroughly tested until it was ascertained within just what limits this method could be successfully used. He stated that in his belief future planting operations on an extended scale would not be limited to seeding watersheds, but could be extended into regions where a greater supply of timber is necessary for commercial uses.

The discussion turned to seed collection and extraction. Supervisor Hall advocated the construction of seed extraction plants with cement floors and small furnaces for heating, stating that the latter secured a much more even distribution of the heat than stoves. Supervisor Ralph Bushnell stated that he had secured good results with the Sibley stove and tent in seed extraction and found this apparatus convenient because readily transported from point to point. Mr. Clifford expressed the opinion that seed could be more cheaply extracted in permanent, well equipped plants located at the most advantageous points.

Associate Forester A. F. Potter emphasized the position of the Secretary of Agriculture in desiring the Service to undertake artificial reforestation very aggressively and desired the Service to give special attention to this work.

Thursday, March 24, Afternoon Session—Supervisor G. E. Marshall, presiding.

The subject "Forest Settlements' Work and Policy," was discussed.

Assistant District Forester R. H. Rutledge, opened the discussion with a general statement of the policy now governing settlements' work. The determination of what tracts should be listed within National Forests must rest upon a comparison of land values for agricultural and Forest purposes respectively.

To permit comparison, these values must be reduced to the same denomination. It is absolutely essential that this work be put upon a basis where the relative values can be shown in dollars and cents.

Mr. Rutledge referred to the attitude on the part of some Supervisors in endeavoring to protect the entity of their Forests and showing an unwarranted tendency to retain every tract of National Forest land as though it were a personal possession. The matter must be viewed in a larger and broader light. The permanency of the Forest Service depends upon its ability to give the public treatment which in the long run will be satisfactory. It is our duty to administer the settlements' work in a manner that will be reasonably satisfactory to members of Congress, who to a certain extent reflect the attitude of their constituents, without going into politics in any way, and so as to appeal to the hard-headed business public. Our administration of the Act of June 11, 1906, must insure the actual settlement of agricultural areas while, at the same time, according with the principle of conservation.

Expert foresters are clearly the best qualified men to determine the value of lands for forest purposes. Such value should be measured by a progressive, scientific standard, taking into consideration the permanent use and productivity of the land, not by the standard hitherto applied by lumbermen, States and other owners of timbered land.

In considering the value of land for forest purposes, we must deal primarily with the elements which cannot be immediately removed. These consist of its soil value for producing timber and the expectation value of the young growth or immature timber which has no sale value and must be destroyed if the land is placed under cultivation. In addition to these, there are certain conservation values which we have hitherto attempted to consider but which cannot be reduced to a definite monetary basis, values which it is extremely difficult to convince the settler exist at all. Such values should be given a thoroughly secondary consideration.

The policy outlined by the Secretary of Agriculture indicates that the Service is gradually coming to the position where merchantable timber standing upon land will be considered an incidental factor in deciding the question of listing, the main points being the character of the soil and the immature timber. If the soil value, and expectation value of the immature timber, plus the value of the merchantable stand is less than the agricultural value of the tract, the trend of the policy, as the Service is now developing it, will be to list the land. If the value of the merchantable stand, added to the other elements of the forest value exceed the value for agricultural purposes, it is probable that the timber will be removed and the land then listed. While the Service is well equipped to determine the various elements of forest value, we are not thoroughly equipped to determine the agricultural value. We have endeavored to established this as a rule by the amount that farmers are paying for raw land of the same character in the locality. This point should be remedied and the determination of agricultural values placed upon the same intensive basis as the determination of forest values.

The decision of the Secretary of the Interior that residence under Forest Service permits cannot be credited against the residence requirements of the homestead law, has very largely nullified the policy of the Service of issuing permits to enable applicants to demonstrate the value of the dry areas for agricultural purposes. In Mr. Rutledge's opinion, the only way to handle applications for such areas is to decide definitely at the time of examination whether or not the land has agricultural value and submit recommendations accordingly. In this decision he felt that the applicant should be given the benefit of any reasonable doubt.

Mr. Rutledge emphasized the necessity for complete information in settlements' reports to enable the District Office to pass upon them intelligently.

Supervisor Dorr Skeels, of the Kootenai National Forest, discussed the special settlements' work on his Forest. A strong request has been made for the elimination of a six mile strip along the Kootenai River, containing 279,697 acres of vacant Government land, on account of its alleged agricultural value. A traverse line with transit was run through the center of this strip and every tract of possible agricultural land, timbered or otherwise, definitely located and surveyed and a specific settlement's report made upon it. This examination showed that out of a total proposed elimination, there were 8,990 acres of unquestionable agricultural land on fertile flats and benches along the river. Seventy-five per cent. of this land bears a heavy stand of timber.

Yield tables were constructed for the types occupying agricultural soil, showing the approximate average value of the bare land for forest production to be $8.00 per acre. The closest estimate of the value of the raw land for agriculture gave an approximate average of $20.00 per acre. The average value of the timber in these tracts is $3.00 per thousand feet. The policy was then outlined and approved by the Secretary of listing directly lands having not over 4,000 feet of timber per acre, since the aggregate value for forest purposes, soil value plus merchantable timber, simply equalled but did not exceed the agricultural value. Areas having a heavier stand of timber will be cut under Forest Service sales as rapidly as practicable, and then listed. On areas having no merchantable timber but stands of immature timber, the value of such young stands will be determined as closely as practicable from the yield tables. If the soil value together with the value of the immature stands does not exceed the agricultural value, such tracts will be listed. If the aggregate forest values exceed the agricultural value, the application will be rejected.

Mr. Skeels expressed his approval of the general principle involved in this selection, though questioning the accuracy of the yield tables upon which the details were worked out. He felt that this general policy would meet the situation in a rational way, although not entirely satisfying the local settlers and applicants. The most serious factor involved is the delay in removing the timber from the areas which cannot be listed immediately, and thereby reviving the former request for an indiscriminate elimination from the National Forests.

Supervisor Fenn, of the Clearwater National Forest, spoke at some length, advocating a far more liberal application of the Act of June 11, 1906, than that contemplated even by the policy in the Kootenai Valley. While strongly opposing any attempt to secure lands under this Act for its timber value, Major Fenn felt that the *bona fide* settler deserved far more consideration than the Service has yet given him, and that the real purpose of the Act of June 11, 1906, has been to a large degree nullified by the arbitrary standards set up by the Service in its administration. Major Fenn cited specific cases of lands in the Clearwater District, Idaho, bearing six or seven thousand feet of timber to the acre, which are being cultivated by settlers under the standing timber and yielding forty bushels of grain to the acre. The timber in this case is practically valueless on account of inaccessibility. Supervisor Fenn demanded a specific definition of the term "chiefly valuable for agriculture," as applicable to such cases as the one he cited. He further emphasized the necessity of having the sentiment of the public with the Service in the handling of such cases, and stated that, in his opinion, the Forest Supervisor should be the advocate of the settler in all Forest questions involving the agricultural values and the scientific determination of forest values.

Supervisor Weigle, of the Coeur d'Alène National Forest, expressed an opposite view, although stating that each Forest has its clearly distinct special conditions. Adjoining the Coeur d'Alène Forest there are over a million acres of agricultural land, outside of the Forest boundaries, that is better suited to homesteading than any land within the Forest and for which there has yet been practically no demand. For this reason, Mr. Weigle felt that the Service should be in no hurry to list lands within the Forests. He believed that every piece of agricultural land in the National Forests should be devoted to farming and home building at one time or another; but felt that there will be just as many people demanding homes ten years or fifteen years from now by which time the policy concerning these lands will be more fully established and the lands themselves be far more accessible. He emphasized also the limited appropriation for Forest Service work and the severe demands upon the time of Forest Officers occasioned by the examination of settlements' applications.

Mr. Weigle stated further that on the Coeur d'Alène National Forest there are over six hundred homestead claims, 80% of which are invalid. He felt that the Service would simply be adding to its trouble by instituting a lot of June 11 claims, many of which will have to be ultimately contested. He felt that the problem is being well worked out in the Kootenai Valley, and that the limit of 4,000 feet to the acre is fully justified to prevent speculation in timber values. He advocated fully the policy of cutting the timber on agricultural land prior to listing in order to do away with the possibility of timber speculation.

A very sharp debate ensued among a number of Supervisors on the question of what limit should be set in listing timbered lands, and how the agricultural and forest values respectively should be determined.

The District Forester undertook to meet Major Fenn's challenge to give a specific definition of the words "chiefly valuable for agriculture." He stated that the purpose for which any tract of land within the National Forest is chiefly valuable must be determined on the same basis as would be followed in determining the value of a piece of real estate in the suburbs of a town, or block in the business district, viz.: by capitalizing the income which the tract in question will produce under any one or all possible uses to which the land might be put. The use whose income gives the greatest capitalized value is clearly the use for which the tract of land is chiefly valuable.

In applying this principle to areas applied for under the Act of June 11, 1906, it is the duty of the Service to ascertain as closely as practicable what the income from the tract will be; first, if it remains in timber; second, if it is converted into farm land. The respective incomes capitalized at the same percentage of interest give the commercial value of the bare land for the respective purposes. The one consistent policy for the Service to follow is that just as rapidly as it is shown that certain areas will produce more wealth for the community at large by being converted into farms than by being retained for timber production, such lands should be placed in the hands of settlers. But it is equally our duty to retain areas which it has been shown will produce more wealth by being retained in forest production than by being converted into farms. Otherwise, we are setting up a false economic standard.

If the bare ground is more valuable for agriculture than forest production, the Service should make it available for farming just as soon as practicable. If the agricutural value exceeds the value of the bare ground plus a certain amount of young growth or plus a certain stand of timber, the land should be listed immediately. If the value of the merchantable timber, added to the value of the soil for timber production exceeds the farming value of the land, timber should be removed prior to listing. Otherwise we are listing timber values rather than agricultural values and simply inviting timber speculation. If the value of the immature growth plus the value of the soil for forest production exceeds the agricultural value, it is the economic duty of the Service to the community at large to retain the land in forest production until the value of the immature timber can be realized. Then the land should be listed.

The District Forester explained fully the policy applied in the Kootenai Valley and made it clear that the 4,000 feet limit simply applied to this Valley, being the best approximate limit which could be worked out from the data on hand as indicating the dividing line between agricultural and forest values. The limit may be greater or less on other Forests as determined exclusively by local conditions. It is the policy of the District to extend the general principle applied in the Kootenai Valley to other National Forests as rapidly as sufficient data upon which to base the respective values can be determined.

Supervisor Barton, of the Pend Oreille National Forest, expressed the opinion that a soil expert should be secured to determine the soil conditions from the agricultural standpoint in the more doubtful cases. He also suggested that an outline form be substituted for the present settlements report, giving the examiner a better opportunity to report all the information which he can obtain and all data bearing upon the case. Mr. Rutledge suggested that, since it is not now possible to secure the withdrawal of rights of way, the Service should endeavor wherever it can be done to adjust the boundaries of settlement applications so as to throw the rights of way out of the areas recommended for listing so that there may be no further delay in the action on such cases.

Several Supervisors discussed the possibility of securing authority for Forest Officers to make official surveys of June 11 claims, and emphasized the necessity of doing this in order to lessen the hardship upon the claimants in securing a patent.

Thursday, March 24, Evening Session.

The discussion of Forest Settlements' work and Policies was continued.

The District Forester outlined fully the situation in reference to dry land areas in the eastern portion of the District. He expressed the opinion that since the present value of these areas for grazing purposes is so slight, if there is any reasonable chance of developing an agricultural value, they should be listed. This is especially necessary in view of the decision of the Secretary of the Interior in regard to residence under Forest Service permits, which makes the demonstration "Permit" system very unsatisfactory to the settler. The general policy should be to list such areas if they have any possible agricultural value, even though remote, unless such action would actively interfere with National Forest interests, as in the monopolistic control of watering places needed in connection with the use of National Forest ranges or in an attempt to secure sites for enterprises which properly come under special use regulations.

Supervisor J. B. Seeley, of the Jefferson National Forest, expressed a somewhat opposite view, referring to the fact that the land laws generally have been used in many fraudulent ways for the acquisition of land illegally. In his opinion, the Forest Service should restrict the acquisition of lands under the Settlements' Act rather than extend it. A general discussion of this matter followed. Supervisor Fenn advocated the general policy outlined by the District Forester. In conclusion, the District Forester emphasized this policy, stating that the Service should rely upon the public land laws and the Department charged with their administration as competent to prevent frauds.

SOME SUGGESTIONS ON PREDICTING GROWTH FOR SHORT PERIODS.

By J. G. Stetson.

The study of the growth of stands for short periods is, it appears to me, of great importance at the present state of development of forestry practice in this country. In fact, in most private work it is of infinitely greater importance than is the study of the mean annual growth of stands and the making of normal or specific yield tables. But few individuals or corporations are at the present time ready to seriously consider the possibility of securing a permanent supply of raw material from their lands or of incurring any expense in securing reproduction,—much less of making any investment in planting. So that the problem of the total yield at maturity of a species or mixture under actual or normal conditions, and the related problem of the quantity of timberland required to permanently supply a plant of a given size with raw material is not in immediate need of solution in many instances.

Private parties are ready, however, I believe, to make some provision which will ensure a second cut from the timber now standing, even though that entails some investment by way of a curtailment in the amount of the present cut or a delaying of all cutting operations for a period. Lumber companies and other owners realize or are coming to realize that with the advancing values of stumpage and the increased growth that can be shown on account of thinning, the leaving of stands of small timber or of a large part of the smaller though merchantable trees of stands of larger timber as a basis for future operations is an extremely profitable investment, if it can be protected from fire. The accessibility of the timber, the density of the stand, the possibility of adequate fire protection and the methods of logging (i. e. whether or not a larger outlay for roads or railroads is necessary than is warranted by the reduced amount of timber to come in cases where part is left) will determine the profitableness of the investment.

So that while the time has not yet come when private parties are ready to make an investment in reproducing timber, in many cases, could make accurate and trustworthy figures of the probable growth of stands now merchantable but still not mature be obtained, these parties would be ready to remove their timber in two or more cuttings or to delay cutting at all for a period.

A study of current annual growth of sample plots is the means of determining this growth for whole tracts. The subject naturally divides itself into two parts,—the study of thinned and of unthinned stands. Prof. Graves in his "Practical Forestry in the Adirondacks" has so thoroughly covered the subject of the future yield of stands after logging that I shall not touch upon that. I shall here consider the determination of the growth of unthinned stands, first even-aged stands and secondly uneven-aged stands. A volume table of the species must be had for any of this work and it will be assumed that a table based on height and diameter breasthigh is at hand.

The field work for even-aged stands is as follows:

(1) Lay off plots of at least five acres each in representative parts of the area and proceed as follows for each plot.

(2) Record the relative elevation and the nature of the soil of the plot.

(3) Tally to the nearest inch all trees over a couple of inches less in diameter breasthigh than the minimum merchantable size.

(4) Take a sufficient number of height measurements to construct a curve of height based on diameter.

(5) Determine the age of the stand by cutting down a few trees of various diameters.

(6) Count back at breast height into a large number of trees of all sizes measuring to the nearest one-hundredth of an inch the growth in radius for the last five and the last ten years. Keep the inch diameter classes separate and tally to the nearest inch.

The office work is as follows:

(1) Average the *diameter* growth in the last five and ten-year periods for each diameter class and deduct from the present diameter to find the average size of the class five and ten years ago respectively.

(2) On a piece of cross-section paper on which the ordinates denote age and the abscissae diameter breasthigh put through points for each diameter class showing the diameter now, five

years ago and ten years ago. (Fig. A.) Draw curves through each of these sets of points and continue same from 10 to 20 years in the probable proper direction as indicated by the part obtained from the three points. The assumption of a horizontal direction by a curve signifies that at the age when as shown by the diagram the curve becomes horizontal trees of that diameter will have stopped growing.

(3) If it is desired now, for example, to predict the growth of the plot for twenty years, note what sizes of trees die before the expiration of that period and discard those sizes from the tally of the plot as taken in the field.

(4) Now from the curves read off the average size in twenty years of each present diameter class to the nearest one-tenth of an inch.

(5) Using the volume table, height curve made for the plot and the present and future tally of diameters, calculate the present stand and the stand in twenty years. The increment per acre for the whole tract is found by weighting the results per acre of the various plots in proportion to the total area in the forest which has the same soil conditions as the plot.

The reliability of this method rests on the assumption—a perfectly justifiable one—that the smaller a tree is in an even-aged stand the greater the degree of suppression to which it has been subjected. In the case of uneven-aged stands this assumption is not true, so that in that case a grouping for study of growth must be based not on diameter but on degree of suppression.

The steps in the field work for uneven-aged stands are the same as for even-aged with the above exception and with the one that the amount of growth in radius must be measured for each of the last three five-year periods.

The curves are plotted on cross-section paper on which the abscissae denote growth and the ordinates diameter. Three points are plotted for each crown class (dominant, co-dominant, intermediate and suppressed) to show the rate of growth of a tree of the size of the average tree in the class as given by the tally, of a tree of the same size five years ago, and ten years ago, the rate of growth of a tree of the present size being determined from the last five years' growth and the same for the other trees. The trend of these curves can be defined by the three points plotted, and the approximate point at which each curve hits the

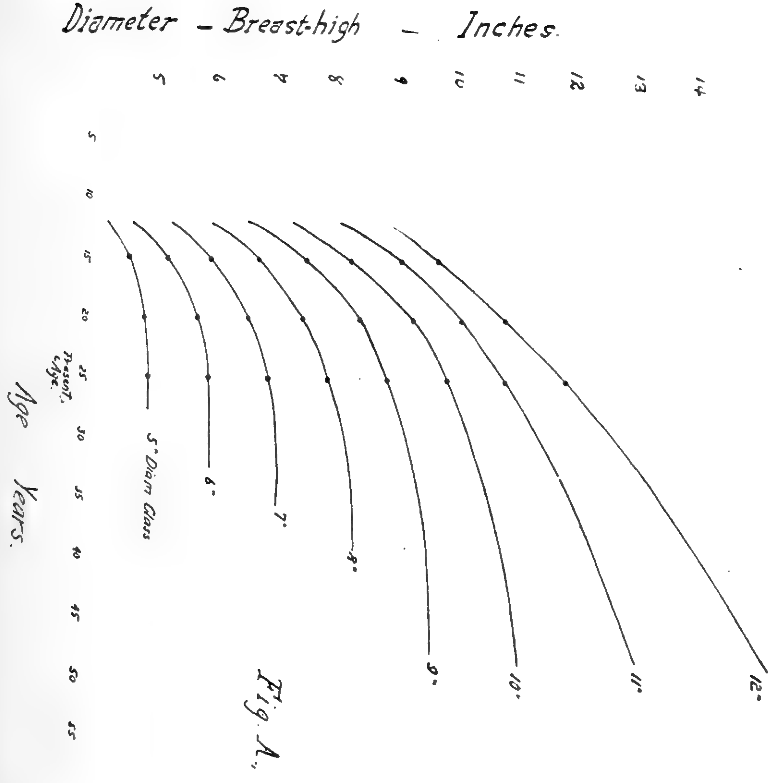

Diameter - Breast-high - Inches.
5 6 7 8 9 10 11 12 13 14
5 10 15 20 25 30 35 40 45 50 55
Present Age.
Age Years.
5" Diam Class
6"
7"
8"
9"
10"
11"
12"

Fig. A.

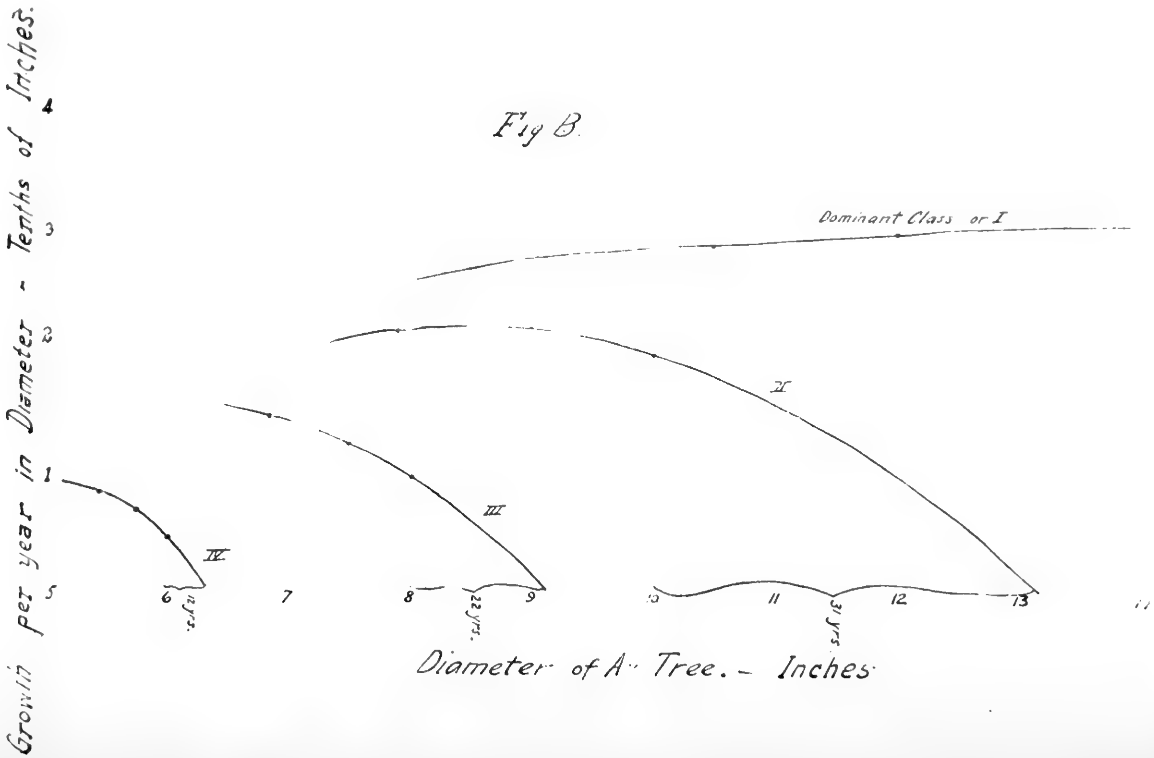
base line determined. The descent of a curve to the base line signifies that at that average size the trees of that crown class will have died. By dividing the average rate of growth from now until that time ($\frac{x + 0}{2}$) into the amount of growth in diameter, the number of years the average tree of the crown class in question has to live can be determined.

It may be claimed that this method for very tolerant species growing in uneven-aged stands is inaccurate inasmuch as in such stands trees now suppressed often start rapid growth and become intermediate or even dominant through the overthrow by wind of trees now overtopping them. Such is of course often the case, but I think that with care in the distinguishing of the crown classes and a short (10-15 years) period of prediction the error arising out of this would be small; it would at least be an error on the side of conservatism.

These methods are to be recommended not only on account of the ability thereby to predict the death of certain trees, but also because of the ability to more accurately (usually more conservatively) decide the rate of growth to apply. In an even-aged stand especially, it is an error to apply to a tree the size of a present diameter class five or ten years ago the rate found by using the last five or ten rings. It is better to apply it to a tree the size of the present tree, but even then in a great majority of cases (in those of trees decreasing in rate of growth) it will be too high. The curves shown in figures A and B will, however, indicate the probable change in the rate of growth during the next few years, and by finding an average rate from these curves the future yield can be more accurately predicted than by the usual method of basing calculations on previous growth with no regard to the *trend* of the rate of growth.

If necessary the curves for the even-aged stand can be plotted with the abscissae growth per year and the ordinates diameter,—one curve for each diameter class. This would necessitate a cutting back fifteen rings and would be done only when it was impossible to accurately determine the age or where the age varied in different parts from five to ten years and yet not enough to class it as an uneven-aged stand.

Fig B.


Growth per year in Diameter - Tenths of Inches.
1
2
3
4
5
6
7
8
9
10
11
12
13
12 yrs.
22 yrs.
31 yrs.
IV
III
II
Dominant Class or I
Diameter of A. Tree. - Inches

METHOD OF CALCULATING YIELD IN WORKING PLANS IN INDIA.

A Correction.

By A. D. Blascheck, *Indian Forest Service.*

I have read with interest Mr. Barrington Moore's article on Forest Working Plans in India in the Forestry Quarterly of March, 1910, but I feel he does not do justice to Indian forestry in describing the method of calculating the possibility of annual cut, as described by him and recommended for adoption in America. This method is stated to be the basis of the Jaunsar Working Plan. As I have not the plan in question before me, my comments must only be taken to have reference to Mr. Barrington Moore's description on pages 47-53 of the journal.

I feel sure that the description of the manner in which the "average annual increment" (whereby is apparently meant the average number of trees of the present stock annually attaining maturity) is said to be calculated rests upon a misapprehension. The result, 719 trees per annum, is not far from correct owing to two compensating errors, and also, for some inexplicable reason, the provision of seven and one-half years fellings out of the existing stock of mature trees. The errors referred to are—

(a) the inclusion in the rotation of the 30 yrs., the period for which survival of mature trees is considered; and

(b) the exclusion from the rotation of the 20 yrs. during which seedlings attain a height of 5 ft.

The correct way to ascertain the number of trees attaining maturity each year is to divide the number of trees of each diameter class which are expected to reach maturity by the number of years in which all trees will pass out of the class into the next highest class, thus—

$$\frac{9{,}472}{20} = 473 \qquad \frac{35{,}277}{27} = 1302$$

$$\frac{13{,}180}{30} = 439 \qquad \frac{21{,}567}{26} = 829$$

$$\frac{21{,}288}{27} = 788 \qquad \frac{?}{20} = \;?$$

That is to say, every year for the first 20 years 473 trees will reach maturity, then for 30 years 439 trees per annum, and so on.

The 13,178 mature trees already existing must either all be considered surplus stock, or, if fellings are to start immediately, 13,178 less the annual coupe is surplus.

A method is then given by Mr. Moore for determining the growing stock, which, it is stated, is the number of mature trees which must always be in the circle to produce the "increment" calculated. This has no reasonable foundation; it is merely a method of calculating the number of mature trees which must be on hand to provide seven and one-half years' fellings allowing for casualties, and expressed in symbols. Apart from this the surplus stated as 7,717 trees is wrong, since no account is taken of the number of first class trees attaining maturity during the seven and one-half years.

Again, the calculation to ensure disposal of the surplus stock is obviously wrong since it arrives at 626 trees per annum against an annual "increment" of 719 trees; it is unnecessary to go into the errors in detail.

The manner in which the maximum annual cut should be fixed is simply by consideration of the number of trees expected annually to attain maturity (i. e. 473 in each of the first 20 years, 439 during the next 30 and so on) and the number of mature trees already on hand (viz. 13, 178). In this case it would probably be fixed at 700 mature trees per annum for the period of the Working Plan (30 yrs.); this would be justifiable having regard to the fact that in so doing the surplus stock should be disposed of in about 50 years, while ample margin has been allowed for error in raising the rotation from the 122 years indicated to 150 years, and there seems every prospect that after 50 years have elapsed the number might be considerably raised.

Overconservative fellings have been and are undoubtedly often still indulged in in India as has been the case elsewhere, but unless dictated by silvicultural or other special conditions the removal of far less than the increment is not justifiable.

Mr. Barrington Moore's article does not bring out clearly that 28″ diameter was tentatively fixed as the exploitable size of the deodar, as was probably the case. Some such step has generally to be taken in preparing working plans in India, where data for a more scientific determination of rotation have not as a rule been collected.

PHENOLOGICAL RECORD, JUNE, 1910, MONT ALTO, PA.

So much is now being written in regard to forest influences, especially on floods, that the following phenological record is of interest. It is No. 1 of a series which has been inaugurated at the Pennsylvania State Forest Academy by Prof. I. T. Worthley.

DAY.	Temperature. Maximum. Open.	Maximum. Woods.	Minimum. Open.	Minimum. Woods.	Range. Open.	Range. Woods.	Within Shelter. Open.	Within Shelter. Woods.	Within Soil. Open.	Within Soil. Woods.	Moisture. Relative Humidity. Open.	Relative Humidity. Woods.	Evaporation. Open.	Evaporation. Woods.	Rain. Open.	Rain. Woods.	Weather.
	Degrees Fahrenheit.										Percent.		Cu. In. per Sq. ft.		Inches.		
1	60	55	52	50	8	5	51	50	56	53	100	100	distu	rbed	......	......	Cloudy. Moderate W. wind.
2	72	66	48	54	24	12	65	63	66	56	92	95	.19	.08	.12	.05	Night rain. Clear day. Mod. N. W. wind.
3	62	60	47	47	5	3	59	57	58	54	93	91	.09	.03	1.24	1.04	Night and a. m. rain. Clearing 4 p. m.
4	73	66	43	45	30	21	63	61	65	56	96	97	.32	.11	......	......	Clear, cloudless. Dew. N. wind.
5	distu	rbed	distu	rbed	......	......	62	61	61	56	97	99	.12	.03	.24	.11	Cloudy night. Rain 11 p. m. on S. wind.
6	80	72	56	55	24	17	64	64	63	58	94	96	.34	.12	.17	.13	Night rain. Day clear. Wind N. & N. W.
7	68	65	51	52	17	13	62	60	64	56	85	86	.51	.13	.07	.02	Night shower. Clear a. m. Cloudy p. m. W.
8	78	70	41	45	37	25	60	60	66	57	99	99	.43	.24	......	......	Clear. Almost cloudless. W. & N. W.
9	72	68	48	53	24	15	56	56	62	56	100	100	distu	rbed	.21	.09	Morning cloudy. Rain 2 p. m. on W. to S. W.
10	64	60	52	51	12	9	62	60	65	56	92	94	.14	.00	1.17	1.00	Night hard rain. Cloudy day. S. E.
11	65	58	52	50	13	8	60	57	65	57	100	100	distu	rbed	trace	trace	Cloudy day. Rain late afternoon. S. & S. E.
12	68	64	52	50	16	14	66	63	66	59	96	98	distu	rbed	.20	.08	Night rain. Cloudy day. No wind.
13	70	64	54	56	16	8	66	63	65	59	96	97	.29	.01	......	......	Cloudy, clearing later. No wind.
14	76	70	53	55	23	15	70	67	68	60	99	99	.23	.07	......	......	Hazy and sultry. No sun or wind. Halo.
15	84	76	58	60	26	16	72	70	72	62	99	99	distu	rbed	......	......	Sultry. Cloudy. Wind light, W. & N. W.
16	77	71	63	63	14	8	66	64	68	63	100	100	.01	.00	2.20	2.00	Heavy storm night and afternoon. S. W.
17	84	70	60	63	24	7	70	67	72	63	92	96	.11	.02	.22	.15	Night rain. Day clear, sultry. High stream. N. W.
18	87	75	62	63	25	12	73	71	74	64	90	95	.26	.10	......	......	Cloudy, hazy. Wind W. to S. to N.
19	87	80	60	62	27	18	73	72	76	65	91	90	.38	.17	......	......	Clear, sultry. Halo. Wind light, N. W.
20	92	83	63	68	29	15	85	79	82	68	81	91	.36	.17	......	......	Hazy, sultry. Halo. Wind light, N.
21	94	81	67	69	27	12	80	76	80	66	90	96	.32	.16	......	......	Hazy, sultry. Halo. Wind light, N. E.
22	92	82	64	66	28	16	78	75	77	66	91	96	.34	.14	......	......	Late afternoon lightning, thunder. S. E.
23	95	85	65	70	30	15	84	78	78	66	84	95	.38	.18	......	......	Clear. Heat oppressive. Dusty. N. & N. E.
24	87	80	66	68	21	12	71	70	72	65	74	80	.38	.22	......	......	Clear, cool. Dusty. Breezes, N. E. & E.
25	82	76	54	58	28	18	78	72	72	64	74	88	.35	.22	......	......	Cloudy. Dusty. W. & S. W.
26	83	73	58	60	25	13	73	70	72	64	80	91	.41	.23	......	......	Cloudy. E. & S. E.
27	86	79	63	63	23	16	76	73	74	64	91	95	.29	.16	trace	trace	Night, light shower. Cloudy. W. to S. W.
28	87	76	66	65	21	11	84	74	74	65	70	91	.18	.01	.42	.27	Thunder shower, heavy, 4.30 a. m.
29	94	76	58	62	36	14	71	70	74	65	94	99	.46	.20	......	......	Clear. Cloudless. Night breeze. N. W.
30	90	78	61	67	29	11	75	72	69	64	91	87	.41	.19	......	......	Hazy. Sultry. Wind light, N. & N. W.
Average,	......	......	......	......	23	13	69	67	69	61	91	95	.29	.12	Total		Normal mean precipitation for June in
Extremes,	95	85	41	45	......	......	......	......	......	......	......	......	......	......	6.26	4.91	Franklin Co. = 3.85 inches.

CURRENT LITERATURE.

A Brief History of Forestry in Europe, the United States and other Countries. By B. E. Fernow. Toronto, 1910. 438 pp. $2.50.

This volume has been reviewed in its incomplete state (lacking the history of the United States) in *F. Quart.* vol. V, p. 54. The foreign professional press has since brought four reviews from competent pens.

Dr. Schwappach, himself the author of a history of Germany, fills six pages of the *Forstliche Rundschau* with abstracts from the volume, covering several countries, without comment. Of several other countries he says:

"The forest history of these countries is generally only brief and little satisfactory: destruction of virgin treasures on one hand and feeble beginnings of better management on the other. Yet the study of these conditions too, under the guidance of the interesting expositions of Fernow, is very instructive."

Prof. W. R. Fisher in the *Quarterly Journal of Forestry* devotes seven pages to a more critical review, from which the following extracts are taken.

"Dr. Fernow's History of Forestry is a welcome and important addition to our literature, and it is the first account of the subject in English."

"Fernow writes admirably about German forestry, with which he is thoroughly acquainted." Three pages of extracts follow.

"On turning to Fernow's account of French forestry, it is evident that he has not studied that subject sufficiently. While giving the French full credit for the admirable work they have done in planting, also in controlling mountain torrents by planting bare hillsides, he says that outside these works French foresters have not developed forestry to any noticeable extent. Those acquainted with French forestry know that this is not correct." No special basis for this exception is given except the following:

"Fernow is not sufficiently posted up in French forest literature, which includes besides the books he mentions a very comprehensive work on forest technology by Mathey, and treatises on silviculture by Mouillefert and Fron, besides the splendid Economie Forestière by G. Huffel to which he has referred."

(These volumes were published after the chapter was in print.)

"He also omits to mention the best French forest magazine, the Bulletin de la Société forestière de Franche Comté et de Belfort, which can compare in excellence with any European forestry magazine." "The French have abolished all rights to litter in forests, though such rights still persist in some German forests."

"A very full account is given of Indian forestry, though even here the author is misinformed in stating that the Provincial Service is to *some extent* recruited from the natives. Except in Burma it is composed *principally* of natives of India."

"We have no space for further reference to this comprehensive history, and we can only hope that the author will be able soon to publish a second edition in which the inaccuracies referred to may be corrected." Such a corrected edition will probably appear within a year.

The *Revue des Eaux et Forêts* reprints in translation the review of Prof. Fisher in addition to one furnished by M. Ch. Guyot, Director of the forest school at Nancy. Naturally this reviewer, too, finds fault with the lack of praise for French forestry, and naturally with more feeling, yet in perfect good tone. The simple statement of fact, that "French forestry literature has never been prolific and to this day occupies still a limited amount of shelfroom," meets with the retort that in such matters it is not quantity, but quality, that one must examine.

In the end, however, the reviewer agrees that "from certain points of view and to a certain measure we deserve this unfavorable impression of our forests and forestry on the part of strangers." Lack of self-appreciation by Frenchmen and lack of traveling in foreign countries due to parsimony, account, in part, according to the reviewer, for this misjudgment. "If, to give ourselves a better appearance, it were possible for the administration to endow our educational institutions better; if especially the only French forest experiment station were in personnel and material direction developed for the important service which it would then be able to render to our forests, then we would not have to complain as regards the too small place which M. Fernow has assigned to us in his history, but, on the contrary, we would have to thank him for the service which without intention he would have rendered us."

The review of Dr. Fankhauser in the *Schweizerische Zeitschrift für Forstwesen* is in entirely different tone. "With great skill has the author brought the voluminous material into a relatively small volume and yet has brought out everywhere the essential in clear and easily intelligible exposition in such a manner that one obtains a good insight into existing conditions. The chapter devoted to Switzerland shows us clearly how exhaustively the author has utilized the more important literature and how excellently he has understood to orient himself in complicated conditions."

"The greatest interest naturaly attaches to the forest history of the United States, especially when it is considered how recent the attempts to secure an orderly forest management. A telling proof of the remarkably rapid and healthy development of forestry in America is to be found in this very volume which sprung from the young American movement, fills already an important lacuna in forestry literature of the world."

We believe that these extracts from competent reviewers will suffice to assure the reader of the value of the book.

J. H. W.

Report of the Minister of Lands and Forests of the Province of Quebec, for 1909. Quebec, 1910. 202 pp.

In the section of Woods and Forests is found, besides the usual statements of revenue collected in various forms, which for the year in question remains below the million dollar mark, the first annual report of the Forestry Service, as well as of the Bureau of Forestry. There are 67,428 square miles under license, from which 554,000,000 feet B. M., a little square timber and other small material, besides 360,000 cords of pulpwood and nearly a million railroad ties were cut, the stumpage dues collected amount to $650,000, ground rents to $207,000 and the total collections to $906,360.

The organization of the forestry branch of the department is not readily intelligible. Apparently the Woods and Forest Branch is in charge of a Superintendent under the Deputy Minister of Lands and Forests, and in this branch the Bureau of

Forestry under a Superintendent and the Forestry Service under a Forestry Engineer (unfortunate nomenclature!) are independent sections, each reporting directly to the Minister. The bureau seems mainly to be occupied with the protection of timberlands against fire, on which subject a short report, illustrated by poor photographs, is submitted. In addition the officer in charge is also in charge of the Laurentides National Park.

The Forestry Engineer, Mr. G. C. Piché, seems to be engaged with six Forestry Agents and some sixty rangers to superintend the logging operations on the timber limits, or at least some of them, four counties containing 500 square miles being mentioned as under such charge, besides 400 square miles of unsurveyed country. A general description of the country, its topographic features, agricultural condition, industries and trade is followed by a short forest description, and history of its development is given.

It appears that through farm settlement since 1820 the 1,600 square miles of country have to the extent of 50 per cent. been settled. Of the 800 square miles of timber 25 per cent. has been burnt over, and the farms contain about 25 per cent. of poor woods.

A discussion on the existing lumbering and settling methods is followed by suggestions for the future, which call for an increase in technical staff; for an inventorying of the limits for the purpose of devising better methods of cutting; for studying rates of growth, reproduction, burning of refuse; for marking trees to be cut with varying diameter limits. The writer properly says: "It is better to spend our money in effectively protecting the forest," than in planting, which latter should be done only where protection against fire is assured.

A few suggestions how fire protection can be improved, a discussion on supervision over settlers' lots and local saw mills concludes this report, which furnishes an earnest evidence that the Province of Quebec will soon have developed a better forest policy.

That private endeavor in the Province has not been behind the government's beginning is shown by the publication, with comments by Mr. Piché, of a forest survey made by Mr. Lyford for the Riordan Paper Company, to which we hope to return later in detail.

Commission of Conservation, Canada. Report of the First Annual Meeting, Held at Ottawa, January, 1910. 216 pp.

Contains the act establishing the Commission, with amendments; the organization in committees and their brief reports; and the various addresses delivered at the meeting, namely, "Inaugural Address," by Hon. Clifford Sifton; address by His Excellency, Earl Grey; "Scientific Forestry in Europe: Its Value and Applicability in Canada," by B. E. Fernow; "The Conservation of Agricultural Resources," by James W. Robertson; "Possible Economies in Production of Minerals of Canada," by Eugene Haanel; "The Conservation of the Natural Resources of Ontario," by Hon. Frank Cochrane; "The Conservation of Water Powers," by Hon. Adam Beck; "Fish and Game in Ontario," by Kelley Evans; "Fur-bearing Animals in Canada and How to Prevent Their Extinction," by F. T. Coryden; "Measures for the Maintenance and Improvement of the Public Health," by P. H. Bryce; "Diseases of Forest Trees," by H. T. Gussow; "Insects Destructive to Canadian Forests," by C. Gordon Hewitt; "The Water Wealth of Canada, With Special Reference to the Ottawa River Basin," by Charles R. Coutlee.

Vermont Forestry Cards, Nos. 1, 2, 3, 4.

This is a novel way of reaching the public ear for conservation by giving information of everyday value on a postal card. The first card gives the number of second growth small hardwood trees required to make a cord, and connects this information with the waste entailed in cutting such trees. The second card gives equivalents of lumber and cordwood from logs of various diameters. The third, entitled "Compound Interest Made by a Log," shows that a 14-inch log contains double the amount of lumber of a 10-inch log, an argument for leaving the smaller trees. The fourth card gives shipping weights of various classes of lumber.

Forest Fires in Vermont. By Austin F. Hawes, State Forester. December, 1909. 48 pp.

Gives in detail reports of fire wardens, with calculations of the damage, which for four years has been estimated at $35,682, the expense of fire fighting as far as reported amounting to $11,209 additional. The different districts most liable to fires are discussed in detail, with maps, and in a summary the author discusses methods of improving conditions in fire fighting; his recommendations include the establishing of telephone lines, look-out stations, authority for the Forester to prescribe preventives in logging operations and better organization.

Statistische Nachweisungen aus der Forestverwaltung des Grossherzogtums Baden für das Jahr 1907. Karlsruhe, 1909.

This most instructive volume contains more than its title indicates, giving, as it does, a very complete statement of forest conditions of the country, which can boast the best financial results from its forest management. It is of special interest in view of the discussions with regard to an overstock of old stands and the propositions to reduce the same, which were briefed in this journal.

A general geographic description is followed by a discussion on the distribution of forest areas. With 38.6 per cent. of forest the country is one of the best wooded in Germany, with variations of 26 per cent. in the valley land to 57 per cent. in the Black Forest. The composition is half conifer, half broadleaf trees. Beech and Spruce represent each one-fourth of the total. Fir and Pine with Larch a little more than another one-fourth of the make-up; and Oak one-tenth. A little more than one per cent., say less than 2,000 acres, is devoted to exotic introductions.

The crown forests represent only 17 per cent., but 47 per cent. of municipal and corporation forest are also under direct management and control of the government.

It is interesting to note that the first working plans do not date back of 1836, when for timber forest the volume allotment method, for coppice simple area division was applied. Ten years later, at the first revision of the plans, an approach to the combined allotment method and also to a normal stock method was made, an attempt at securing normal stock conditions being prescribed. Soon the plans were made only for the next decade with a summary area distribution for the following periods.

In 1869, Heyer's method in general terms was adopted and has for the last 40 years been used. Every 10 years, age, increment, and stock is determined for each stand and the distribution of the total stock in the several age classes; then making a comparison between actual and normal stock for each age class, the budget for the next 10 years is determined. (See For. Quar. Vol. VII, p. 87.)

As normal increment is taken the increment at felling age of some well stocked and well managed stand with the actual species and system of management as basis. As actual increment the current increment for the decade was used at first, but later the actual average at felling age (as Heyer does). The average normal stock in the crown forests has been determined as 4,275 cubic feet, the average normal increment as 77 cubic feet (1.8 per cent.).

Silviculturally it is of interest to note that in the last 30 years an increase in conifer growth by 10 per cent. has taken place, partly by planting of waste places, partly by underplanting in deciduous forest; so that, while in 1876 conifer forest represented 40 per cent., in 1902 it had increased to 49 per cent.

Timber forest is the prevailing type in crown and municipal forest, with 95 per cent. in the first, 86 per cent. in the latter. In the whole country selection forest is represented by 7.7 per cent., but if the private forest area is excluded, not more than 1.6 per cent. is managed under this system. Natural regeneration, and that in long regeneration periods (see F. Qu. Vol. VIII, No. 2), is practiced on 80 and 70 per cent. respectively of crown and municipal forest, or altogether on 58 per cent. of the total forest area, leaving 26 per cent (47 per cent. on private forest) for a clearing system.

Favorable climatic and site conditions warrant the adherence to natural regeneration.

The rotations in the crown forests vary from 90 to 120 years for the bulk, in a few smaller areas up to 130 years. From the normal and actual stock data rotations of 111 and 108 years would be figured. These calculations are interesting in view of the lately brought charges that a surplus of old stock was on hand and should be removed. The opposite seems the case, namely, a discrepancy in stock of some 27,000,000 cubic feet. But in the distribution over the age classes, it is admitted, abnormality exists in that the age classes over 100 years are in excess, the others showing deficits. The cause is sought in the excessive fellings at the end of the 18th and the beginning of the 19th centuries, which were resorted to in order to pay war debts, the young age classes at that time established representing the present old stands.

Special attention in the management (and in the report) is given to a thorough utilization of the "light increment." It is recorded that a 120-year-old fir stand, site I, during the last 18 years showed an increment of 303 cubic feet per acre and year; a 111-year-old spruce stand, site I, an increment of 230 cubic feet; a 141-year-old beech stand, site II, opened up, an increment of 145 cubic feet.

In the crown forest the cut has in the last 30 years been increased from 61 to 93 cubic feet per acre (an increase of 53 per cent.). In the municipal forests also an increase of 34 per cent. is noted, to 85 cubic feet. The workwood per cent. has also risen from 40 per cent. to 50 per cent. in the crown forest, and to 45 per cent. in the municipal forest. There are considerable variations noticeable from district to district, the volume production varying from 24.3 to 187 cubic feet and from 49 cents to $13.98 per acre.

The average value of wood per cubic foot in 1907 was 6.9 cents for fuel and just double, 14 cents, for workwood. Since 1850, the average price of all wood has risen from 3.3 cents to 9.3 cents, or at the annual rate of nearly 2 per cent. compound for 57 years.

The gross returns have doubled in the last 30 years to $8.99 per acre, and, since the expenses have not increased proportionately, the net revenue has risen more than 100 per cent, namely, from $2.45 in 1878 to $5.23 in 1907. In spite of the prevalence of natural regeneration the expense for cultures is 22.7 cents per acre, not less than the average of all other State forest departments with the exception of Saxony and Hesse.

All forest property of Baden is under surveillance, and, with a few exceptions, the municipal and corporation forests are directly managed by the State forest administration at the rate of one per mil of taxable forest value. Private property is only so far under control as to require a permit for clearing, which is rarely denied, especially when replanting is contemplated.

The question of forest taxation and its history is also specially discussed. In 1854, the basis for taxation was the value of 15 times the normal yield on the stump, which generally brought the tax to 4.4 per mil. In 1878 this was reduced to 2.8 per mil. Meanwhile the rise of wood prices produced a disproportion between agricultural and forest values, and the old rate was reestablished in 1880. The new tax law of 1906, which changes the real estate tax into an income tax, was not applied in forest taxation. Instead, the forest value is determined by using the average price for five years in calculating returns including thinnings, and, after deducting cost of normal management, capitalizing this net forest rent with four per cent. By this calculation the acre of crown forests represents a tax value of around $108, that of the municipal forests a tax value of $105.

The detail of administrative organization, system of education, salaries, etc., and many other points, are fully set forth and illustrated by tabulations of data. B. E. F.

Die Beschaffung des Kiefern-und Fiditensamens, einst, jetzt und Künftig. Von Oberförster Haak. Aus Mitteiumgen des Deutschen Forstvereins. 1909, No. 6. 32 pp., 2°.

This is an exhaustive treatise on all the practical questions which can arise in the use of the seed of the two species, the Scotch Pine and Norway Spruce, but much of it would also refer to other seeds. An extensive reference to the literature on the subject accompanies the very interesting account.

The author provides the following summary:

1. Much of the pine and spruce seed lately in the market has been of inferior value partly on account of undesirable derivation, partly on account of low germination per cent.

2. To obviate this dangerous condition a fuller utilization of home crops is necessary. It is possible to secure by proper installation seed out of cones before it has lost one per cent. of germination, and to conduct the drying process without any loss. The higher the germination the smaller amounts of seed will be required.

3. Not cheapness but goodness and proper derivation, it should be generally understood, must be the aim, and should be demanded by all users of seed. Not less than 85 per cent. germination should be acceptable.

4. Not only the number of plants but their quality and the assurance of success of a plantation depends on the quality of the seed; the plant per cent. is the decisive moment.

5. If a contract has been made at a certain germination per cent., say 85 per cent., and the dealer can finally furnish a better per cent., he should be allowed to furnish less quantity.

6. Under such rules a more intensive germinating test should be required, namely, 10 days instead of the usual 30 for pine, at which time, if the conditions were proper, the quality can be adjudged.

Very many details are given in the body of the text.

Forest Fires in Vermont. By Austin F. Hawes, State Forester. Publication No. 2, Vermont Forest Service, Burlington, Vt. 1909. 48 pp.

The initial step in enacting a Vermont forest fire law followed the disastrous fires of 1903. The next step was the establishment of the State Forest Service, closely following the wide fire damage occurring in 1908. This report purposes to give the results of the first four years' operation of the law; to point out the methods of fire prevention and control employed by the wardens, not only the effective methods but those having less practical results; to bring out any defects in the law and to make suggestions that will result in a more efficient and economical warden service.

In Part I a brief summary of the wardens' reports for the four years is given, together with the list of towns that either reported or failed to report for any one year. During this time 144 fires were reported from 90 towns.

Total area burned,	16,733 acres.	
Total estimated damage,	$35,682 56	
Total cost of extinguishing so far as reported,	11,209 13	
Causes were as follows:		
Burning brush or stumps,	27	18%
Hunters and fishermen,	20	14%
Railroads,	9	5%
Incendiary,	19	13%

"Cause unknown,"	65	45%
Miscellaneous, ...	9	
including the following named causes: Automobile, balloon, berry pickers and saw mill.		

Part II gives by counties and towns the amount paid by the State for fire claims in 1908. The State pays any amount expended by a town in excess of 5% of the grand list.

The total cost of these fires was $9,039.32.

The total cost to the State, 20 towns, was $5,962.89.

The total cost to the towns not having State aid, 70 towns, $1,789.92.

Thus where State aid was required 66% of the expense was borne.

Part III deals with the field investigations conducted during the summer of 1909.

The State was divided into fire districts. The five that sustained the worst fires were visited and the area of each fire mapped. A full report of the fire, its cause, history, method of combating, efficiency of the officers in charge, attitude of the people towards fires, estimate of damage, including merchantable and unmerchantable hardwoods, and conifers and young reproduction, and various other details were obtained and embodied in the report for each district, together with a general description of the district covering industrial, agricultural and forest conditions. Maps of each district showing the location of all fires visited, both for 1908 and older fires, are inserted.

The illustrations given are applicable to Vermont conditions. Fire wagons, such as are used in Massachusetts and which might be used in a few of the more thickly populated regions, as well as where roads and distances will permit, are shown. Also a complete set of a system of lookout stations and towers which are proving their usefulness in Maine and New Hampshire.

Part IV embodies a summary of the results obtained and the recommendations that it is believed will improve the efficiency of the forest law.

Briefly it was found:

1. That the mountainous districts suffered the most damage

2. That the chief cause of fires is carelessness due to hunters, clearing land or smokers.

3. That unless a season of prolonged drought occurs there are very few fires of any account.

4. That hardwood belts should be maintained wherever possible, as one means toward protecting coniferous forests.

5. That on steep slopes the soil is usually totally destroyed, precluding any further reproduction.

6. That where the damage to soil is not so severe, all valuable reproduction is killed or overcome by a heavy seeding of poplar, cherry, birch, blackberry and raspberries.

7. That in many cases the scene of the fire was reached too late for greatest efficiency and economy of labor, or that fighting ceased before the fire was entirely extinguished.

8. That in bad fire districts the present warden is inadequate because of the rough topography, distance of warden's home or lack of telephone communication. Thus, often no recognized official is in charge. Lack of permanency in holding the office means inexperience and absence of a warden or recognized official results in inadequate expense accounts. Based on the results of this report it is suggested that the State forest law be amended in the following manner:

1. So as to allow all wardens $2.00 a day for time spent in connection with their duties as wardens whether actually fighting fires, investigating suspicious smoke, patrolling in danger seasons, writing report or other work looking to the prevention of fires.

2. To give the State Forester authority to divide towns, where he believes there is particular danger from fire, into two or more districts and appoint in each district an assistant or district warden who shall serve for a year, but be under the authority of the first selectman. The aim would be to reappoint from year to year, during good service, the same men, just as will be done in the unorganized towns, so that there will be in these bad fire districts men of experience to assist the first selectman in his work.

3. That the State Forester be authorized to expend out of his appropriation such moneys as the Board of Agriculture and Forestry recommend for the maintenance of a telephone at the house of any permanent warden, and for paying the expenses of

such wardens as he may invite to a local meeting for the discussion of fire problems. This would not be an additional expense to the State, and has for a precedent the meetings of road commissioners; it is also along the line of the Massachusetts law, where a special appropriation of $2,000 is made for this purpose.

Most of the serious fires burned largely in cut over land and gained in this slash a heat and momentum which not only damaged the reproduction but enabled them to sweep through adjoining forests. The lumbermen of New York, who suffered so much by fires in 1908, secured the passage of a law compelling the lopping of the branches of all softwood trees from the tops at time of lumbering. This is so that the tops will come in contact with the soil, and being covered with snow, will soon rot so that they will not be a menace for fires in the future. This is rather a drastic law and I would suggest the following modification for Vermont:

4. Whenever a forest owner believes that his property is to be endangered by the lumber operations on a tract nearby, he may complain to the State Forester when such operations are beginning. The State Forester shall cause all such complaints to be examined, and if he shall so order, the branches of all softwood tree tops being lumbered shall be lopped. Upon neglect of the owner to carry out the instructions of the State Forester within a specified time he shall be subject to a fine of not over $500. The payment of such fine shall not in any way release him from suit for damages should he be responsible for fire thereafter. It would rarely be necessary to require the lopping of these tops on any considerable areas. A strip one hundred yards wide on the side next the complainer would usually be sufficient, but the width of the strip would depend upon the topography.

The Forest Commissioner in 1908 had great difficulty in auditing the fire bills because many of them were sent in long after fires which he knew nothing of at the time they were burning.

5. The law shall oblige the first selectman to notify the State Forester as soon as the expense of fire fighting for a calendar year reaches $100, and the State should not be obliged to pay toward the fighting of any fires which occur before such notice is given.

6. Whenever any lumber company or group of forest owners

are willing to go to the expense of incorporating such a station and connecting it with the necessary telephone service, the State forester shall be authorized to spend money from his annual appropriation for maintaining a watchman at such station during such period as the State Forester may think advisable.

W. K. W.

"Forest Conditions in Virginia and Proposed Measures for Forest Protection." By W. W. Ashe, Forest Assistant, U. S. Forest Service. House Document No. V. Communication from the Governor of Virginia. Richmond. 1910. 20 pp.

The information in this circular was collected by the Forest Service in co-operation with the State of Virginia, the object being to outline a practicable forest policy for the State and to propose needed legislation. The author discusses the present forest conditions and shows that the maximum lumber cut has been reached and is at present maintained only by cutting smaller and smaller trees each year. The present output is approximately three times the annual growth, while fires and improper methods of lumbering are steadily reducing the present small increment. Within twenty years the industrial concerns which are dependent upon forest products will have difficulty in obtaining their supply of timber within the State.

Just criticism is made of the radical change in logging operations. The former custom of culling the larger trees has been superseded by the present clear cutting system, which not only increases the fire danger but leaves few or no seed trees, changes the character of the forest types, and reduces the value of the next crop. If the State will educate the land owners to protect their 15,000,000 acres of forest lands from fire and institute proper methods of management, a shortage in the timber supply may be avoided and the present cut maintained.

The author, in his proposed forest policy, advocates a law which will provide for the appointment of a State Forester, the establishment of educational courses in forestry in the colleges and schools, and lectures at farmers' institutes throughout the State, the employment of fire wardens in localities where fires are most dangerous, the revision of the system of taxation of forest lands, and the maintenance of municipal and demonstration forests. J. H. F.

"The Farm Forests of Virginia and Recommendations for Their Improvement." By W. W. Ashe, Forest Assistant, U. S. Forest Service. Richmond, Va. 1910, 12 pp.

This circular, published by the Commissioner of Agriculture of the State of Virginia, is intended to present to the people of the State in convenient form directions for the management of their farm forests. It was prepared chiefly from data obtained in a study made by the Forest Service in co-operation with the State.

There are approximately 10,000,000 acres of farm land, or two-thirds of the State, in forest, which should be improved so as to be of profit to the owners. A brief description is given of the forest types found in the State, followed by simple but excellent recommendations for treating the different types. The necessity for fire protection is strongly pointed out. Farmers are advised to plant up areas of waste land during the winter months when they can not attend to other farm work. The necessity for educational work is emphasized.

This circular is not a handbook to tell Virginia farmers how to carry on all kinds of forest operation; it is rather a preliminary treatise intended to show the thoughtful people of the State the importance of developing and maintaining woodlots in conjunction with farms, and how this may be done profitably. It should receive the careful attention of all persons who have the economic welfare of the State at heart.

J. H. F.

Fifth Annual Report of the Forest Park Reservation Commission of New Jersey, for the Year Ending October 31st, 1909.

This report emphasizes the fact that the important problem in New Jersey at the present time is to control forest fires, and that it is useless to advise forest plantings or to urge that woodlands be cared for until adequate fire protection can be assured.

During the official year ending October 31st, 1909, 563 forest fires were reported, burning 93,525 acres, causing a damage of $133,944. The cost of the Fire Service for the year was $13,772.

This shows a greater number of fires than was reported for any previous year. This is due mainly to the incompleteness of earlier reports. The efficiency of the present organization is well shown and its existence justified by comparing the average number of acres burned over for each fire and the amount of damage done during the three years since its inception, compared with previous years. During the last three years the average number of acres burned over was 112, with a damage of $166 per fire, while the average for five previous years reported was 1,155 acres, with a damage of $4,636.

Of the 563 forest fires reported, 8% burned less than one acre, 38% less than 10 acres, 77% less than 100 acres, 94% less than 500 acres, and only 3% more than 1,000 acres.

One hundred and forty-five of these fires were caused by locomotives, 62 by brush burning, 55 by smokers, 14 incendiary, 30 miscellaneous and 257 unknown.

Only 11% of the fires were due to brush burning, as compared with 25 to 30% for previous years. This shows that the law requiring permits for burning brush near a forest is being vigorously enforced. Three thousand four hundred and twenty-five of these permits were issued during the year.

Forty-seven per cent. of the known causes of fires were due to locomotives. This is a "serious indictment" and justifies the action taken by the Forest Commission in the law of 1909 with regard to the establishment of fire lines along railroads where they traverse forests. The report contains illustrations and descriptions of these fire lines. The whole work of construction is to be done by the railroads and at their expense within five years, one-fifth to be finished each year. The total length to be cut by March 1, 1910, by the different railroads in the State was 179½ miles. The result of this attempt to lessen the number of fires started by locomotives will be awaited with interest.

The report gives a description of the organization of the Forest Fire Service as amended by the law of 1905 and states the duties of each official.

Of the 2,000,000 acres of forest land in New Jersey only 9,897 acres are now owned by the State. It is not the aim of the Forest Commission to acquire large tracts of land, but to "confirm and strengthen private forest interests," and to manage the State lands as demonstration areas.

The report closes with a description of the different activities of the Forestry Department outside of fire protection and the management of the State forests and with a statement of the needs of the department for the future.

J. A. F.

OTHER CURRENT LITERATURE.

Proceedings of the First Convention of Pennsylvania Foresters. Held at Harrisburg, March, 1908. 1910. 49 pp.

Published by the Department of Forestry. Contains fourteen papers on various problems of interest to the State.

Forest Conference Under the Auspices of the Society for the Protection of New Hampshire Forests. August, 1909. 33 pp.

Contains five addresses, among which is one on Taxation of Forests of Professional Interests.

Der Waldbau. Von Dittmar. Neudamm. 1910. 279 pp. *Mk.* 4.50.

While intended for every class of foresters, it is apparently written for underforesters; without special merits.

Das Holz. Von H. Kattmeier. Leipzig. 1910. 143 pp. *Mk.* 1.25.

Intended for laymen, but in the chapter on wood trade, written by a tradesman, are things of interest to foresters.

Natur und Kurst im Walde. Von Theodor Felber, 2nd edition. Fraüenfeld. 1910. 134 pp. *Fr.* 4.

Of value to those who desire to foster the beautiful in the forest, as in municipal forest parks, etc.

Der Wald als Erzieher. Von R. Düesberg. Berlin. 1910. 204 pp. *Mk.* 5.

A philosophical discussion which has attracted a great deal of attention in the country of its author. It discusses silvicultural and managerial problems and political economy questions in an original somewhat revolutionary and idealistic manner.

Studies in Ornamental Trees and Shrubs. By H. W. Monroe. 74 pp. Illustrated. Berkeley, Cal., 1910. (University of California publications, botany, Vo. 4, No. 1). Published to supply the demand for information concerning the better sorts of ornamental trees and shrubs adapted to California.

City Tree Planting; the Selection, Planting and Care of Trees Along City Thoroughfares. 26 pp. Illustrated. Detroit. 1910. (Detroit City Plan and Improvement Commission. Report No. 1.)

Native Trees of Kentucky; a Handbook. 140 pp. Illustrated. Kentucky Federation of Women's Clubs. 1910.

Tree Culture. 35 pp. Illustrated. Stillwater, Okla. 1910. (Oklahoma Agricultural Experiment Station. Bulletin 86.)

The Trees of California. By W. L. Japson. 1909. 228 pp. Illustrated. Cunningham, Curtis & Welch. San Francisco.

Gold Coast; Report on Forests. 238 pp. Illustrated, map. London. Wyman & Sons. 1910. (Colonial Reports, Miscellaneous. No. 66.)

Reports on Certain Continental Forests. By F. L. Cowley-Brown. 83 pp. Illustrated. Madras. 1908. (India Madras Presidency—Forest Department.)

Tables Showing the Progress in working Plans in the Provinces Outside the Madras and Bombay Presidencies Up to 31st December, 1908. By A. M. F. Caccia. 44 pp. Calcutta. 1910. (India—Forest Department—Forest Pamphlet No. 9.)

Progress Report of Forest Administration, 1908-09. 23 pp. Calcutta. Superintendent Government Printing. 1910. (India-Andaman Islands—Forest Department.)

Progress Report of Forest Administration in Baluchistan, 1908-09. 41 pp. (India—Baluchistan—Forest Department.) Calcutta. Superintendent of Government Printing. 1909.

Orange River Colony—Department of Agriculture—Forestry Division. Fifth Annual Report, 1908-09. 56 pp. Blomfontein. 1909.

India—Forest Department—Review of Forest Administration in British India for the Year 1907-08. 1910. 54 pp. Superintendent of Government Printing. Calcutta, India.

Philippine Islands—Bureau of Forestry. Annual Report of the Director of Forestry, 1908-1909. 1909. 20 pp. Manila, P. I.

Instructions for Making Forest Surveys and Maps. 1910. 51 pp. Illustrated. Forest Service. Washington, D. C.

Table for the Measurement of Logs. By N. W. Spaulding. 1909. 20 pp. California Saws Works. San Francisco.

The Preservative Treatment of Farm Timbers. By C. P. Willis. 1910. 19 pp. Illustrated. Farmers Bulletin 387. U. S. Department of Agriculture.

Hail Injury on Forest Trees. By F. J. Phillips. 1910. 8 pp. Illustrated.

Transactions of the Academy of Science of St. Louis, Vol. 19. No. 3.

The Beech. By S. W. Maury. 1909. 16 pp. Illustrated. Nunemacher Press, Louisville, Ky.

The Gingko. By S. W. Maury. 1909. 15 pp. Illustrated. Nunemacher Press, Louisville, Ky.

Studies of Fruit and Nut Bearing Trees. By E. R. Mosher. 1908. 52 pp. Illustrated. C. W. Bardeen. Syracuse, N. Y.

Studies of Our Cone Bearing Trees. By E. R. Mosher. 1909. 34 pp. Illustrated. C. W. Bardeen, Syracuse, N. Y.

Studies of Our Oaks and Maples. By E. R. Mosher. 1909. 14 pp. Illustrated. C. W. Bardeen, Syracuse, N. Y.

The Planting and Care of Shade Trees. 82 pp. Illustrated. Forest Park Reservation Commission, Paterson, New Jersey. State Printer. 1909.

Indiana State Board of Forestry. Ninth Annual Report, 1909. 88 pp. Illustrated. Indianapolis, Ind. 1910.

Wood Preservers' Association. Proceedings of the Sixth Annual Meeting, 1910. 168 pp. Galesburg, Ills. 1910.

Notes on the Legal Aspects of the Conservation Problem. 20 pp. Denver. Colorado Scientific Society. 1910.

Conservation of Natural Resources; Special Message of the President of the United States Transmitted to the Two Houses of Congress, January 14, 1910. 11 pp. Government Printing Office. Washington, D. C.

Quebec—Department of Lands and Forests. Report for the Twelve Months Ending 30th June, 1909. 202 pp. Plates. Quebec, 1910.

The Blue Pine "Polygraphus" Bark Borer. By E. P. Stebbing. 7 pp. Illustrated. India—Forest Department. Leaflet No. 5. Calcutta. 1910.

The Large Deodar Bark Borer. By E. P. Stebbing. India—Forest Department. Leaflet No. 4. Calcutta. 1909.

Burmese Leza Wood, Lagerstroemia Tomentosa. By R. S. Troup. 1909. 6 pp. Illustrated. Forest Pamphlet No. 10, Department of Forestry. Calcutta, India.

Carallia Wood (Carallia integerrima). By R. S. Troup. 1909.

9 pp. Illustrated. Forest Pamphlet No. 11, Department of Forestry. Calcutta, India.

Special Relations of Forests to Rivers in the United States. By W. W. Ashe. 21 pp. Government Printing Office. Washington. 1909.

Outline for Lectures on Forestry. By Austin Cary. 12 pp. Albany, N. Y. 1910. (New York—Forest, Fish and Game Commission. Bulletin 5.)

PERIODICAL LITERATURE.

GEOGRAPHY AND DESCRIPTION.

Swiss Reboisement Work.

That the efforts to secure rational conservation of resources meet opposition in other countries than ours which have more need for it, appears from an article of Prof. Decoppet, in which he relates the struggle in the Canton Tessin from 1876 to 1908 to secure rational management.

During this period nearly $400,000 (55% contributed by the Bund, 20% by the Canton) have been spent in checking torrents and avalanches and reforesting waste mountainsides, which per unit of area is three to ten times as much as other cantons have spent.

A commission was instituted to investigate the reasons for this disproportionate expenditure.

The success of the reboisement work in the Val Colla is shown by word and picture: "Who has not known the former conditions of the region cannot imagine to-day what it was. The region, formerly desolate and continuously giving rise to apprehension in the lower valleys, is now a pleasing landscape with numerous successful forest plantations." Here, the people had proper appreciation of the value of the work. Elsewhere inimical disposition of the people fearing curtailment of grazing privileges rendered the work difficult and willful interference was frequent. To overcome these private interests, a new law provides for purchase of State (cantonal) forest areas.

The Commission criticizes the management of the reforestation areas and pleads for a better support of the foresters by the magistrates.

Ueber die von 1876 bis 1908 im Tessin gemachten Verbauungsarbeiten. Schweizerische Zeitschrift für Forstwesen. March, 1910, pp. 73-82.

Timber Resources of Japan.

Although Japan supports a dense population most of the area is mountainous with an abundant supply of timber. Lumbering is done in a small way, and the timber is rarely cut into lengths exceeding 10 to 12 feet. In towns and cities it is handled in log form or split log form, the logs are stood on end in the yards and all material is cut to order. Where it is handled in board form it is sold in small shops much as sugar or flour. Little of the lumber used exceeds one-half inch in thickness, and much is less. Timbers, large and small, are put together by mortising, and no iron of any sort is used in many of the largest buildings. Japan produces oak which rivals the best in the United States, and exports both to China and the United States. At Nikko the empire maintains a wonderful plantation of Cryptomerias which is nearly 200 years old and contains trees said to be 300 feet high. Mature trees are cut and replaced by planting.

American Lumberman. March 26, 1910.

Timber of Virginia.

Virginia has about 15,000,000 acres of forest land which is equal to 58 per cent. of the area of the state. One million acres are covered with virgin forest; 800,000 acres are badly burned brush or waste land, of which 200,000 acres can be developed. Cutover land is restocking slowly on account of fires. At least 2,000,000 acres are held by farmers, and this represents more than three-fourths of the $100,000,000 capital invested in the forest lands of the state. In 1900, the average pine log in the Norfolk district was 16 inches in diameter while at present it is only 14 inches.

The annual lumber cut of 1,200,000,000 board feet at present is four times what it was in 1880, and represents at least three times the total annual growth. Two-thirds the lumber is supplied from old growth. The principal increase in cut has been for paper pulp, tanning extract, railroad ties, mine timbers and poles.

American Lumberman. March 5, 1910.

Minnesota's Forests.

Originally there were approximately 28,000,000 acres of forest in Minnesota of which conifers covered 18,000,000 acres. At present there remain 15,000,000 acres of forest land covered with merchantable timber of various kinds. Sawlog timber of all species aggregates 20,968,902,000 board feet and is found in 21 counties. In the past thirty years 40 billion feet of timber have been cut, and the present cut is about one billion feet annually. The State Forestry Board has charge of three forest reserves as follows: Pillsbury forest of 1,000 acres near Cass Lake, of which 200 acres have been planted with conifers, Burnside forest of 20,000 acres in St. Louis county, and the Itasca state park of about 15,000 acres. In addition, the State has acquired 2,700 acres in the Fond du Lac Indian Reservation in Charlton County, which will be made a forest experiment station. The State is authorized to buy land for forest reserves, but no money has been appropriated for this purpose. The United States owns the Minnesota National forest of 294,752 acres near Cass Lake and the Superior National forest of 909,734 acres in the northeastern part of the state.

American Lumberman. March 19, 1910.

Forest Resources of Louisiana.

Louisiana has an area of about 28,000,000 acres, 13,000,000 acres of which are alluvial. The remainder is upland largely under the protection of levees. Approximately 4,269,928 acres is in pine lands; 9,000,000 acres in cypress; and 3,338,486 acres in oak, gum, willow, persimmon, hickory, magnolia, beech, elm, sycamore and poplar. In 1908 there were estimated to be 516 saw-mills with a cut of nearly 3,000,000,000 feet of lumber.

The Lumber Trade Journal. May 1, 1910, p. 17.

Tropics Future Source of Construction Timbers.

After six years' experience in the Philippines as an ecologist and forester, Dr. H. N. Whitford concludes that:

1. The virgin forest area of the Philippines comprises approximately 40,000 square miles or about one-third the total area.

2. Seventy-five per cent. of the virgin forest area (30,000 square miles) is covered with forests in which the members of the dipterocarp family predominate.

3. The members of the dipterocarp family, comprising an average of 75 per cent. of the volume, can, from a forester's and lumberman's standpoint, be divided into three tree groups, viz., the hard and durable yacals, the apitongs, and the lauans.

4. The apitongs and lauans can furnish by far the greatest amount of timber. The apitongs can be favorably compared to

the hard pines in general mechanical properties, the lauans, to the soft pines.

5. From many standpoints the dipterocarp family is to the Philippines what the pine and oak families are to the United States and other temperate countries.

6. Success in virgin forest growth should be measured in terms of bulk or bulk and annual increment combined.

7. The nearer the climatic, edaphic, and biotic conditions reach the optimum, the heavier the bulk of the forest and the simpler the systematic arboreal composition.

8. If measured in bulk alone, some temperate regions as compared with the Philippines show greater success in forest growth. If annual increment is used in combination with bulk, the forests of the Philippines will compare favorably with forest growth in temperate regions.

9. If the tropics in general are like the Philippines in the above respects, they can be depended on to produce woods to compete with general construction timbers grown in temperate regions.

10. An inventory of the forest resources of other tropical regions will give scientific and economic results of great importance.

The important points, from a forester's standpoint, brought out by this article are: (1) That 75 per cent. of the volume of Philippine saw timber is composed of trees belonging to the family Diptocarpaceae, which will furnish lumber to serve the same purposes, in general, as the pines and oaks are used for in the United States. (2) In volume the Philippine forests do not attain such a great yield per acre as certain portions of northwestern United States. (3) "It is believed that the rate of growth in the tropics is much greater than in temperate zones, that generally speaking the softwood forest trees will reach maturity in one-half to two-thirds of the time they require in regions where climatic conditions inhabit growth entirely for a considerable part of the year." So that from the forester's standpoint of increment for future yields, the tropics in general and the Insular possessions in particular, offer a more profitable field for the growing of timber than do temperate climates. (4) It is extremely important that an inventory be completed of the forest resources of all tropical regions concerning the amount and character of the timber of which there is little reliable information. (5) If the tropics in general are like the Philippines in regard to timber resources, they can be depended on to produce woods to compete with general construction timbers grown in the temperate regions.

The Composition and Volume of the Dipterocarp Forests of the Philippines. Philippine Journal of Science. December, 1909. 22 pp.

BOTANY AND ZOOLOGY.

Change in Forest Types.

Wibeck has investigated by inquiry and search in literature and maps back to the 14th and 13th century, the question as to whether the beech in Sweden at its northern limit is being crowded out by the spruce.

The beech, originally the more valuable tree on account of the mast, was early protected; indeed, in 1414 or thereabout, cutting beech and oak was forbidden in the city forest of Waxiö, and in 1647 an ordinance was promulgated and again in 1725 ordering the planting of these species; but, by 1793, full liberty in their exploitation was given. Since then the beech has receded, owing to the opening up of the dense stands and deterioration of the soil, fire assisting. In the beech selection forest, spruce, beech, birch and pine in various proportions establish themselves, and finally the spruce becomes victor. Locally, bog formation by the encroaching of bogs into beech forest would lead to the same result. In clearing of beech forest, the birch with some admixture of spruce and pine becomes prominent. Sometimes heather comes in to be followed by juniper and finally by a return of beech or spruce or pine.

Where plant societies meet in relatively natural conditions the beech remains victor over oak, elm, basswood, ash; where no frost danger and the soil not too wet, beech also conquers in the pure birch forest, and also sometimes displaces pine, so that one type changes into the other according to circumstances.

The sequence of these changes and displacements is shown schematically.

While the beech in this zone of its distribution probably always occurred only in islands occupying favorable sites, it is now frequently displaced by spruce.

Meddelanden fran Statens Skogsförsöksanstalt. Haftet 6, 1910.

Variability of Spruce.

In a very detailed investigation from tree to tree on a limited area, some 141 spruces were carefully described by Nils Sylven especially with regard to branching form and position of leaves, form of cones and scales, and silvical characteristics. It was found that differences in these respects occur independently of each other so that it is difficult if not impossible to make a classification. Difference of branching alone seems to be hereditary. As regards branching habit five types were found and these types show also important silvical variations. The "comb" type (with pendulous twigs) was found to be less liable to fungus trouble and also more rapid in diameter growth, probably due to favorable exposure to light of the foliage of the hanging branchlets.

Meddelanden fran Statens Skogsförsöksanstalt. Haftet 6, 1909.

Ingrowing Phenomena.

Dr. Kanngiesser brings together pictures, classifies and explains the various forms of ingrowing which are apt to occur in the woods. Virgin woods, mismanaged woods, pastured woods, and hedges furnish most frequent examples. He distinguishes branch copulations, stem copulations, handled trees, two-legged trees, cross-barred trees, hanging trees, snail trees, spiral growths, the copulation of different species, and root copulations.

Literature references are given.

Verwachsungen. Allgemeine Forst-u. Jagdzeitung. April, 1910, pp. 123-128.

Cause of Insect Damages.

An interesting biological contribution is furnished by Prof. Wachtl in explanation of the frequent experience that in attacks by the nun certain specimens of spruce are not or less affected.

He points out that *Picea excelsa* has two distinct varieties—a matter unfortunately forgotten in silvicultural practice—which vary not only in descriptive characters of cones (*chlorocarpa* and *erythrocarpa*) and wood (hard and soft) but also in phenological regard, the soft-wooded, yellow-fruited variety leafing out later than its congener. This fact the author suggests renders it in part immune from the attacks of the early insect development. While he has not determined whether those immune trees invariably belong to the same variety, he cites the observation of having found on an early leafing spruce fully developed caterpillars of the nun, while other spruces were still in full winter rest. He believes the origin of insect pests to come from groups of early leafing variety, and accentuates the need of distinction between the two in silvicultural operations.

Neue Gesichtspunkte über die Ehtstehung von Nonnen Kalamitäten und die Mittel zu ihrer Abwehr.
Centralblatt f. d. g. Forstwesen. Apr., 1910, pp.145-151.

Anatomical Characters of Pine Wood.

Bailey has pointed out that in the evolution of modern pines from Cretaceous ancestors there has been a gradual modification of certain anatomical characters of the wood. Cretaceous pines as well as Prepinus were characterized by thick-walled ray parenchyma, piciform lateral ray pits, by the absence of marginal ray tracheids, and by abundant tangential pitting of the autumnal tracheids. In the development of modern species there is a well marked tendency for the disappearance of thick-walled ray cells, for the appearance of large lateral ray pits, for the development of marginal ray tracheids, and for the loss of tangential pitting of the autumnal tracheids. In as much as these modifying processes have progressed with varying degrees of completeness in living pines, variations in anatomical characters afford a basis for the classification and identification of pine wood. Especially is this true of the lateral ray pits. The large pits of *Pinus strobus* and *P. resinosa* have developed by the enlargement and fusion of numerous piciform pits of the ancestral type, such as occur in the nut pines of the southwestern United States and Mexico. Many intermediate steps in the transformation process exist in the hard and soft pines and are of diagnostic importance.

Anatomical characters in the evolution of Pinus. American Naturalist. May, 1910.

Nesting Boxes.

In German forests such birds as nest in hollow trees have for some years past been furnished with nesting places by hanging hollow billets of wood in trees. These last only two or three years and worst of all shrinkage of the bark may entirely close the opening, possibly imprisoning and starving the inmates.

Clay nesting boxes have recently appeared on the market and proven equally acceptable to the birds. They last well, are cheaper in price and in cost of hanging and afford better protection against squirrels and other predatory climbers by offering them no foothold.

Der Vogelschutz. Silva. May 13, 1910, pp. 148-9.

SOIL, WATER, AND CLIMATE.

Forest Cover and Temperature of Soil.

Since 1902, the Experiment Station of the Forest School at Nancy has carried on comparative observations upon the temperature of the soil under forest and in the field. The results of these observations were published by Mr. Cuiff, and Huffel quotes in his article the data obtained by Cuiff.

The observations were carried on by means of three series of thermometers which were located at depths of .20, .40, .60, and .80 meters in three places: under high forest, under shrubs, and in the open field, at a distance of 50 meters from the forest. The observations were continued from 1902 until 1905. They brought out, in addition to the generally known result that forests moderate the fluctuations of the temperature of the soil, also the fact that the average annual temperature of the surface of the soil is the same under tall and under low forest. In summer, however, the soil is perceptibly cooler under a low forest than under a high forest, while in winter the reverse is true. It has also been observed that the amplitude of the annual fluctuations generally decreases with the depth, and that it is narrower under a forest than outside of it.

In 1905, records were kept every two hours during 25 days. These records showed the daily fluctuations in temperature. It has been found that the amplitude of the daily fluctuations is less in the forest than in the field, and in a young forest it is greater than in an old one. Also that the maximum temperature is reached under an old forest later than under any other cover; in the open field it is reached earliest of all.

In 1907, the soil thermometers were transferred to the forest of Menelle in Vosges, where observations were begun on January 1, 1908. Observations were carried on also in three parallel series. The first series of soil thermometers was placed within a 100-year-old stand of spruce, the second, in a wind-fall which had grown over with brush, and the third, in a clearing within the forest. At these places observations were carried on also on the temperature of the air. Huffel states the results of observations for 1908 and makes the following conclusions:

(1) Soil covered with forest is cooler in summer, up to a depth of 80 centimeters, than a bare soil.

(2) In summer the temperature of the air in the forest is also lower than outside the forest, but the lowering of the temperature of the air in the forest is less than that of the soil.

(3) The disappearance of the forest perceptibly affects the temperature conditions of the air and the soil, which has been clearly demonstrated by the observations in the windfall.

Huffel's results do not, of course, add anything new to what has already been established by numerous observations in many different places throughout the world. They are merely illustrations and confirmations of the general results conclusively established by previous observations.

Influence du Couvert de la Forêt sur la Température du Sol. Revue des Eaux et Forêts. December, 1909.

Soil Physics Influenced by Species.

On the basis of five series of experiments and exact measurements under beech, oak and mixed oak and beech stands, Dr. Wallenbock determined the influence on soil conditions of these several types of forest, and shows clearly the superior favorable influence of the shady beech in the character of the soil flora, and increase of water capacity, and other physical soil conditions. He summarizes:

1. The physical conditions of forest soils depend on the species forming the stand and the soil cover depending on it; 2. The dead soil cover formed under the dense shade of pure beech forest increases water capacity of the soil in much greater degree than the living vegetation found in pure oak stands; 3. The effect of the soil surface due to the favorable influence of humus accumulations on physical conditions of stiff loam soil is experienced

under beech to three times the depth under oak; 4. With oak and beech in mixture the water capacity of the soil depends upon the percentic participation of the beech in the mixture, for upon it depends the degree of shade which represses the living soil flora in favor of a dead cover.

Bodenphysikalische Untersuchungen in Mischbeständen von Eiche und Buche. Centralblatt f. d. g. Forstwesen, April, 1910, pp. 151-156.

Effect of Lime on Humification.

Dr. Helbig reports on the results of a series of experiments made at the laboratory for soil physics in Karlsruhe to determine how lime in different forms and amounts influences the decomposition of dry raw humus of fir. Hitherto, it has remained undetermined whether decomposition of vegetable substance is favored or not by addition of lime. The experiments were made in pots, placed in the open, filled with fresh humus, and treated with different quantities of carbonate of lime, chemically pure, and of quicklime, and the investigation continued for four years.

From the tabulated findings the author concludes:

That lime favors mineralization of the dry humus in question, quicklime acting more rapidly than calcium carbonate.

With increase of lime decomposition was accelerated up to a certain optimum. Further additions produced decreased action. Proportionality of progress and quantities could not be determined.

Einwirkung von Kalk auf Tannentrockentorf. Forstwissenschaftliches Centralblatt. May, 1910, pp. 271-277.

Climatology and Vegetation in Colorado.

Robbins has made interesting comparisons between the distribution of vegetation in the various plant zones of Colorado and topographic and climatic conditions in these same areas. Variations in altitude, wind, precipitation, temperature, and humidity are seen to correspond to variations in the floras of the following plant zones, Plains, Eastern Lower Foothills and Mesa, Eastern Upper Foothills, Montane, Subalpine, Alpine, San Luis Valley, Middle Park, and Western Sage and Lower Foothills.

Climatology and vegetation in Colorado. Bot. Gaz. April, 1910, pp. 256-280.

SILVICULTURE, PROTECTION, AND EXTENSION.

Wagner's Strip Selection System.

Dr. Cieslar, having visited the district in which Wagner for the last ten years practiced his new form of selection forest, explains the rationale of the system with a view to its possible adoption in Austria.

The district Gaildorf lies in Wurtemberg (between Stuttgart and Nuremberg) in a hill country mostly on very good loam soil, comprising altogether not over 3700 acres divided into two ranges, the one to which the description applies of about 2000 acres.

The original stand was a mixture of .6 spruce, .25 fir and beech; younger stands below 55 years are pure planted spruce, except the youngest, which under Wagner's procedure have reëstablished the mixture. The fact that with a rotation of 100 years the age class above 80 years contains nearly 30% is most favorable to a method which requires a very large number of points of attack for securing the regeneration. Although the yield per acre is as high as 103 cubic feet (including thinnings), 54 of the 72 subdivisions, each in the average of 28 acres extent, are under operation, with 88 felling areas or regeneration fronts. A map illustrates the checkerboard location of these felling areas.

A preliminary statement points out that light, temperature, and soil moisture are the three factors which a manager can influence and should secure in optimum during the regeneration period; soil moisture especially is essential to secure regeneration, hence in rainpoor districts natural regeneration is difficult and in districts with large rainfall easy. Under the cover of nurse trees evenly distributed the crowns keep away much moisture and transpire much, so that the young growth is at a disadvantage. In group system on quiet days more rain is secured to the soil, less so on windy days. An uneven distribution of crown cover here is more favorable both as to light and moisture. In a strip system these advantages would be still greater, more rain and light reaching the regeneration, but if carried on as hitherto by fellings from East to West, to avoid windfall, late frosts, drouth, and strong insolation, loss of moisture to the regeneration from west and northwest rains are experienced. These considerations lead to Wagners strip selection system, beginning fellings on north sides in strips by selection and clearing the selection strip when regeneration is established, then progressing southward. While progress from northwest to southeast would be still more favorable from the point of view of moisture conditions, considerations of windfall prevent it. A detail examination of meteorological data is necessary to determine whether or how this procedure is applicable elsewhere.

Due to climatic conditions it can be accepted as correct, that in middle Europe everywhere the northwest and north sides of stands excel over all other exposures in ready seeding and regeneration, "the west sides, being exposed to winds, the south and east sides to sun are more or less sterile." By progressing with the fellings as Wagner does, from north to south, the regeneration can be secured even in regions where the precipitation is of modest amount, moisture, as the author elaborates, being the main factor of success. In Gaildorf, however, the precipitation is ample, 16 inches.

Wagner's proposition to proceed from north to south has according to him also the advantage that the regeneration on the north side is less exposed to late and winter frost, than the east and south exposure threatens. Snow accumulates on the north side and protected on the south side by the old stands, melts more slowly, occasioning more winter moisture; also the dew is here more frequent and persistent. Less damage from logging is also secured.

By choosing a strip method of procedure with the fellings the operation is kept on a small area and the regeneration period can be shortened, so that soon a change from overhead shade to side shade can be secured. The method also presents the great advantage that in the regeneration of mixed tolerant and intolerant species the former are reproduced in the opened-up stand under crown cover, thriving well, while the light-needing species like pine and the less shade-enduring like spruce regenerate by seed from the neighboring stand later under the side shade. This could be well observed everywhere as typical, the tolerant species securing the slight advantage in height growth which is needed by them.

The progress of the regeneration depends upon the success, which can be easily judged on the small areas; mistakes can hardly be made. When the strip is satisfactorily regenerated it is quickly opened up, the side shade being sufficient for the young growth. There are then three fellings, modified as needed: an uneven opening up of a strip as in a selection forest or group system, on the northside; then further opening up as the regeneration demands, while a second strip is opened up like the first; a removal felling. There are, therefore, eventually three strips of varying conditions or felling types at each point of attack.

If the regeneration develops favorably fellings are made every year, mostly however, every two or three years, and, if regeneration is slow, four years. The "regeneration fronts" extend for 500 to 1000 feet so that per front from 2500 to 5000 cubic feet are cut.

This method is to be sure applicable only where an intensive management and the maintenance of ample means of transportation are possible.

The silvicultural results are praised by the author without stint. Everywhere fir and beech is satisfactorily developed under the cover, while spruce is to be found as a product of side seeding in large numbers within the length of the timber height. It could also be observed that where east exposures had been opened up the regeneration was poor, a sparse beech growth without spruce.

For the conditions prevailing, then, the method must be considered a great success. But in less favorably located, mountainous territory its value, the author thinks, would be greatly limited, the variable wind danger and the cost of carrying so many felling areas make this intensive silvicultural system impracticable. Here, the principle of large area management is imperative. Only here and there may the conditions be favorable for the strip selection system.

Wagner's Blendersaumschlag. Centralblatt f. d. g. Forstwesen. Feb. 1910, pp. 49—.

Sowing or Planting.

During the last half of last century, planting, which before had been the exception, became the rule, crowding out not only the practice of sowing but of natural regeneration even where this was not necessary. Lately, lack of success with planting has somewhat modified the attitude towards sowing. Frömbling recalls the early history of this movement in Hanover.

Sixty or seventy years ago the custom of planting oak saplings, a number for each one cut and at various family festivals, was still in vogue in the oak pastures and in the Luneburg heath, the material being mostly secured by theft, if necessary, from natural sowings, and often of no value or promise, producing the runts of the well known "Hutewald."

Even after the plant material was grown in nurseries, the plantations of saplings with wide spacing to save expense, done with most painstaking care, were not of much more value.

Conifer planting, usually in bunches, dug with the ball out of sowings, was then so rare that it deserves no mention. Altogether, plantings were children of necessity only, until Biermans showed that all species, but especially conifers, could by fertilizing richly with ashes, be brought to rapid development in nurseries. This gave the impetus to a general extension of planting. Biermans was hailed as a prophet and became the most celebrated forester of the time. Thirty years later the writer came into charge of Biermans' district, and for eleven years had to work to remove the damage done by his experiments carried on on a large scale without proper consideration. Yet his influence was for good, and planting practice became general until now the results demonstrate where it has advantages and where not.

The advantages of planting have been overstated, and the disadvantages of sowing have also been overstated.

The author points out the well known, yet in practice often overlooked, law of the difference of inherited vigor in seeds and germs and the capacity for development of the different members of a stand.

The fear of the struggle for existence in a dense sowing is unjustified; it is the best means of Nature to preserve and improve species; where it is prevented, retrogression and eventual extinction is the consequence. These simple natural laws of development need more consideration in discussing the pro and con in the question of sowing or planting.

Unfortunately poor or good endowment is not so readily recognized in the seed or young plant that the planter could make his selection; he cannot avoid mixing good and poor and only too late is the difference exhibited. In the struggle for existence the èlite becomes strong. Hence it cannot be otherwise than that every plantation must be made with a larger amount of seed than would suffice otherwise; this is nature's method of selection. Hence, generally sufficiently dense sowings have a great advantage over plantings.

It is an error to consider the extensive death of individuals at first as a loss to be deplored; inborn inability to live is the reason, and the exclusion of the weak is welcome. It is of questionable value and mostly a mistake to anticipate the natural clearing much, for one runs the risk of favoring the unfit, until it is fully decided which by their natural endowment are fit to be maintained.

The error of adjudging the large loss during their youth in dense sowings as due to exterior, unfavorable influence on each other of the members of the stand, led to a reduction of the amount of seed used and to substitution of planting.

If each seed were capable of growing into a tree, the low amount of one pound per acre which is now-a-days recommended for pine could be still further reduced. On the other hand, the excellent stands inherited from our forefathers, which may serve as models, originated from multiples of the amount of seed now believed sufficient. "Whoever has had the advantage beyond the limits of an ordinary generation of observing the origin and progress of these stands must shake his head over the modern ideas, and counsel return."

Dense stand calls more rarely for expensive repairs, covers the soil, furnishes earlier intermediate harvest and more valuable final harvest, and the saving at the start proves finally waste.

Since no planting as regards numbers and density compares favorably with a full sowing every planted stand must exhibit the disadvantages which come from insufficient density. As the spacing decreases the disadvantages become less, and the reverse. Hence, the planting of several plants on a plat approaches in its advantages a sowing.

The author criticizes at length the attempt at forcing the development of plant material in nurseries, because in this way naturally unfit and poorly endowed material is grown which when transplanted to the forest has no capacity for thriving in untoward conditions. He admits that in intensive nursery management in the repeated transplantings a selection is made, ruling out the poorer material, but he doubts whether at that stage the true character of the material is discoverable. Even among saplings poor stock occurs. He advocates the wander camp, when the material is grown under the precise conditions under which it has to battle. While repeated transplanting may have value in helping over the dangers of infantile troubles on the planting area, it would be an error to think that beyond this the measure produces results in the future development of the stand. Intensive nursery practice increases the cost of planting which is then attempted to be met by reducing density, and thus indirectly influences unfavorably the planting practice. He criticizes, therefore, the planting of four-year-old transplants of Spruce at four and one-half feet spacing, himself advocating two-year-old untransplanted stock, two of them eight-inch apart in plats of three square feet spaced three and one-half feet, which is relatively cheap and effective.

Another objection to the intensive nursery practice the author finds in the unpardonable neglect of natural regeneration in places where it would be successful.

Summarizing, the following principles are announced:

1. Only a dense position in early life enables a stand, no matter of what species, to produce the best results.

2. Since in plantings the spacing must always be wider than in sowings, the latter deserves in principle the preference.

3. Since special conditions only too often force to planting, it is to be insisted that sowing or natural regeneration be employed wherever success with these methods is promised.

4. Every planting is to be made as dense as possible and in order to save cost with youngest possible material.

5. Nursery practice should be as simple and natural as possible. All forcing in seed or transplant nurseries is objectionable luxury, which is bound to react unfavorably.

Regarding the causes of the retardation and suppression of individuals in a stand the author accentuates that individuals of the same species, once retarded and suppressed under the pressure of the same species, can never recover, if set free. On the contrary, the suppressed stand of one species under another species, as Spruce under Pine, or Beech, Spruce, Fir under Oak can grow into successful stands upon the removal of the dominant growth.

Saat oder Pflanzung? Forstwissenschaftliches Centralblatt. May, 1910, pp. 253-271.

Germination Tests. From the Danish Seed Control Station Miss Jacobsen reports experiences of five years with some 150 species of forest trees, some new and rare and difficult of germination. The special aim seemingly has been how to improve methods and to reduce time of germination without vitiating results.

The author criticizes some of the propositions of Schwappach to secure uniform practice at seed control stations, made in Vienna in 1907, as objectionable. The "Jacobsen" germination apparatus consists of a zinc pan filled half with water, across which glass rods or perforated zinc plates are laid. On these are placed circular woolen rags, on these open cotton rags and on these paper. The seeds are placed on the paper and a clear glass cover placed over the whole so that full daylight has access. From the woolen rags wicks are hanging down into the water, and daily every three hours the water is heated to 36° C., and then allowed to cool. Under the glass cover the temperature rises to 26° or 28° C. Under this treatment all Picea species and other small grained seeds like Chamaecyparis, Larix, Thuja, and small-seeded Pseudotsuga and Pinus germinate best. The largest seeds of Pinus and Abies do not stand this heat and deficiency of moisture. These are placed on filter paper in room temperature, or else in sand. Some germinate better on a porch than in a warm room. Among these *Pinus strobus.*

The rule for the duration of tests is 30 days, but as Zederbauer has shown (See F. Qu. Vol. IV, p. 203), this is too long, most species having germinated long before. The author proposes 20 days for the apparatus in use.

To show that what is considered best conditions of germination does not always prove so, the author cites a series of germinations of *P. strobus*, noting the number of seeds germinated from period to period and those remaining fresh but not germinated at the end of the time of testing.

Days,	30	60	70	100	130	*Fresh, not germin.*
In warm room,	2	9	14	18	22	60
On unheated porch,	0	3	39	69	73	16

Apparently the lower temperature was more favorable. It is suggested that especially seeds which are adapted to winter conditions do not germinate well until spring, no matter when they are placed for germination.

The question arises whether it is proper to count the 60 fresh but not germinated seeds as germinative or not. If the knife is supposed to furnish a satisfactory answer, then these seeds should also be figured in, the method evidently being the cause of their delayed germination.

Tables accompany the article giving details of germination tests of over 100 species in which are stated the number of samples tested, the weight per 1,000, the germinating "energy" (Germination per cent. within one-third or one-half the length of test); the germinative power (per cent.); the number of fresh ungerminated grains at end of test; and the length of germinative period.

Keimprüfung von Waldsamen. Centralblatt f. d. g. Forstwesen. Jan., 1910, pp. 22-28.

Pruning in the Forest.

In view of the lately reported work of pruning by the students of the Mont Alto forest school an article by Schmuziger is of interest on the practice of pruning. He points out that several decades ago pruning was extensively practiced in Europe. Knotty wood bringing 0.5 to 0.9, in the average 0.7, and less of the price of clear wood, a clear stick of beech 8-inch in diameter bringing double the price per unit of a 16-inch knotty log, such pruning seemed justified. To save in expense, lots were given for a small payment to poor people to prune, using the wood for fuel. After some decades the disadvantages of this pruning were recognized; a reaction set in, and green pruning, especially in spruce and fir, was tabooed.

The author adduces authority to show that both height growth and volume growth are diminished by green pruning. (See F. Qu. Vol. VII, p. 447.) He discusses behavior of various species in cleaning themselves; the time at which pruning is least dangerous (early spring); the danger from fungus growth; the observation that forking is an individual habit and is not corrected by pruning. He comes to the conclusion that for the growing of workwood green pruning is not needed; that the removal of dry branches in conifers is, however, justified where it can be done without too much cost and with care. It should then be confined merely to the best, selected specimens, for with the inferior material it is of no use. Such pruning should not take place until the stand is at least 20 to 25 years old. Green pruning is in place only where better species are to be protected against inferior and the entire removal of the latter is not desirable on account of soil protection.

Aufastungen. Schweizerische Zeitschrift für Forstwesen. May, 1910, pp. 155-164.

Frost Hardiness of Pseudotsuga.

The question as to whether the green variety of Douglas Fir is or is not frosthardy in Germany is discussed, based upon experience, by Graf von Wilamovitz. He points out that the situation in which the tree is to be planted must decide which variety to choose, namely, in severe and dry situations and on poor pine soil the green Canadian mountain form (Fraser River) or else the blue variety of the dry Rocky Mountains, but on fresh sites, good spruce and oak soils, the green form from the Coast is preferable because of its more rapid growth. In growing seedlings by all means avoid the use of fertilizer, which increases danger from frost. It is expected that soon German seed of Douglas Fir will be available.

Ist die grüne Douglasfichte in Deutschland frosthart? Zeitschrift. f. Forst u. Jagdwesen. June, 1910, pp. 360-363.

Rhennish Conditions.

The poorest forests found in Rhennish Prussia, as in many other parts of Germany, are the small lots in the hands of peasant owners. Small forest owners were rare in the middle ages and only became numerous when the "mark" forests were parcelled out. These small owners were at first subject to a strict supervision, a state of affairs terminated under the influence of the French Revolution.

The earliest clearing was for farm land, but this removed the forest only from the best sites and in the valleys. Charcoal and mine timbers soon made heavy inroads on the remaining upland forests and the peasant owners took no care for future crops. They reaped, but never sowed. And even this ill-treatment was made worse by the removal of the leaf litter and its fertility.

In a single county (Kreise) of Rhennish Prussia there are 7,000 parcels of forest of an area less than one acre, with a smaller number of somewhat larger area. Anything like a forest policy is precluded in such a state of affairs. For cash in hand the owner must harvest what he can and leave reproduction to nature. That such methods ruined the forest goes without saying. Small forests can only be maintained by co-operative management and must be satisfied with low interest rates. The larger forests and especially the communal forests, which should set examples of proper management for smaller owners to follow, have not always done their duty in this respect. Improvement societies and the cities have furnished better examples and initiated the movement for the proper appreciation of forest property. This movement once started has made rapid progress until at present even poorly-wooded areas are worth $500 per acre.

Most city forests are not managed for income, to be sure, but for sanitary, social and aesthetic purposes instead; the question of maintenance and improvement of the soil is nevertheless the main question here as elsewhere.

Litter-gathering has reduced the fertility of the soil, and washing has laid bare the roots of trees, until the heath itself will only grow on the lower slopes, leaving the higher entirely bare. Oxygen and water are excluded from the soil by the puddled surface and the ordinary processes of weathering are interrupted. The secret of successful planting under these conditions is thorough preparation of the soil, beginning with deep plowing six months before planting. It will generally be found sufficient to cultivate strips 80 cm. wide and 130 cm. apart whether seeding or planting is done. These strips must of course run with the contours.

For planting use beech mixed with red oak and white pine; do not use Norway spruce or substitute the German for the American oak. The mixture should be made either by rows or groups. A thorough hoeing each spring is almost necessary for several years. The planting of Norway spruce is to be avoided, for although it has been widely used it has succeeded only on the best soils. The spruce does nothing to improve the soil and has many other shortcomings dwelt upon at length in this place.

Pine is better, reproducing naturally in these heath soils, and although not doing its best, thrives far better than the spruce and at the same time improves the soil, preparing it for beech and oak. The advantage of pine over spruce is clearly shown where the two are planted in mixture. If the spruce thrives sufficiently well the less valuable pine can readily be held in check; where soil conditions are untoward the spruce develops into an understory under the pine. In most impoverished soils it will be found advisable to follow these coniferous stands with beech and oak.

For the oak, planting with plants several feet high is preferable to seeding or to setting smaller plants. The German oak is less suited to these poor soils than the American red oak, and the use of the exotic species is strongly recommended for this reason and also because it easily maintains itself in mixture with beech. Even when the ground is seeded with birch just after planting, a single cutting is sufficient to prevent for all time any injury to the mixture from this source.

Regeneration of hardwood sprout forests is somewhat more difficult, especially inasmuch as these areas are exposed to damage from factory smoke, so that broadleaf species must be used. Planting is best here, too, and care must be taken to loosen the earth, for the roots not only in the strips but later also in the intervening space, by plowing. Where outlay is a controlling factor the same result may be secured somewhat more slowly by seeding well-prepared strips.

If desirable the Austrian pine and the Banksian pine may be used on the poorer soils, while for spruce the Litha spruce or Colorado blue spruce may be substituted.

Wiederaufforstung verodeter Waldländereien auf den Ausläfern des rheineschen Tonschiefergebirgees. Silva, April-May, 1910, pp. 121-3; 131-3; 137-9.

Smoke Affects Pseudotsuga.

The thrift of the Douglas fir introduced into Germany under Bismarck by John Booth has been very satisfactory in many localities; elsewhere it has been destroyed in early life, due, as some have said, to frost injury. The needles turn brown or red in late winter and drop off. Green needles are put forth in the spring, but their size and color make it clear that the vigor of the plant has been impaired. This loss of foliage recurs two or three times and then the tree dies.

There are many indications that the whole injury is not due to frost. Atmospherii contamination with factory smoke (carrying SO^2), soil, and climate have in turn been held to account for the loss. To these dessication has now been added as a new explanation.

The damage is done on warm days in late winter while the roots are frozen. The warm dry air increases transpiration while the frost-bound roots furnish no water from the soil. Dessication results and the foliage is discolored. Less evident, though quite as serious, results occur in the cambium, reducing its vitality and finally ending its activity.

Das Verhalten der grünen Douglasie. Silva. May 27, 1910, pp. 163-4.

MENSURATION, FINANCE, AND MANAGEMENT.

Increment Per cent.

In a very thoughtful discussion Schiffel points out that a knowledge of increment per cent. will become more necessary and will eventually form an integral part of any forest description. Citing a number of authorities he shows how much they are at variance as to how increment per cents. are to be figured, whether at simple or compound interest and as to whether the manner of progress in increment should influence the method of calculation, whether an arithmetical or geometric progression is involved.

In quite elementary and convincing manner the author shows that in the usual comparison and percentic expression of the difference of two measurements, as for instance in comparing the two diameters of a stick or the variations in height of a stand, the method of calculation knows nothing of a series but concerns itself merely with a summary quantity, comparing the end result with the initial base, such as a simple interest calculation gives. Similarly, if a forest 10 years ago had a net value of \$50,000 and to-day the value is \$75,000, the increment per cent is $\frac{25000 \times 100}{50000}$ $= 50\%$, *i. e.*, the net yield in 10 years has increased by 50%, or annually by 5%. This calculation, although expressed in money, nobody will find fault with, for the nature of the problem does not require that annually the increment of \$2,500 be added to the original amount of \$50,000; it is justifiable to count the increment as not a part of the initial capital.

Another method of per cent. calculation originates in the conception of the year's increment as a quantity not capable of differentation from the base, *i. e.*, not as a simple multiplication but a real growth in the physiological sense. Then an arithmetical series results: h + (h + i) + (h + i) + i + (h + 2 i) + i, etc. If now the annual increment per cents. are calculated according to the formula $p = \frac{100\,i}{a}$, we secure not equal annual increment per cents, but a falling geometric series, because with the same numerator the denominator grows according to an arithmetical progression, *i. e.*, because the calculation is not based on the initial amount but on each preceding and varied member. The point is made that not in the difference of the progress of increment but in this manner of calculation the methods of determining the increment per cent. differ.

The difference of the results in the calculation are brought out in the following example:

Age	*Height*	*Increment*	*Current increment per cent related to*	
			preceding member	*Initial member*
15	5.	.4	8.	8
16	5.4	.5	9.25	10
17	5.9	.6	10.16	12
18	6.5	.7	10.76	14
19	7.2	.5	6.94	10
20	7.7	.4	5.19	8
21	8.1	.5	6.17	10
22	8.6	.6	6.97	12
23	9.2	.4	4.34	8
24	9.6	.4	4.16	8
25	10			
Total			72.01	100
Arithmetic mean			7.2%	10%

Another example is furnished to support the principle. The character of the increment, whether during the period of calculation it rises, falls, or remains equal, has no practical influence on the amount of the arithmetical mean annual increment per cent.

According to the problem to be solved either of the two methods of per cent. calculation is applicable.

If in any period of life the current annual increment per cent. of a tree is to be calculated, it would be contrary to nature and incorrect to relate the increment to any former dimension or volume, but it must be related to the dimension or volume of the previous year. If this is the correct attitude, then the same method should be pursued in determining an average or current annual increment per cent. for a longer period, be it for volume or for its value, which is nothing but volume multiplied by price per unit; that is to say, the method in which each annual amount appears as a member of a series, resulting from the addition of the increment to the previous member. Yet, practically, this is not possible, hence a method which is satisfied with the knowledge of initial and end member of a period is needed. We assume, therefore, the average annual increment per cent. as an annually equal one, and assume that it takes place in a rising potential series, although the actual progress is quite different. In this way we come to a compound interest calculation: $H = h. 1.op^n$.

It would be a grave error to assume that any member of the series could now be found with this per cent., which is determined only for the end result.

The author summarizes:

1. The method of increment per cent. calculation must be chosen with reference to the nature of the problem.

2. The increment calculation for trees and stands in dimensions, area, volume and value is made for time and should be based upon the principle that the amount of annual growth be added to the initial amount.

3. The annual increment per cent. depends on the amount of increment and on the base to which it is referred. It sinks with decreasing or stationary increment and can also sink with rising increment.

4. The arithmetical mean and current annual increment per cent. of a period depends in very small degree on the progress of increment within that period, so that for its calculation any distribution of the whole increment (if not too extreme) may be supposed without altering the value of the average annual increment per cent.

5. The simplest and also correct formula for determining the current annual increment per cent. within a given period for trees and stands is $1.op^n = \frac{N.}{V}$ V = initial stock, N = amount at end of period n.

These tenets do not agree with those of Baur, Judeich, Stötzer, and Müller, who make the manner of progress of increment influence the method of calculation and make a difference between volume and value calculations; they agree with Guttenberg's and Kunze's.

Interesting relations between different increment per cents. are shown and explained. A new development of Pressler's formula shows that it does not merely approximate the truth but gives theoretically correct values under the supposition that the average increment in the year of the middle of the period prevails through the whole period. Kunze's discovery that the area increment per cent. is approximately double the diameter increment per cent. is shown as of considerable practical value.

Ueber Zuwachsprocente. Centralblatt f. d. g. Forstwesen. Jan. 1910, pp. 6-20.

Growth Studies on Beech.

Interesting calculations on value increment of beech, made on 2,655 trees on different sites in Alsace and Loraine by Usener, show that no very considerable growth differences on different sites and exposures were found. except on the Jura limestone. East exposure in one of the localities showed the largest increment. Yet in two districts on red sandstone formation and at about the same altitude, the financial aspects varied considerably, owing to difference in market. In the one case, the average value per cubic foot of 130 to 150-year-old wood was 5.8 to 5.9 cents, and per tree \$4.33 to \$5.45: in the other case the figures were 7.8 to 8.2 cents and \$4.80 to \$7.60 per unit, respectively.

In the first case the price increment during 9 years had been 2%, in the other case 2.8%. In both places the price increment for workwood was not very different, namely, 2.5 and 2.4%; but fuelwood showed only 1.8% increment in the first and 2.2% in the second place.

The three different increments stood as follows:

	Age.	*Vol.* *a*	*Qual.* *b*	*Price* *c*	*Val.* *a+b+c*
			Increment per cent.		
Case I					
	120	1.3	.1	1.9	3.3
	130	1.1	.1	1.9	3.1
	140	.9	.1	1.9	2.9
Case II					
	130	2.1	.2	2.2	4.5
	140	2.	.3	2.2	4.5

The large volume increment in the last two positions is explained in that it refers to trees of open stands with broad crowns. price increment, and the writer expects still further increases with industrial development.

The main factor influencing the value increment is here, too, the *Zuwachsuntersuchungen an Buchen.* Allgemeine Forst. u. Jagdzeitung. Feb., 1910, pp. 46-48.

Tree Growth in Mexico

The author, who is a consulting forester, has spent over two years in Mexico and made a special study of some of the possibilities of forestry. Spanish Cedar is represented in Mexico by three species—*Cedrela odorata, Cedrela occidentalis,* and *Cedrela oaxacensis.* The last named is a scrubby tree found only on the plateau near Oaxaca, has its range fixed by altitude, and is not merchantable. The second is found on the drier soils of the West coast, while *Cedrela odorata* is generally distributed throughout the Gulf coast states, where there is a large amount of rainfall. Both commercial species have wood of the same reddish-brown color; both show a satinlike finish when planed, and both have the same characteristic pungent odor.

The author measured logs cut for export and for home use as well as studied standing trees and makes three classes of logs, namely:

Class 1.—Logs that grew rapidly throughout the life of the tree. These logs showed an average diameter growth of 1¼ to 2 inches a year and in rare cases even more. This class constitutes less than 5 per cent. of the total, because conditions favoring such growth are rare.

Class 2.—Logs that showed narrow annual rings throughout the life of the tree. Their growth averaged ¼ to ¾ of an inch in diameter each year.

Class 3.—Logs that had narrow rings for 15 to 35 years with a subsequent and often quite sudden increase in growth, followed by a natural slowing down due to age and size. The majority of logs were in this class, and the yearly diameter increase in early life averages about ¾ of an inch with a frequent increase to 1 inch or 1½ inches.

The trees of the first class usually started on burns or windfalls which occurred on the best sites where there was a warm, rich, deep sandy loam with plenty of humidity and soil moisture. Class 2 grew on a poor soil where rapid growth is impossible at any period of life, or were overtopped, or crowded by grass from germination to maturity. Class 3 constitutes the majority because the cedar is tenacious and because in a majority of cases the seed must germinate in dense shade and the plant must wait for an opportunity to get room, or until it outgrows the overstory of other species when it rapidly increases in diameter. The author claims that the normal growth is represented by Class 1 with an average diameter growth of 1¼ inches per annum and which is estimated to give a yield at a 10-year thinning of 15,000 board feet, with another thinning of 25,000 board feet at 15 years and a final cutting of 35,000 board feet at 20 years. This would give a total of 75,000 board feet in 20 years.

There are two species of Mexican Ash which grow nearly as fast as Spanish Cedar and are suitable for many purposes. Mexican Pine under good conditions will grow 1 inch in diameter per annum while Mahogany often grows at the rate of ¾ of an inch in diameter a year. Eucalyptus is reported as growing faster than in California and "roble," which is related to Catalpa, is merchantable in 15 to 20 years.

American Lumberman. March 26, 1910.

Uniform Log Rule.

As lumbering extends into new regions and improvements in machinery are used new log rules, says Mr. Ross, have been thought necessary for the changed conditions. Up to the present, 54 different rules have been devised of which 46 may be described as board measure rules and the remaining 8 as volume rules. Of the 46 board measure rules 17 are from formulas, 17 from diagrams, 8 from mill tallies and 4 from combinations of these. The formula class includes the International, Champlain, Universal, British Columbia, Preston, Baxter, Doyle, Ake, Square of Three-Quarters, Square of Two-Thirds, Cumberland River, Forty-five, Ropp, Vermont, Winder, Stillwell and Orange River Rules. The diagram class includes the Scribner, Maine, Bangor, Parsons, Quebec, Spaulding, Favorite, Hanna, Drew, Baughmann Rotary Saw, Baughmann Band Saw, Derby, Partridge, Wilson, Finch and Apgar, Warner and Younglove Rules. The mill tally rules include the Carey, Chapin, Dusenberry, Saco River, Northwestern, Wilcox, Herring and Schenck. The combination class includes the Doyle-Scribner, Doyle-Baxter, New Brunswick and Boynton. The volume rules include the Ohio River Cube, Constantine, Ballon, New Hampshire, Nineteen Inch Standard, Twenty-one Inch Standard, Twenty-two Inch Standard and Twenty-four Inch Standard.

The saw kerf waste is always some fraction of the area of the end of the log and increases as the square of its diameter. Simple arithmetical calculations show the percentage of waste for given kerfs to be as follows:

Saw kerf	1-2	7-16	3-8	5-16	1-4	3-16	5-32	1-8	7-64	3-32
Percentage waste	33	30	27	24	20	16	13	11	10	8.6

The deduction necessary for square-edging the boards is almost proportional to the bark surface of the log, and therefore increases directly as its diameter. The only rules which rationally provide for edging are the International, Champlain, Universal, British Columbia, Baxter and Preston. In addition the International is the only rule which properly allows for normal crook and taper. The saw kerf of this rule is one-eighth of an inch with a safety factor of an additional one-sixteenth of an inch for uneven sawing. It was constructed for logs 3 to 60 inches in diameter and 8 to 20 feet long.

A test of the International Rule was made at one of the mills in the Ottowa valley and showed that the rule is an exceedingly accurate one. The scale of 402 White and Red Pine logs as they came to the saw carriage was 82,920 board feet and the actual product was 83,288 board feet, which is an over-run of four-tenths of one per cent. By overlapping the diameters between 6 and 17 inches for the sake of comparison with other rules the following results were secured:

Diam. of small end in inches	*No. of logs tested*	*Per cent. over-run of saw-cut as compared with the scale by*			
		International	*Champlain*	*Scribner*	*Doyle*
6-8	28	2.6	10.3	33	143
7-9	54	2.3	8.8	35	115
8-12	101	0.0	7.1	34	72
10-17	104	-1.1	4.7	23	45
18-20	90	0.5	6.7	14	24
21-24	126	1.1	5.2	14	18
25-33	31	-0.5	3.3	9	10

These figures show that the Scribner and Doyle rules are not suitable for small logs, which ought to be especially significant, since logs are constantly getting smaller. Another point in favor of the International is that it can be modified for saws of different kerfs.

Another table shows the undesirablility of the Doyle rule for small logs:

Diam. of 16 ft. logs in inches.	Scales Doyle	Champlain	Scribner	Quebec	Actual	Interna'l
4	0	8	7	12	6	5
5	1	14	13	15	12	15
6	4	22	18	16	19	20
7	9	32	24	24	30	30
8	16	43	32	32	40	45
9	25	56	42	45	55	55
10	36	70	54	59	67	70
12	64	105	79	80	101	105
14	100	146	114	120	154	150

Granting the value of the International for board measure, the author argues for the adoption of the cubic foot as the best all around standard of measure since it is absolutely fair to both buyer and seller, no matter whether the material be manufactured into boards, dimension stuff, lath, shingles, pulp, veneer or other products.

Canada Lumberman and Woodworker. May 1, 1910.

UTILIZATION, MARKET, AND TECHNOLOGY.

Railroad Ties.

In Germany metal ties are used to such an extent that lately an association has been formed to further the use of wooden ties. At the annual meeting of this association last year beech ties were especially discussed by Schneidt, when it was shown that the unsatisfactory experience with impregnated beech ties was due to improper treatment. Beech ties properly treated with zinc chloride and laid in Alsace in 1892, after 16 years' service had still 95 per cent. in track. In France, beech ties treated with 75 pounds tar oil last in the average 30 years.

The reason for this long life is the possibility of a thorough impregnation of the porous wood, in which respect it is superior to oak and pine. Only the small amount of heartwood does not take the liquid readily. This red or gray heart is due to an injury of the tree, broken branches, etc., which admit a fungus. This, however, surrounded by well treated wood is not great injury, and the Prussian Railway Administration allows 3 inches of red heart, makes, however, objections to gray heart; other administrations admit both. The weight of an impregnated beech tie is 260 pounds, heavier than any other used, for oak ties treated weigh 220 pounds, pine 144 pounds, while the iron ties mostly used weigh only 130 pounds, so that here, too, lies an advantage for the beech tie. The checking of ties can be prevented by proper piling. Other points in proper treatment are given.

A calculation of cost shows that a kilometer of iron tie bed costs 29,169 mark against 22,774 mark on beech ties.

At another occasion the same authority stated that in France a superstructure of beech ties with wooden tie plates, three-eighths inch thick, instead of iron tie plates, has been in successful use for several decades, and trial stretches with the same construction in Prussia for 3½ years have also proved themselves most satisfactory. Another advantage of the beech ties is that for this tie a gravel bed suffices, while the iron tie requires the best broken stone bed.

Die buchene Eisenbahnschwelle. Centralblatt f. d. g. Forstwesen. Feb., 1910, pp. 87-91.
Buchenschwellen. Allgemeine Forst-u. Jagdzeitung. April, 1919, p. 148.

Quality of Spruce.

The final results of ten years of timber physics work on spruce alone is published by Janka from the Austrian experiment station, the third publication on the same subject, different localities being involved in each. One remarkable result is that the red wood of the so-called hard (off-wind) side of a tree grown in the open shows greater weight and greater hardness, but a smaller compression strength and elasticity, than the wood of the soft (wind) side. Otherwise the lawful relations between specific weight, strength and hardness are maintained without reference to locality, and, since hardness is the easiest and simplest test, this may eventually serve as a general test of quality.

The quality of wood can be judged from the character of the failure, poor quality shows a smooth fracture, medium quality a jagged, good quality a splintery fracture.

The old rule that wide-ringed coniferous wood is poor, narrow-ringed wood good quality has no basis, for the specific weight and hence strength depends on the summerwood per cent.; but in general it is true, as long as summerwood per cent. and width of ring are proportional.

Besides ringwidth, the even or unevenness of grain is of importance as regards quality, evenness being desirable. A medium width of 2.2 *mm* (1 inch in 11 years) which corresponds to an average specific air-dry weight of 42 to 43, seems to be the most desirable. To grow the best material, dense spacing at the start, close cover in its youth, moderate thinning during the principal growth period and open position at higher age is recommended.

Mitteilungen aus dem forstlichen Versuchswesen Oesterreichs. XXV. Heft, 1909.

Box Lumber.

Practically every kind of lumber is used for boxes. In the South, however, cottonwood is the favorite for whiskey and other white boxes, since it furnishes the whitest of the Southern woods. The sap of red gum is often used as a substitute and although this sapwood has been considered less valuable than the heart, this is largely due to careless piling. Cypress and yellow pine are also used largely. Handle manufacturers often use pine for box ends because it holds nails well, and cypress for the sides since it is stronger. Low grade pine will also work up into box material with less waste than any other Southern wood, but high prices often limit its use.

The St. Louis Lumberman. Nov. 15, 1909, p. 81.

Black Walnut.

During the middle eighties the use of Black Walnut for furniture became very limited because of the demand for oak furniture and the scarcity of walnut. Since that time large amounts of the Walnut have been exported to Germany, but its use in the United States has been limited. For a long time Circassian Walnut has been in use, but now there is a revival and a strong demand for Black Walnut to be used in the making of "solid Circassian furniture." The demand for Black Walnut is largely for thick stock.

Hardwood Record. May 10, 1910.

Veneers.

Softening logs for veneer machines may be done by live steam, exhaust steam, hot water or a combination of these. Steaming rapidly with live steam causes more checks and cracks than any other method. The best method employed for the most valuable logs is to soak them for about twenty-four hours in luke-warm water and then turn in steam to raise the temperature gradually so that there will not be a great difference in the inner and outer temperatures of the log. Too much boiling or too high a temperature may cause the log to become tough and stringy and it is claimed by some that the temperature should be kept just below boiling. It is also claimed that steam is better for some species while hot water is better for others.

St. Louis Lumberman. March 15, 1910.

Western Hemlock.

Western hemlock produces lumber superior to that of Eastern hemlock. It has been used for flooring and found to be durable. When sawed with slash grain it produces a beautiful effect and takes a good finish. It is a splendid barn board and the coarser parts are unexcelled for ship-lap. A large quantity is used for screen doors, the material being sent East for manufacture after which doors are again shipped West. For siding this species is superior to spruce and in the Middle West, where it is largely used for railroad ties, it has been found to last longer than pine and as long as Douglas Fir, while it holds a spike better than either. On the Columbia River hemlock is used for paper pulp and the manager of the American Extract Works has stated that the percentage of tannin from several sources is as follows: Washington, 17.04; Pennsylvania, 13.28; Quebec, 10.16. Dry, sized dimension stuff weighs 2,000 pounds to the thousand.

Hemlock withstands the attack of teredo better than Douglas fir, and in the Philippines withstands white ants better than pine, Douglas fir or spruce. It is estimated that there are seven or eight billion feet remaining in Washington and four or five billion feet in Oregon. On the west slope of the Cascades it forms 5 to 25 per cent. of the stand, while in Clallam and Jefferson Counties, Washington, there are large areas of pure stands.

West Coast Lumberman. Feb. 15, 1910.

Wood for Athletic Goods.

Probably in no other line are there as high requirements made as in woods used for bats, golf sticks, Indian clubs, dumb-bells and similar articles. Unusual requirements are made as to durability, strength, elasticity and absolute clearness. Sapwood only is used in bat manufacture and clear, second-growth ash is preferred to old seedling trees. The standard bat stick is 38 inches long by 2¾ inches square at one end and 2¼ inches at the other. Second class sticks are 32 inches long and 2¼ inches square without taper. Most of the ash for bats comes from Ohio and to a limited extent from Tennessee. The sticks are piled regularly with plenty of air for circulation and given one year's seasoning in the open. The so-called willow bats are made from basswood which is selected for absolute clearness and straightness. The rough sticks are shipped green and are a little longer and larger than ash sticks, being 40 inches long before dressing. A few months is required for seasoning. Bats are turned by lathe after standard patterns.

Maple from the North is used for Indian clubs and is cut in square sticks 2½ to 5 inches thick and to even lengths in feet. It is shipped green and seasoned one year at the factory. Short ends are often used for dumb-bells. For golf clubs clear sapwood of second-growth hickory is required in stock one inch square and four feet long. To insure against worm injury the stock is shipped from woods to factory as quickly as possible. After one year's seasoning the sticks are rounded and then stored in kilns for 3 months' further drying. In the kiln the sticks are stacked in layers of five with numerous cross pieces to prevent warping and each stack is weighted with six to seven pounds per superficial foot to prevent warping. After this process the golf sticks are turned to pattern in a Chapman automatic lathe which is fed automatically from the bottom of a rack in which the sticks are piled six to eight deep. After shaping, a simple lathe is required to turn the small end for receiving the iron collar.

Hardwood Record. Apr. 10, 1910.

Ship Knees.

Ship knees are made largely from Douglas fir, tamarack and oak, but fir is preferred because of elasticity, durability and evenness of grain. Fir is also preferred over oak because tannin rusts the iron fastenings while resin does not.

The mild climate of the Pacific region is peculiarly favorable for the production of even grain while the cold climates are likely to produce shakes. Low swampy ground with a clay bottom seems to produce the best fir knees.

The best knees are made by the natural crook of the trees and are secured by digging around the larger roots, then cutting them off and allowing the tree to fall. Enough of the butt is left to make the upright hub of the knee. Saws are used to split the tree and axes for reducing the knee to the proper dimensions. Knees are sold according to thickness, and the thicker the knee the longer the arms are. The thickest knees are used in the keel, lighter ones go under the decking, and, if there is an overhead deck, still lighter ones are used for it. One of the largest knees furnished from the Pacific coast had a thickness of eighteen inches with arms respectively seven and twenty-eight feet long.

West Coast Lumberman. Feb. 15, 1910.

By Products.

The Gilmer method of destructive distillation which has been in use in the South for the past six years is said to be the best method yet devised for the southern pines and to have produced the following high average:

Cost per cord, dry weight 3,500 pounds:	
1 cord wood,	$1 50
Labor,	2 00
General expense,	1 00
Fuel,	1 00
Contingencies,	1 00
	$6 50

Results.	
8 gallons turpentine,	$4 00
50 gallons tar,	4 00
500 pounds metallic charcoal at 85c,	5 00
8 gallons tar oil, at 10c,	80
1 gallon pine oil,	35
Gas (used as fuel in plant),	50
200 gallons compound wood acids,	
	$14 65

The Dobson-Hanford mechanical and steam process is said to have produced the following results in wood pulp and other materials.

Cost per cord, green weight, 4,500 pounds:	
1 cord wood,	$1 00
Cost of manufacture,	4 00
General expense,	1 00
	$6 00

Results.	
1,800 pounds fiber, $0.01 per pound,	$18 00
8 gallons turpentine, at $0.50,	4 00
100 pounds resin oil, at $0.05,	5 00
	$27 00

By this method the wood is "hogged," then ground and subjected to steaming, after which the juices are pressed out by hydraulic pressure. These juices are separated into turpentine, wood and resin oils, and a strong clean wood fiber is left which is suitable for fancy and common paper.

The Lumber Review. Apr. 15, 1910, p. 42.

Weight of Lumber.

The following weights for lumber have been established from actual tests which were performed under the advisement of a committee of the Hardwood Manufacturers' Association. An accumulation of information was received from different sections of the country, showing the everage weights of the different varieties of wood and the different character of manufacture. Attests have been submitted showing the results, which are now the official standard weights, to be absolutely accurate.

Kind of Wood. Thickness. Condition.	*Pounds per 1,000 ft. dry.*
Ash, 1 inch and thicker—rough,	3,500
Basswood, 1 inch and thicker—rough,	2,600
Beech, 1 inch and thicker—rough,	4,000
Birch, 1 inch and thicker—rough,	4,000
Buckeye, 1 inch and thicker—rough,	2,600
Butternut, 1 inch and thicker—rough,	2,800
Cherry, 1 inch and thicker—rough,	4,000
Chestnut, 1 inch and thicker—rough,	2,800
Cottonwood, 1 inch and thicker—rough,	2,800
Elm (soft), 1 inch and thicker—rough,	3,200
Elm (rock), 1 inch and thicker—rough,	3,800
Gum, 1 inch and thicker—rough, red,	3,300
Gum, ½ inch bevel siding—S1S,	900
Gum, — inch drop siding—S2S,	2,200
Gum, — inch flooring—S2S,	2,200
Gum, ⅜ inch ceiling—S2S,	850
Gum, ½ inch ceiling—S2S,	1,300
Gum, ¾ inch ceiling—S2S,	2,000
Gum, ⅝ inch ceiling—S2S,	1,600
Gum, 1 inch — S2S — inch red,	2,500

Gum, 1 inch — S2S — inch sap,	2,350
Hickory, 1 inch—rough,	5,000
Hickory, axles and reaches—rough dry,	4,500
Hickory, rim strips—rough,	5,000
Hickory, green,	6,000
Maple (soft), 1 inch and thicker—rough,	3,000
Maple (hard), 1 inch and thicker—rough,	4,000
Oak, 1 inch and thicker—rough,	3,900
Oak, — $\frac{3}{8}$ inch thick—rough,	2,000
Oak, $\frac{1}{2}$ inch thick—rough,	2,200
Oak, $\frac{5}{8}$ inch thick—rough,	2,700
Oak, $\frac{3}{4}$ inch thick—rough,	3,200
Oak chair and furniture stock, 1 inch and thicker,	4,200
Oak squares, 1 inch by 1 inch and larger,	4,200
Oak wagon stock and felloes—dry,	4,500
Oak wagon stock and felloes—green,	6,000
Oak plow handle strips—dry,	4,250
Poplar, 1inch and thicker—rough,	2,800
Poplar, $\frac{5}{8}$ inch—rough,	1,600
Poplar, $\frac{3}{4}$ inch—rough,	2,100
Poplar, $\frac{1}{2}$ inch bevel siding—S2S,	850
Poplar, drop siding—S2S,	2,000
Poplar, $\frac{3}{8}$ inch ceiling—S2S,	800
Poplar, $\frac{1}{2}$ inch ceiling and partition—S2S,	1,200
Poplar, $\frac{5}{8}$ inch ceiling and partition—S2S,	1,500
Poplar, $\frac{3}{4}$ inch ceiling and partition—S2S,	1,750
Poplar, 13-16 inch ceiling and partition—S2S,	2,000
Poplar, 1 inch—S2S, to 13-16,	2,200
Sycamore, 1 inch and thicker—rough,	3,200
Walnut, 1 inch and thicker—rough,	4,000

St. Louis Lumberman. Feb. 15, 1910.

Uneven Flooring.

Most uneven flooring is caused by carelessness. It is well known that as the knives grow dull the material becomes slightly thicker; that insufficient drying may cause inequality after the flooring is stored in the shed; that there is a tendency for the planer man to "scant" the planing where the lumber is a little uneven or rough; that there is a difference between heart wood and sap wood; and that there are several different methods of dressing and matching lumber which would cause a variation in two lots of material. Flat back stock is slightly thicker than that trimmed on both sides.

The Lumber Trade Journal. April 15, 1910.

Knowledge of Forest Utilization. The German forester has evolved from a huntsman and not from a lumberman, and accordingly the whole profession in Germany is less familiar than we are with wood-using industries, wood technology, lumber markets, and all those activities which in this country are studied under the name of forest products. The need of such knowledge is beginning to be felt and proposals for ways of supplying this deficiency are being made.

It is here specifically pointed out that the forester should familiarize himself (1) with wood-using industries and especially with the grading of wood for different purposes so that he may better know the defects to be eliminated in his product; (2) with lumber trade routes and commercial sizes of lumber; (3) with business forms and practices in general and in particular those obtaining in the lumber trade; (4) with banking; (5) with the details of saw-mill operation.

These studies should be begun in the forest school and continued afterward in a practical way by at least a portion of the men on a forest. Older men already in active service may increase their familiarity with the lumber trade through the trade literature, by special courses in forest schools, by contact with wood dealers and users, and finally when there is opportunity by actually working in a lumber mill or office.

Ueber Umfang und Art holzkaufmännischer Ausbildung des Forstmannes. Silva. May 13, 1910, pp. 145-7.

STATISTICS AND HISTORY.

Austrian Forest Budget. It is difficult to form a precise idea of the finances of the Austrian forest administration, because in the budgets they appear mixed up with other finances of the Department of Agriculture and can probably be separated only in the detail statement of the budget.

In educational direction, curiously enough the Hochschule für Bodenkultur which embraces the higher forest school is not under the Department of Agriculture but of Instruction. The lower grade schools are endowed under the former Department with around $300,000; the experiment station with $14,000, forestry and agricultural associations receive a magnificent subvention of $200,000; for reforestation and other cultural measures, $160,000; for gathering statistics $30,000 are spent. To the general melioration fund a contribution of $1,600,000 is voted. The general supervision of cultural conditions for personnel is provided for to the amount of $220,000. The organization is highly complicated. In the political administration the number of technical forest officers is 390, besides 124 specially employed on reboisement work. The administration of the crownlands itself occupies some 277 technical men, besides 43 aspirants.

The crown lands, including forest and farms, comprise only 2.8 million acres, nearly one-half of which is unproductive. The cut is placed at 46 cubic feet per acre, either a conservative figure or an expression of the poor growth conditions. Of this cut, 52.5% is workwood. Servitudes tax the property to the extent of $300,000 in value. Including this the total yield is figured at around $2 million or not quite 75 cents per acre. Some 250,000 acres of lands, forests belonging to religious institutions, are also under management of the government.

Centralblatt f. d. g. Forstwesen. Jan. 1910, pp. 42-47.

Prussian Budget.

The financial results of the Prussian Forest Department continue to grow. The budget 1910 shows an increase of over five million dollars which with an increase of expenditures of over three million dollars leaves a net increase of $2,108,000 over the budget of the previous year. This increase, however, is only apparent and is due in part to an involuntary increase in the cut occasioned by the necessity of disposing of timber damaged by the nun. Moreover $1,800,000 are credited for sales of forest property. This item formerly was not credited to the Forest Department but was accounted for in the general finance administration. The total cut per acre remains still below 53 cubic feet. A general reform of the administration with a view of decentralization and increase of the responsibility of the district managers is under contemplation. Some 600 new under-foresters' positions have already been instituted.

In the expenses, the item for planting has been increased by $185,000 over that for 1909; workmen's dwellings, and telephone installations also figure in the expenses, and funds for the purchase of forest lands.

Forstwissenschaftliches Centralblatt. May, 1910, pp. 278-281.

United States Lumber Cut. A compilation of the reports on timber cut in the United States places it as follows:

Year	*Cut in billion feet.*
1850,	5
1860,	8
1870,	13
1880,	18
1890,	24
1900,	35
1908,	33

The total amount of manufactured lumber since 1850 is estimated at not less than 1,200 billion board feet, which is practically one-half the estimated quantity of saw timber of all kinds now standing in the United States. The figures are fairly accurate for only the last ten years and it is to be regretted that good figures are not available for the white pine cut. Curves are given for the cut of the Northeastern States, Lake States, Southern States and Pacific States since 1850 and are likewise given for these regions in percentage of total lumber production. Valuable tables are given for the lumber production of 29 species since 1900 while mill values are given for 30 species for the same period. A table is also given showing the increase in per cent. of price and cut for 15 species. The census reports show that the average mill price for all kinds of lumber increased 38 per cent. from 1900 to 1908 and that the average price in 1908 was 7.2 per cent. less than in 1907.

The Lumber Trade Journal. May 1, 1910.

MISCELLANEOUS.

Private Forestry.

Private forestry for the most part must be on a profitable basis and yet demands continuity of raising timber. Any forestry system which does not yield at least 100 cubic feet per annum, the writer thinks, is a poor one. At present the greatest opportunity for the private owner is in the purchase of good stands of young timber rather than planting denuded areas. It is possible in many cases to purchase land well stocked with timber up to 75 years old for the same amount or less than it would be to buy denuded areas and plant. Planting on a large scale at the present is not an attractive investment when the initial outlay, risks and returns are considered. Profits from young, natural stands may be expected to increase because of improved markets, increase in stumpage value and increase in increment.

The author believes that the lumbermen have responsibilities to the public and that they should commence at once the practice of forestry over a part of their holdings. It is not considered advisable to do so for the entire holdings for the following reasons:

1. It would require a considerable immediate investment. 2. It is not possible to determine what it would cost in an individual case. 3. Demonstration of practicable methods of cutting and fire regulation is needed.

By examination and study a forester could make a plan of work and an estimate of costs. However, it is believed that each owner requires an actual test of forestry as a part of his regular operations and that the following objects are important:

1. That interested lumbermen make an immediate test of forestry on their own holdings. 2. That this work be regarded as a beginning, with a view to ascertaining the possibility, rather than an attempt at organized forestry over entire holdings. 3. That lumbermen associate themselves together, either in their trade associations or new associations, in order to reduce the expenses of forestry to a minimum. 4. That each owner set aside 1,000 to 10,000 acres as a practical demonstration ground. 5. That the association employ a forester to direct the technical

work. 6. That each owner employ local guards or rangers for fire protection, restriction of cuttings, etc.

The Lumber Trade Journal. May 1, 1910.

Germany Needs Hardwoods.

The need of Germany for hardwood material has not been sufficiently recognized by those responsible for her forest policy. Since 1865 the wood consumed in Germany has exceeded that produced, by steadily increasing amounts. The excess is drawn from the world market and consists largely of hardwoods. The soft woods are raised at home. Foreign supplies of softwood are large and prices are moderate. It accordingly seems good policy for Germany to grow more hardwoods and import softwoods instead of hardwoods. The situation is reviewed on the basis of the species which might supply this need best and as a result it appears to be especially desirable to further the growing of alder, ash, hornbeam, and aspen.

Zur Nachzucht der Wichtigsten Laubnutzholzer. Silva. April 15, 1910, pp. 113-116.

NEWS AND NOTES.

The Spruce Manufacturers' Association which was organized in 1909 has adopted specific grading rules which have been published in the American Lumberman of March 12, 1910.

John W. Gates of Port Arthur, Texas, is experimenting with eucalypts along the Gulf of Mexico. He has planted a ten acre grove as well as a row of trees ten feet apart around a 300 acre tract. The first planting was made about two years ago and the trees are reported to have withstood the coldest recorded December weather the Gulf region has experienced.

Many of the lumber journals have had editorials and news notes condemning the recent practice of selling lands in California for planting eucalypts. It is recognized that many companies are making false statements and that many investors are going to lose money. It is the practice of some of the companies to use coppice figures for seedling growth, maximum growth for average growth, figures from groves in the southern part of the state for hypothetical ones in the region near San Francisco, figures for blue gum (*Eucalyptus globulus*) for red gum (*Eucalyptus rostrata*), and many rash statements concerning the wonderful variability in the present use of the timber as though such use were well established rather than imperfectly tested or not tested at all. It must be recognized that the eucalypts at present furnish our most wonderful plantation tree but the industry is bound to be harmed by many of the statements now being advertised.

In the Pacific Northwest the Forest Service is practicing forest planting upon an experimental basis only. Where there is a dense ground cover of brush, litter and humus, burning will be practiced followed by broadcasting seed. Where burning is impracticable seed spots are being used which are spaced five to six feet apart and are made by a mattock. This system has proved to be more costly per unit of area than broadcasting. Planting seedlings is adapted to the east side of the Cascades where there is dryness during the summer months and a struggle with the underbrush. On the Snoqualmie Forest in Washington a timber sale has been made in what had originally been a stand of Douglas fir, cedar and hemlock in which the Douglas fir has died out entirely leaving no seed trees. After the cutting is completed, the slashing will be burned and Douglas fir seed sown broadcast with the idea of restocking the area with the most valuable species. Considerable work will also be done on Bull Run River watershed in the Oregon National Forest. This is the watershed that supplies the city of Portland with its water.

Mr. Edwin A. Ziegler, who left the Forest Service last fall to become an instructor in the State Forest Academy of the Pennsylvania Department of Forestry at Mont Alto, Pa., has been made Director, vice George H. Wirt, who has been transferred to Harrisburg and been made Chief Forester under the Commissioner of Forestry.

Pennsylvania's state forests of nearly one million acres are administered by graduates of the State Forest Academy, who now number thirty, and are increased by ten each year. At this rate, it will not be long before the area each forester has allotted to him can be much reduced from the 20,000 acres which now constitute the territory of each man.

The change in Pennsylvania's forest-service organization noted in this issue of the Quarterly is a move in the right direction. Nothing was more evident at the 1910 Convention of Pennsylvania Foresters than the chance which exists for a man of ability, with technical training and experience, to fill the gap between the executive Commission and the administrative field force. The latter have to deal with many and varied technical problems which the lay commissioners cannot help much with. A chief forester who is acquainted with the forest conditions throughout Pennsylvania has an excellent opportunity if given a chance to knit into an effective whole the excellent nucleus of a strong forest force that now exists.

The forest-nursery and forest-survey work of the Pennsylvania Railroad this summer has enlisted the service of forest students as follows: Maine, W. L. Gooch; Pennsylvania State, H. Borden, O. E. Huse; Toronto, E. C. Manning, A. E. Parlow; Yale, P. L. Buttrick, L. B. Pagter, H. L. Russell.

The forest force of the Pennsylvania Railroad Company has been increased by the appointment of Chapin Jones, Yale '09, and since with the Forest Service, S. T. Pollock, Pennsylvania State '10, and W. E. Dunham, Yale '10.

The Greenwich Wood-Preserving Plant of the Pennsylvania Railroad was put into operation during June. It is located along tidewater on the Delaware River within the city limits of Philadelphia, and will handle the treatable ties and timbers brought by boat from the pineries and hardwood bottoms of the South. There were on hand in the yard of the plant when it began its runs 408,000 ties and 758,000 board feet of timbers. For the present, only one impregnating cylinder will be used, with an output of 2,000 ties daily. By 1911 two cylinders will be in use, and the capacity of the plant doubled in consequence.

The government of the Province of Quebec has instituted a forest school in affiliation with Laval University at Quebec, under the direction of Mr. G. C. Piché. It is again to be a high grade school instead of ranger school which is much more needed in Canada.

Candidates must be 20 years of age and speak and write both French and English, entering by a competitive examination. There are ten free scholarships provided which assure free tuition and employment by the government during their studies by the holders, who are obliged to serve one year preliminary to the course, which comprises two years.

The importation of plant material into the United States, most of it probably not for forest purposes, but garden, orchard and park material, in 1907-8 amounted to over $1,786,000, Holland furnishing about 50 per cent. of it, France, $388,000; Belgium, $280,000; and Germany, $164,000.

The students of the Biltmore Forest School returned to New York in April from Darmstadt, where they had spent the winter, and proceeded to the Adirondacks, where several weeks were spent studying the extensive planting operations inaugurated by the Cornell School of Forestry, the State of New York and by lumber and railroad companies. In May, the students returned to Biltmore, where they will remain during the summer, spending the fall in the lumber woods of the Lake States.

The new Forest Products Laboratory of the U. S. Forest Service was opened with appropriate ceremonies at Madison, Wis., on June 4th. Addresses were made by Edwin A. Start, Henry S. Graves, and B. R. Goggins. The guests were offered an opportunity for the inspection of the new laboratory and such departments of the University as they desired to visit, and brief meetings were also held of representatives of organizations and industries, such as the American Railway Engineering and Maintenance of Way Association, which may make use of the laboratory.

The summer term for the forestry students of the University of Michigan opened June 28th and will close on August 11. Through coöperation with the Public Domain Commission, the work will be carried on at Cold Springs, on the shores of Higgins Lake, Roscommon County, Mich., which is on the State Forest Reserve of 38,000 acres, where the students will have an opportunity to become familiar with the typical cut-over growth of the jack pine, Norway pine, white pine, scrub oak, and other species. Two courses will be given: one covering civil engineering, particular attention being given to surveying methods; and the other, forest mensuration, with calculation of the volume of felled and standing timber, the use of log scales, methods of estimating, etc.

It is reported that the U. S. Department of Agriculture, in order to encourage the construction by the Humboldt & Eastern Railway Company of a road from Eureka to the Sacramento Valley, has offered to sell about one billion feet of timber in the Trinity National Forest. The successful contractor will be allowed ten years to cut and remove the timber, and the minimum price which will be accepted will be $1.50 per M. for all timber removed during the first five years, and $2 per M. for the remaining period. The railroad will depend for the first few years largely upon tonnage to be derived from National Forest timber, and therefore needs assurance that a large amount of timber will be cut and shipped annually.

Correction is hereby made of an error in the News and Notes of the Quarterly, Vol. 8, No. 2, 1910, page 272, which was to the effect that "Mr. C. H. Sellers, who was one of Mr. G. B. Lull's assistants while the latter was State Forester of California, has followed him into the service of the North American Hardwood Timber Company, and has charge of its Eucalypt nursery at Fruit Ridge, near Sacramento." As a corrected statement of facts, Mr. Sellers left the State service a year before Mr. Lull, in order to engage in the Eucalypts business, and is now owner of the Eucalypts nursery at Fruit Ridge, and is not employed by the North American Hardwood Timber Company.

During the session of Congress just closed, there was introduced into the U. S. Senate a bill "to promote the science and practice of forestry by the establishment of the Morton Institution of Agriculture and Forestry as a memorial to the late J. Sterling Morton, former Secretary of Agriculture." This bill failed of passage, as was to be expected, since it located the institution at Nebraska City, Neb., which is not a suitable location for an institution of this kind, and is not in keeping with Federal precedents. Furthermore, the location of the memorial at this point would tend to separate the official and administrative work of the present Forest Service from the technical and investigative part of forestry work. The bill as introduced proposed to place the control of the institution under the Secretary of Agriculture and to provide buildings and grounds at a cost not exceeding $250,000; the whole to be in charge of a director whose salary was to be $6,000 annually, which is more than the Forester of the United States at present receives. An institution of this kind, if located at Washington, might be productive of good results.

The Weeks Bill for the acquirement of National Forests in the Appalachain Region and the White Mountains passed the House of Representatives on the 24th of June, but failed of passage in the Senate, thus postponing to at least another session the passage of an Act which will provide National Forests in the Eastern

States. While enthusiasm for the passage of this Bill was not as keen as during previous sessions, several societies, including the American Forestry Association, the Society for the Protection of New Hampshire Forests, and the Massachusetts Forestry Association were very active in behalf of the Bill, and it is hoped that their efforts will eventually bring about its passage.

C. R. Wilbur, Yale '07, has been appointed an Assistant State Forester in New Jersey.

Teaching has tempted the following men to change their positions:

J. M. Briscoe, Yale '09, will go to the University of Maine from the U. S. Forest Service.

F. A. Gaylord, Yale '09, will go to Michigan Agricultural College from the U. S. Forest Service.

F. F. Moon, Yale '09, will go to Massachusetts Agricultural College from the New York State Forest Service.

S. J. Record, Yale '04, will go to Yale Forest School from the U. S. Forest Service.

Samuel N. Spring, State Forester of Connecticut, is collaborating with E. H. Frothingham, of the U. S. Forest Service, in a study of the treatment of second-growth hardwoods. Their idea is to get together figures to show the yield of hardwoods at different ages, and to see if they cannot work out something specific in regard to the treatment of such stands so that they will produce better qualities of material, together with the possibility of marketing their produce better.

Private parties in Connecticut bought 450,000 trees from their State Forester last spring. A little more than half of these were set out in plantations. The balance was one lot of two-year-old white pines which were put in transplant beds for use in forest planting next spring.

Sawdust is usually regarded an an objectionable product because it increases the danger of fire if deposited near mills or lumber piles and necessitates either cartage with accompanying expense or the construction of a "burner" and the use of conveyors or carts to transfer it from the saws.

A double economy, however, is now in progress. As a result of the use of band saws instead of the old circular and gang saws, a log that, under the old system produced eight boards, will now produce nine, a very substantial increase in product with a corresponding decrease in the amount of sawdust produced.

Owing to its chemical and mechanical properties, it has an ever increasing field of usefulness. Used as an absorbent for nitroglycerine, it produces dynamite. Used with clay and burned, it produces a terra-cotta brick full of small cavities that, owing to its lightness and its properties as a non-conductor, makes excellent fire-proof material for partition walls. Treating it with fused caustic alkali produces oxalic acid. Treating it with sulphuric acid and fermenting the sugar so formed, produces alcohol. Mixed with a suitable binder and compressed, it can be used for making mouldings and imitation carvings; while, if mixed with Portland cement, it produces a flooring material. It is an excellent packing material for fragile articles and for dangerous explosives and can be used as packing in walls to make them soundproof and cold-proof.

Of Samuel Bowdlear Green, Dean of the School of Forestry in the University of Minnesota, who died of apoplexy on July 16, the American Lumberman has well said:

> "Professor Green was essentially of a judicial temperament. He saw both sides of every question. He possessed the one faculty that is indispensable to leadership in any movement in which interests are varied and conflicting. He was not a radical partisan or advocate of any policy, party or interest. He understood, recognized, and respected the rights and opinions of all. His advocacy was in the direction of education. He knew that the forests must be used to be conserved, and it was his chief end and aim to teach the people to know that true conservation of the forests is synonymous with their proper use. Thus in his policy the theoretical and practical were so combined and harmonized as not to arouse the antagonism or opposition of any interest. He had the fullest confidence and respect of lumbermen and all who knew him."

Professor Green was born in Chelsea, Mass., graduated from Massachusetts Agricultural College in 1879, and studied abroad. He became Professor of Horticulture in the University of Minnesota in 1888, Professor of Horticulture and Forestry in 1892, and was dean of the forest school when he died. He was author of "Amateur Fruit Growing," Vegetable Gardening," "Forestry in Minnesota," and "Principles of American Forestry." He was president of the Minnesota Horticultural Society, of the Minnesota Farmers' Institute, and of the Arbitration Board in the Switchmen's Strike; a member of the State Board of Forestry and of the Executive Committee of the Minnesota Forestry Association; and Chairman of the Curriculum and Grounds Committee in the Agricultural College.

Professor Green was among those who laid the foundations of forestry in Minnesota, and it is a satisfaction to his many friends that he was spared to see success crown his efforts to build up Minnesota's forest school, which was made a separate department of the University in May 31.

On July 16, 1910, after an operation for appendicitis, Louis Christian Miller died in Denver, Colorado, to the loss of his friends and co-workers.

Born in Missouri in 1873, Mr. Miller grew up on a farm, attending public schools in Missouri and Oklahoma. In 1900, he graduated from the Oklahoma Agricultural and Mechanical College.

The same year he entered the Section of Tree Planting in the Bureau of Forestry, and ever since has worked on forest-extension problems. The term of 1902-1903 he spent at Yale Forest School, and in 1903 became a Field (now Forest) Assistant.

Mr. Miller helped locate the Dismal River and Niobrara National Forests, started the experimental work on the former, studied the value of chaparral as a watershed cover in California, was Chief of the Section of Reserve Planting, and was Chief of the Section of Planting in District 2 when his untimely death prevented the fruition of his work. The Forest Service has cause to mourn the loss of his long experience with and wide knowledge of the reforestation problems before it.

The breezy cheerfulness of Mr. Miller will be missed by all who knew him, and his friends will cherish the memory of his enthusiasm and generosity of spirit, which prompted him to always lend his hearty co-operation to whatever would tend to help along the cause of forestry.

FORESTRY QUARTERLY

VOL. VIII] DECEMBER, 1910. [NO. 4.

TWO NEW INSECT PESTS IN NEBRASKA.

A New Insect Enemy of the Western Yellow Pine.

For two or more years occasional reports have reached the office of the Nebraska entomologist from the northwestern part of the State to the effect that the native pines growing along the pine-ridge of that section were being attacked and defoliated by some insect. Several persons who reported injuries were of the impression that the pine bark beetle (*Dendroctonus ponderosae*) from the Black Hills country had reached Nebraska and was responsible for the damage. Early during the present year additional reports, and at the same time specimens, of the insect under consideration were received from the seat of trouble. These specimens proved to be the larvae or slugs of a saw fly of considerable size. Without any definite knowledge of the probable parent of these slugs it was at the time impossible to name it. During former years, considerable collecting of specimens had been done by various parties visiting the regions from the Unversity of Nebraska and among these specimens thus collected were a half dozen individuals of a saw fly that apparently belonged to the genus Lophyrus. The species, however, was not determinable at the time and specimens were recently sent to the U. S. National Museum for determination. The report on these insects gave the name *Lophyrus townsendi* with a question as to the species.

As the insect was present in unusual numbers over a large area of territory it became necessary to investigate the matter further. Accordingly during the spring and summer of 1910 three separate trips were made to the region for the purpose of gaining some definite information as to the amount of injury, the area covered, the life history and habits of the insects under consideration, and the probability of its continuing to spread and to further damage the timber of that portion of the State. These trips were undertaken by Myron H. Swenk, J. T. Zimmer and the writer. During the latter part of the month of May, Mr. Swenk visited the region first and found the insect present in large numbers. He also found that the larvae were then practically full fed and had commenced to enter the ground for the purpose of spinning their cocoons. From June 10 to 13 inclusive, Mr. Swenk again visited the region and on this second trip the writer accompanied him. At the time it was found that most of the slugs had left the trees and entered the ground, where the majority were already in the pupa stage, or just entering it, while a few of the imagos had commenced to emerge. About a month later, July 6 to 19 inclusive, the infested region was visited for the third time, by Mr. J. T. Zimmer and myself. At this time the majority of the mature insects were issuing and egg-laying had just begun.

During the various visits to the region, many specimens of the larvae and cocoons were collected and brought back for the purpose of continuing the study of the life histories begun in the field, with the idea of securing information that might lead to the possible control of this insect by parasites or otherwise. This material was kept under continual observation here at the Station and has aided greatly in giving some insight into the insect's life history. At first, judging from the fragmentary evidence available, it was surmised that this insect was either double or treble brooded, and that the extensive injury which was in progress during the spring month was only one of two or three attacks by the larvae that were probable for the year; hence much concern was felt as to the possible effect on the pines of the region infested. At present, however, it seems that there is only a single generation, and that the insect has altogether a very interesting life cycle materially different from that of most other saw flies. A discussion of this feature will be considered in a later paper.

That this saw fly is capable of doing considerable harm to the pines of northwestern Nebraska and also in the Black Hills region is very evident, since many trees growing over a territory equaling a township or more in extent were nearly or completely defoliated by the larvae at the time of the first visit. Specimens of the insect have been collected at Custer, South Dakota, as well as in both Dawes and Sioux Counties in Nebraska, and I believe related forms or species have been found in both New Mexico and Old Mexico.

During the study of this insect it has been found that it is largely attacked by several parasitic insects. So far two species of Tachina flies, one Bombyliid and three Ichneumonids have been bred. One of these latter, a species of Exenterus (?), seems to be the chief and controlling parasite and it was in connection with the life cycle of this last named parasite that the decision was made as to the possible single-broodedness of the host.

The incomplete information as to this insect's life history makes further study necessary. Meanwhile, we should be pleased to receive any information concerning the presence and attack by saw fly larvae upon Western Yellow Pine in other sections of the country.

LAWRENCE BRUNER.

The Pine-Tip Moth (*Retinia frustrana* Scudder).

For the past two seasons the young pines growing upon the National Forest at Halsey, Nebraska, have suffered quite severe injury through the ravages of this insect. Our attention was first called to this condition early in July, 1909, when we received from Mr. Mast, at that time Supervisor of this Forest, samples of injured pine growth with the information that this was typical of the condition of many of the tips of the young trees. As the situation seemed rather serious, a personal examination of these young pines was made by the writer July, 1909. The infested trees were carefully examined and it was found that about 35 per cent. of the new tips were affected by this insect, and practically all of them were dead and brown. The trees most injured were in the older parts of the plantations where the Jack Pine was about six feet tall with smaller Scotch Pine scattered among them. During the past season, 1910, these injuries have spread to practically all the young pines on the Forest and the attack was noticeably more serious, the injured twigs exceeding 50 per cent. of the entire number and on some trees including nearly every new shoot.

While time has not allowed a detailed study of the life history of the pest as it occurs on this Forest, the chief points have been determined. The insect is at least two-brooded in this locality; the injury by the first brood or larvae becoming manifest by the middle of June, at which time the larvae are approaching full size and the older ones are already going into the pupa condition. The pupal stage is of short duration and the moths commenced to emerge by June 28 and continued coming out for nearly a month. The majority of the moths had emerged by July 10. In late July and early August the tiny larvae of the second brood may be found working in the terminal buds, and, as this brood develops, the previous injury is duplicated. The egg of the moth is a small, flat, yellowish object and seems to be usually deposited near the extreme end of the young tips so that the larvae on hatching burrow immediately into the tender bud, and, as it develops, they form a cavity from 1 to 3 inches in length. When full grown, the insect pupates near the terminal end of the infested tip. This burrowing causes the death of the tip, and, as the needles rapidly turn brown and drop off, the injury becomes very conspicuous.

On the National Forest the principal injury occurs on Jack Pine but the Scotch Pine and Western Yellow Pine are also affected. A considerable amount of parasiticism is present among the tip moths, a small, black ichneumon fly and a Chalcis fly being the principal parasites. There is also evidence that an entomophilous fungus has been at work during the past season, and it is to be hoped that these natural enemies will soon gain control of the tip moth pest, and obviate a condition which has threatened to seriously interfere with the very promising experiment in sand hills forestation.

MYRON H. SWENK.

University of Nebraska.

THE PROGRESS OF RECONNAISSANCE.

BY A. B. RECKNAGEL.

On October 29, 1908, the writer presented before the Society of American Foresters an article on "The New Reconnaissance—Working Plans That Work."* At that time reconnaissance work was in its infancy; now the methods outlined in the article referred to have become standard all over the country, and reconnaissance estimates of National Forests are being pushed vigorously in every one of the western districts.

The purpose of this present paper is to briefly review the progress which has been made since the first reconnaissance field party started work on the Coconino National Forest in April, 1908. The Coconino reconnaissance has been made the basis of the working plan for the sawtimber type of the Coconino and Tusayan (formerly part of the Coconino) National Forests, by Mr. J. H. Allison, who succeeded Mr. Frank Vogel in charge of the reconnaissance party there. This working plan will soon be published by the Service, and will serve as an admirable exponent of what can be accomplished by systematized reconnaissance.

There have been two general policies of reconnaissance in the different Districts: (1) A complete reconnaissance, such as outlined on pages 9 to 12 of the article referred to above; (2) A cursory reconnaissance, with a view of securing a careful description of just what is found on the Forest; to take a general inventory of the stock of timber, locate its distribution and occurrence by forest types, ascertain what stands are in need of cutting, and the order in which different areas should be logged. In District 6 (Washington and Oregon) frequently no attempt is made to actually estimate the timber, but rather, to map as accurately as possible the types, the varying age classes, and the condition of the timber.

This latter class of reconnaissance does not require so large a field party, since one or two men can quite easily secure the

* Proceedings of the Society of American Foresters, Vol. IV, No. 1, 1909, reprinted Yale Publishing Ass'n., incorporated, New Haven, Conn.

necessary data. Of course, it is preliminary, but is, nevertheless, a distinct advance over former times.

Two general policies have obtained in determining the personnel of the reconnaissance party. In District 3 (the Southwest) particularly, it has always been the policy to have distinct reconnaissance parties composed of men specially trained in that class of work, and to rely on rangers only in so far as they may serve as guides through their districts, or as their temporary assignment to a reconnaissance party may prove a profitable experience to them. This does not mean that men have not been recruited locally to complete reconnaissance parties, but the policy of employing rangers for such specialized timber cruising has not proved successful in District 3. However, in other Districts, particularly in District 2, (Denver), it is distinctly the policy to let rangers secure reconnaissance data as opportunity is afforded them, and to place large parties in the field only where this seems especially desirable or necessary as, for example, where a reconnaissance is combined with a special sales examination upon application for a large body of timber.

In one thing all Districts are agreed, to wit: the necessity of a complete report, using, with slight modifications, the form contained on pages 9 to 12 of the article referred to above; usually the final report is prepared by a technical man.

More and more the reconnaissance work is made to comprise all the various activities on the Forest. Thus the Office of Grazing, in Washington, has recently issued a very complete outline to be used in reconnaissance work. The present day reconnaissance is the basis for a plan comprising all phases of National Forest administration, and thus it falls right into line with the policy of letting Supervisors conduct their Forests with only a general supervisory control on the part of the District Office.

The recently completed reconnaissance of the Choctawhatchee National Forest, in Florida, marks a still further forward step. In the past the estimates have been ocular, with the "40" as a basis for judgment. In Florida, owing to the need for more exact data, the strip method was used, and all trees on a strip two chains in width, or 10 per cent. of the entire area, were tallied by diameter classes. While such accurate methods are not usually possible, owing to the increased cost, they show clearly the transition from rough reconnaissance estimates to exact working plan estimates, a transition which ultimately is bound to come in every National Forest.

The accompanying table of costs shows the figures for some of the typical Forests in District 3. It will be noted that the cost in Arkansas is considerably higher than anywhere else owing to the greater number of species composing the forest there. As an average, by the present reconnaissance method, the cost of one-half a cent per M. ft. B. M., and from one to two cents per acre can be considered standard.

COST OF RECONNAISSANCE FIELD WORK

Forest	*Area Covered Acres*	*Cost* *Per Acre*	*Per M. ft. B. M.*
Arkansas, Ark.	50,160	$.0517	$.031
Choctawhatchee, Fla.	177,720	.0142	...
Coconino, Ariz.	1,316.440	.0116	.0048
Coconino, Ariz. (Grand Canyon)	66,600	.013	.0046
Prescott, Ariz.	95,254	.019	.0043
Sitgreaves, Ariz.	270,115	.0087	.0023

Until reconnaissance estimates and working plans could be made for every Forest, timber sale (policy) data, minimum (now standard) stumpage rates, marking rules and tentative estimates were collected for each Forest, as described in the first part of the article referred to above. These (policy) matters are now running very smoothly, and need but little modification each year. For example: every Supervisor is allotted a certain annual cut, based on the best estimates obtainable. This annual cut he treats as one would a bank account. The limitation for each Forest is approved by the Secretary of Agriculture. Of course, it is not expected that the Supervisor will necessarily use up the limitation each year, so he can either let it accumulate for a number of years, or else he can make a larger sale than the limitation allows, pro-rating it for several years in the future. The limitation serves the purpose of an effective "lid" on over-cutting. Similarly, the standard stumpage rates and general marking rules (especially as supplemented by the work of the "Marking Board" in marking sample areas in typical stands) have equalized the timber sale policy until now the whole matter is in sufficiently definite shape to be embodied in the Forest Service Code.

These results mark the passing of mile-stones in the long road towards the goal of having working plans for each Forest. The timber sale and planting policy on each and every Forest has been standardized and is well understood. Reconnaissance parties are busy gathering further data, and men alive to the need of a better control of the resources and business of each Forest are making *working plans that work.*

DETERMINATION OF QUALITY OF LOCALITY BY FIBER LENGTH OF WOOD.

By C. D. Mell.

The use of the microscope has proved to be one of the most valuable aids in the determination of the value of woods for specific purposes. Likewise, the character of the wood of trees grown under different soil and climatic conditions reflect certain differences under the microscope that are sufficiently important to be remembered by the silviculturist when he wishes to determine what he calls the "quality of locality." The most superficial observer knows that there is a wide variation in the quality of the wood of trees grown in different parts of the country. Users of wood are familiar with the fact that the amount of stress which a piece of wood can withstand is more variable than that of steel or iron, and that the wood of trees grown on a dry hillside differs very widely from that grown on rich moist lowlands. The latter produces trees with wide annual rings and a large proportion of late or summer wood that is stronger, than the weaker and more porous early or spring wood. This is especially true of the hardwood species, as the oaks, for instance, that grow very slowly, and consequently develop very porous wood with a small proportion of late wood. The large vessels are first formed in the beginning of the growing season for the rapid transport of water to the tree tops, and if this period is short or the soil moisture is insufficient very little late wood will be laid on, and the concentric layers of growth consequently remain very narrow. The outer portion of the annual increment layer in wood of fast growing trees is composed chiefly of wood fibers, and the abundance and length of these elements determine the character of the wood. If the late wood is wide in comparison with the early wood, the tree may be considered a fast grower, and the wood fibers are larger and longer than the same elements in trees that grow less rapidly. This structural difference between the wood of trees belonging to the same species is in some cases quite small, while in others it may be very noticeable, depending upon the environmental conditions.

Aims of the Investigation.—It has been observed that the cell walls of wood fibers are more highly lignified in trees that develop very narrow concentric zones, which brings up the question whether the soil and climatic conditions have any influence upon the length of wood fibers. Microscopical examinations have already shown that the length of these elements varies considerably in the wood of different trees of the same species and in different parts of the same tree. An attempt has, therefore, been made to ascertain the cause of this variation, or at least, to determine probable factors that stimulate the growth in length of wood fibers. To this end, suitable material of California Walnut (*Juglans californica* Wats.) was collected from trees growing in different soils and situations, and subjected to a microscopical examination. The material was macerated and the fibers measured and data tabulated, and from these data averages were computed. The measurements were made first, to determine the average length of the wood fibers of this species for comparison with those of the wood of the other species of this genus; second, to ascertain the effect of soil conditions upon the length of wood fibers; and, third, to determine the maximum and minimum length of wood fibers for each specimen, and thus find the range of variation for all the samples selected from trees growing under the different local conditions which are said to retard or stimulate development of the wood elements.

Material Used.—The trees from which these sample blocks were taken were all growing in entirely different soils. Of the samples, set No. 1 was taken from trees growing in rich black soil with abundant light and growing space; set No. 2 was obtained from trees growing in moist sand with a medium amount of light and growing space; set No. 3 was secured from trees growing in dry sand and gravel. The experiments were performed with freshly cut wood selected from trees which, with but one exception, were under 5 inches in diameter. The small blocks that were macerated were taken from the third and fourth rings of growth inside the bark, thus avoiding fibers near the pith and near the cambium. Other and equally thorough tests were made with a larger number of blocks which contained no data as to soil conditions, for the purpose of getting a general average length. It may be important to know that all the material used in this work was taken from stems and not from branches of trees. Whether there is any difference between the fibers of the branches and the stems is not definitely known. There is a likelihood, however, that the wood fibers on the upper side of a horizontal branch differ in length from those on the lower side, and for this reason blocks cut from branches were not used in this investigation.

One hundred fiber measurements were taken from each individual block and their averages computed, with the results shown in the following table; the maximum and minimum lengths for each set of blocks are also given:

Maximum, Minimum and Average Lengths of Fibers for Each Set of Blocks.

	Length of fibers in millimeters		
Character of soil	*Average* *mm.*	*Maximum* *mm.*	*Minimum* *mm.*
Set 1			
Deep black soil	1.134	1.554	.714
Set 2			
Moderately moist sand	1.097	1.428	.672
Set 3			
Dry sand and gravel	.968	1.302	.546

The above table serves to show beyond a doubt that the character of the soil has much to do with the character of the wood. Practical foresters have determined that rich moist soil stimulates height growth, and these figures confirm that such conditions likewise stimulate the growth in length of elements in the stems. Although the average length of fibres in set 1 exceeds the average in set 2 but little, it, nevertheless establishes a fact of value in silviculture that has never before been brought out.

It may have seldom occurred to the practical forester that the microscope can be of help to him in establishing certain definite fundamental principles which have hitherto been known only in a general way. Not only do the average figures show this gradual diminution in length from set 1 to set 3, but the maximum and minimum figures likewise exhibit a similar gradation. In set 1 is found not only the highest average length, but also the highest degree of differentiation from maximum to minimum length, which is .84 *mm.* In sets 2 and 3 the difference between the two extremes is exactly alike or .756 *mm.*

These figures are perhaps sufficient to verify the statements made in reference to the influence of soil upon the wood elements. In regard to the variation in length of fibers in the three sets, the table shows without further explanation that there is a certain relation between the external factors that influence growth and the anatomical structure of the wood fibers, and that the quality of locality may be determined by means of a microscopical examination of the wood.

EXPLOITING TELEGRAPH POLES IN COLORADO.

By Arthur T. Upson.

On the Sopris National Forest in central Colorado a large amount of Lodgepole Pine and Engelmann Spruce was killed by the fires of 1896. This timber had reached a good size for telegraph poles when the fire passed through it. Most of it is still standing and in good condition; the pine is free of bark with long clean boles; the spruce is limby with the bark still clinging to it. The timber is situated on a very steep slope about 2,000 feet above a valley which drains to the Colorado Midland R. R. about six miles distant.

A small portable sawmill is located in the center of this burned area with the primary intention of logging live trees for lumber and exploiting telegraph poles as a side line. Three logging roads lead from the mill through the dead timber to the uninjured stand above while the lumber road zig-zags down the steep, rough slope to the valley about a mile distant, and then runs over smooth ground to the railroad. The owner has received a contract for several thousand poles of 25, 30, 35, and 40 feet long with a diameter at the small end of 6″ for 25 feet poles and 7″ for the three larger sizes. The poles are to be straight, peeled, well sawed at both ends, with little butt swell, and few season checks.

The time clause allowed in the contracts demanded about 100 poles a day and to meet this requirement the mill owner found it necessary to keep several crews in the woods. The saw crews consisted of two men equipped with one ax, a cross cut saw and a five foot measuring stick, who notched, felled, and cut the trees to pole lengths. The timber had to be carefully felled for the dead boles were easily broken and whenever a tree was splintered or swelled at the butt, a portion of the large end had to be sawed off. The diameter of the tree at breast height was the highest limit allowed for the stump but each tree was cut to the longest pole length it would yield and still conform to the top diameter limit. The average day's work of ten hours was 45 to 55 poles per day which was smaller than normal because of the time lost in cutting off splintered tops and butts with too great a taper.

The swamper followed the saw crew to clear the ground of brush and make trails for hauling the poles to the logging road. He also helped the skidder fasten the chain on the poles. The skidder used one horse for pulling out one pole at a time, except where two poles of small size were lying close together. The poles were skidded an eighth to a quarter of a mile to a skidway located at the side of the lumber road, where the road was cut down three feet leaving the skidway about four feet above it. The skidder left the poles near the skidway for a man to trim off the knots, any remaining splinters, and peel the bark off the spruce. The poles were then rolled onto the skids and piled with the small ends toward the valley. The trimmer had to be an expert in using the cant-hook and also in using the axe for a mis-stroke would splinter and mutilate the pole. One trimmer handled about 40 to 50 poles a day which was as fast as one skidder could bring them.

The haul from the skidway to the valley level was made by a teamster with two horses and a cart which consisted of the front wheels and axle of a common, heavy wagon. The bolster was built up to the top of the standards making the bunk about three and one-half feet high and a trifle over four feet wide. In loading, the cart was drawn up to the skidway which was a few inches higher than the bunk, the poles were rolled on and chained to the bunk in two bunches of 3 poles each, then from one to three poles were added to the load and the whole was chained together in the middle. In this way seven to nine poles could be hauled to the load and eight trips could be made per day which made the total daily haul average 60 poles. The trimmer always helped the teamster load. The teamster had to be skilled and careful as this part of the road was very steep and accidents easily happened. At the end of this steep, short haul the valley was not wide enough to permit turning around so the poles were dropped with the small end forward but from this point the poles were hauled to the railroad on a four-horse wagon on which they had to be loaded with the large end forward. This necessitated extra labor to turn the poles, which was done by one man and a horse who could place about 100 poles a day. From this position loading was easily accomplished by rolling the poles over skids onto the wagon. The bunks on the wagon were concave to a depth of 12 inches in the center, with a long standard at each bunk, while the reach was lengthened to better distribute the weight of the load. The teamster made two round trips per day carrying twelve to fourteen poles each trip.

The poles were unloaded at the railroad where they were hauled on the skidway by one man and a horse. Care was taken to place the poles with alternating large and small ends in order to load the car evenly. The skidway was located at the edge of the railroad where it runs through a cut, so as to have the skidway several feet above the top of a flat car and allow rapid, cheap work. The loading was done by contract at $3.00 per car and the loader was instructed to make the poles lie closely and evenly. Round car stakes were used which were six inches in diameter and nine feet long. One man could load a car of 95 to 100 poles per day.

Since the timber came from a National Forest the scaling was done on the car by a Forest Service scaler who used the Scribner Decimal C rule and scaled the poles as either two or three logs to provide for the increased content due to taper. The increase in diameter was calculated from the table given for this purpose in the Forest Service Use Book. The Forest Service sold the timber to the pole contractor at $1.50 per M, board measure.

The following tables show the wages of the men, the number of men in an average crew, the itemized cost of poles f. o. b., wages, and the maintenance of men and horses.

Boss,	$75.00 per month and board.
Sawyer,	1.75 per day and board.
Skidder,	1.75 per day and board.
Trimmer,	1.75 per day and board.
Teamster,	60.00 per month and board.
Loader,	3.00 per car.
Board per man,	.75 per day.
Horse hire,	1.00 per day.

Number of men and horses required to exploit 100 poles per day and load on car:

1 Boss.
2 Two-men saw crews.
2 Swampers.
2 Skidders and 2 horses.
2 Trimmers.
2 Cart teamsters and 4 horses.
1 Man with one horse to turn poles.
4 Wagon teamsters and 16 horses.
1 Skidder with one horse at car.
1 Loader.
Total 18 men and 24 horses.

Itemized average cost of pole exploitation f. o. b. cars per 100 poles (haul of 6 miles):

Stumpage,	$15.00
Cutting,	10.00
Skidding,	7.00
Swamping,	5.00
Peeling and trimming,	5.00
Cart hauling,	9.20
Turning,	3.50
Wagon hauling,	27.15
Skidding to car,	3.50
Loading,	3.00
Superintendence,	3.65
Cooking and toting,	5.00
Wear, tear, and losses,	3.50
	$100.50

The pole contractor receives from $200 to $225 per 100 poles, which leaves him a profit of $100 to $125. Since there is a large amount of fire-killed timber in the Rocky Mountains, it would seem a very profitable investment for contractors with special equipment to establish camps for pole exploitation where the timber lies at even greater distance from the railroad than in this case, and that in many cases a conservative utilization could be secured where the dead timber is now going to waste.

A COMPARISON OF MAINE AND BLODGETT LOG RULES.

BY IRVING G. STETSON.

The comparison of various rules for the measurement of logs is not a new subject: much has been written regarding their relative merits. Most of the articles have, however, dealt especially with the comparing of the scale figures with the results obtained in the mill so as to ascertain the amount of under- or overrun of the rule with the mill cut in edged lumber.

The writer was led some time since, on account of the lack of exact knowledge of the relation between the two rules chiefly used in his State (Maine), to make a study on a theoretical basis of the relation between the Maine and Blodgett log rules leaving out of consideration the relation with the mill cut. The results of that study were based on an assumed average taper. The present study, based on actually cut trees, proves the correctness of the conclusions reached in the previous study.

An article by E. A. Ziegler in Vol. 4, No. 1, of the Proceedings of the Society of American Foresters deals with the same subject. In that article the two rules are compared on the basis of 12 and 30 foot logs. In both cases, however, the comparison is with the Blodgett Rule converted into board feet by the factor 106 Blodgett cubic feet = 1000 board feet, this being the converting factor used when the log using the Blodgett rule is measured at the end. As a matter of fact the measurement is now practically always taken at the center of the log and the factor 115 Blodgett cubic feet = 1000 board feet is used; so that to get a proper basis for comparison the logs should be measured in this way. In the comparison for 30 foot logs, moreover, in the above article the actual figures are taken from the Maine rule for 30 foot logs just as they stand in the rule, whereas in scaling practice 30 foot logs are scaled as two 15 foot logs allowing a "rise" of one inch from the top to the center of the log. This customary method of scaling gives results considerably higher than those taken directly from the scale figures for 30 foot logs.

The writer has attempted to compare the figures in the two rules as they result from actual methods of scaling now in use. It is hoped that the conclusions reached may throw some light on the matter, and offer a means of determining approximately what scale or estimate for any given lot of logs or stand of timber may be expected by the use of one or other of the rules.

The Maine rule, according to an advertisement of Chas. T. Holland, the originator, published in 1867 was "prepared from full sized, accurately drawn diagrams representing the end of logs of each inch in diameter from six to forty-eight inclusive." The inscribed square was obtained and an inch allowed for each board with a space of ¼ inch for saw kerf. The boards outside of this square were also reckoned in, including all that would work six inches in width and upwards. In the rule, no allowance is made for taper, i. e., the scale given is that of a cylinder of the diameter of the top of the log in question. In practice, however, logs over 28 feet long are scaled as two logs, the butt log being given a rise of 1 inch in the case of logs 28 to 32 feet long, 2 inches in logs 32 to 36 feet long, and 3 inches in those 36 to 40 feet long, while the rise of logs over 40 feet long is purely a matter of guess-work on the part of the individual scaler. The Maine rule is one of the best for short logs but for long logs ridiculous results are obtained where pieces are scaled as one log, and even by the use of these customary tapers the results are still too small.

The measurement of 103 logs resulted in the following average tapers, the logs, moreover, having been cut in a stand of spruce timber which held its size well into the tops. Results obtained from a stand grown on poorer soil would show still more variation from the customary rises used in scaling:

Number of Logs.	*Length. Feet.*	*Average Taper, Top to Center of Log, Inside Bark. Inches.*
31	20-23	1.5
20	24-27	2.0
10	28-31	2.5
15	32-35	2.9
12	36-40	4.0
15	41-48	4.4

If the Maine rule is to be used for long logs a caliper should be employed and the logs scaled in 16 feet lengths. The results in this case would be excellent, as the Maine rule is conceded to be one of the best now in use for short logs.

The Blodgett or New Hampshire rule is really a "standard" rule similar to the New York 19 Inch Standard. According to the Revised Statutes of New Hampshire of 1901, "A stick 16 inches in diameter and 12 inches in length shall constitute one cubic foot, and the same ratio shall apply to any size and quantity, and each cubic foot shall constitute 10 feet of 1000 board feet." In actual practice, however, when logs are measured in the middle, 115 Blodgett cubic feet are considered as 1000 board feet or in other words 8.7 board feet are equivalent to one Blodgett cubic foot. The rule does not increase by the proper amount with the larger diameter because of the fact that the fixed factor of 115 Blodgett cubic feet = 1000 board feet does not allow for less proportional loss, due to slabbing, in the larger logs. Even for small logs the factor 8.7 is too low: I find that to check up with Clark's International or the Maine rule,—which run about the same for short logs under 12 inches in diameter—the factor should be, even for logs measuring 10 to 11 inches inside the bark at the center of the log, about 9.2.

Such are the two rules; in Maine both are used. Some land-owners use one rule in giving logging permits on their lands, some the other; operators buy by one rule and sell by the other; cruisers give estimates in board feet without stating whether they mean mill run, Blodgett scale or Maine scale! No one seems to know the actual relation between the rules; many not even which of them runs the higher. This condition of affairs makes it desirable to have some data on the subject so that land-owners, millmen and operators can make their contracts on a known basis instead of as at present in the dark to a greater or less extent.

While better results might have been obtained by the measurement of more trees and logs, the results which follow are without doubt somewhere near the truth and would apply to all stands and lots of logs of a similar nature, i. e., stands of spruce on good soil, grown pure, and in mixture with hardwoods.

The tables which follow show the results obtained for logs of various lengths and top diameters. While the figures for the Blodgett rule are given for logs of certain top diameters, in scaling the logs were scaled at the center as is the usual custom, the top diameter classification being used simply as a basis for comparison. The tables were constructed from curves so as to even off the irregularities due to the differences in the number of logs of the different diameters scaled.

Tops Diam. Inside bark	*16 ft.*		*24 ft.*		*32 ft.*		*40 ft.*	
	Maine Ft B M	*Blodgett Ft B M*	*Maine Ft B M*	*Blodgett Ft B M*	*Maine Ft B M*	*Blodgett Ft B M*	*Maine Ft B M*	*Blodgett Ft B M*
6	20	31	30	50	64	90	90	145
7	31	41	47	70	83	103	124	185
8	44	54	66	80	112	120	158	220
9	52	69	78	95	135	140	235	245
10	68	86	102	110	173	165	263	260
11	83	91	124	145	203	180	305	290
12	105	121	157	165	247	221	354	320
13	120	138	180	185				
14	142	156	213	210				
15	161	179	242	230				

The table for 16 foot logs was constructed from 28 logs, half tops and half butt logs. The other tables were constructed from 34, 17 and 19 logs respectively, practically all the logs being butt logs. A table for 16 foot logs made entirely from butt or top logs would show smaller and greater results respectively than those given in the table under the Blodgett rule. If all tops, the results would be much higher than the Maine rule right through; if all butts, they would be lower with the possible exception of the 6 and 7 foot logs. In scaling for the tables by the Maine rule the figures for the 16 and 24 foot logs were taken directly from the rule without allowing any rise; 2 inch rise was allowed for the 32 foot logs, and 3 inches for the 40 foot logs.

For logs as they run, then, the results may be summarized as follows:

16 ft. logs:—Blodgett averages 33% greater than Maine.
24 ft. logs:— 6-13″ inc. Blodgett averages 34% greater than Maine.
14-15″ inc. Maine averages 3% greater than Blodgett.
32 ft. logs:— 6-9″ inc. Blodgett averages 22% greater than Maine.
10-12″ inc. Maine averages 8% greater than Blodgett.
40 ft. logs:— 6-9″ inc. Blodgett averages 33% greater than Maine.
10-12″ inc. Maine averages 6% greater than Blodgett.

In other words for short logs as they run, i. e., where about half of such logs are tops—the Blodgett rule overruns the Maine;

for long logs as they run,—i. e., where they are mostly all butt logs—the Blodgett overruns up to and including 9 inch logs, while logs over that size scale more by the Maine rule than by the Blodgett, the amount increasing with the size of the logs. As most spruce logs now cut are long, and between 6 and 12 inches top diameter, it is seen that the scale by the Blodgett rule overruns that by the Maine by about 25 per cent. on an average. Where the logs are larger and cut shorter the discrepancy is less, although for practically any run of spruce logs in these days the Blodgett will in all cases be greater.

The relation of the estimate of a stand of timber to the problem may now be considered. The following table, which was constructed from 66 trees cut well into the tops (5-7 inch tops) and sawed down to the swell of the roots, shows the scale to be expected from spruce timber grown on good soil. The scale when the trees are taken out as one log is given,—by the Maine rule using customary tapers, by the Blodgett rule and by the Maine rule with actual tapers; also the scale if the trees are cut in two at the point near the tops where the taper begins to increase rapidly. (When the trees are cut in two, the tops under the Blodgett rule are customarily scaled by allowing only 100 Blodgett cubic feet to the thousand board feet instead of 115. This was the method used in scaling for the table.)

The table may be summarized as follows:

			Scale if taken out as one log.			*Scale if cut in two where taper increases rapidly*	
D. B. H. in.	*No. of trees.*	*Used length feet.*	*Maine Rule Usual tapers (evened off by curve).*	*Maine Rule Actual tapers.*	*Blodgett Rule (evened off by curve).*	*Maine Rule Usual tapers.*	*Blodgett Rule.*
11	5	31	80	82	108	84	103
12	10	35	88	96	118	91	104
13	21	35	98	111	133	103	123
14	6	40	112	127	148	119	145
15	11	39	130	157	169	151	183
16	7	42	155	167	190	153	195
17	4	45	191	238	227	209	264
18	1	39	230	259	275	241	279
19	1	36	280	295	330	280	335

D. B. H.	*Blodgett overruns Maine rule. per cent.*
11	35
12	34
13	35
14	32
15	29
16	24
17	16
18	19
19	19

The irregularities in the downward trend of the percentage are due to the method of derivation of the Maine rule,—from diagrams rather than from formula.

From this table, a cruiser, having an estimate in either of the rules of a stand of timber and knowing the average size of the trees, could get a pretty fair estimate of what the timber when cut would scale in the other of the two rules.

WATER POWERS IN THE NORTHWEST.

By W. E. Herring, District Engineer, F. S.

Power is the vital element in our industrial development. The greater the increase in our population and manufacturing, the greater the dependence upon it. The two sources available are steam power and water power. Coal, wood, and oil are the fuels used in the generation of steam power, and all are becoming more scarce each year. That the price of fuel is advancing is well illustrated on the Pacific Coast where the cost of fuel oil has advanced in the past five years from 25 cents a barrel, equivalent to about $1 per ton for coal, to $1 a barrel. Water power is undoubtedly cheaper than steam power, and as competition becomes more acute, the value of water power over steam becomes greater. Advances which have already been made in the distance to which electrical energy can be carried, as well as the advances which are sure to come in the near future, will tend largely to further increase the value of such power over steam power. The great initial incentive for the development of hydro-electric plants in the northwest has been the existing high cost of fuel. The entire scope of country west of the Cascades is particularly well adapted to such developments owing to the heavy rainfall and its distribution, the large number of glaciers which act as regulators of the stream flow and the extremely heavy fall in the streams.

The greatest activity has been displayed in the past two years in the acquisition of power sites on the different streams, and practically all of the more important streams have been covered with water filings and surveys made on them for proposed water power plants. The possibilities of such plants have been steadily growing, and the advantages consequently increasing, until the desirable sites have all been taken. In Washington alone, west of the Cascade Mountains, out of a possible development of 421,500 HP, 90.1 per cent. or 379,500 HP are covered by filings, or so protected or guarded by filings that no outsider could make use of the water. Of more interest, however, is the fact that 237,500 HP, or 62.5 per cent., have been filed upon in the last year. Different individuals have made these filings and there seems to be no connection between them. One party who has filed upon about 75,000 HP has not the necessary means to even make the surveys necessary on the projects, and his filings are entirely speculative. He will undoubtedly attempt to hold his rights by refiling on the water.

But few other States have the water power possibilities within their boundaries that are found in Washington and Oregon, and the larger portions are to be found in the territory west of the Cascade Range. Possible developments of 50,000 to 75,000 HP are not uncommon, and a great many exist that will produce in excess of 25,000 HP.

Up to the present time there has not been such economical and general development of water power as includes the storage of water on a scale at all commensurate with the advantages to be gained. Experience, however, with the existing plants in this section of the country has proven conclusively the value of such work and in all of the proposed large developments it plays a most important part. Two reasons are given for the neglect of this feature in the past. First, poor judgment of the stream flow owing to a lack of continuous records of the flow, and second, the desire for immediate and large returns on the investment. The operating plants failed signally to provide for storage to tide them over the low water period in the stream, and a majority of them failed further to provide even a small equalizing reservoir or forebay which could be utilized during their peak load, and lacking either of these it has been found necessary to install and maintain stream auxiliary plants. This is done at great expense and in many cases could certainly have been obviated had the necessary precautions been taken in the initial construction.

When it is realized that every water horsepower used means the saving of from 7½ to 12 tons of coal, 18 to 35 cords of wood—depending upon the kind of wood—or 30 to 40 barrels of oil every year, the saving of our resources by the use of water power can readily be appreciated.

The precipitation west of the Cascades in Oregon and Washington varies from 25 inches to 120 inches per annum, decreasing from the Coast Range towards the interior and thence increasing again towards the Cascade Range.

Unfortunately there are no continuous records of stream measurements on any of the streams, and in fact, the Willamette is the only one on which measurements extending over any period of time are available. Practically all of the streams on the west side of the Cascades have constant beds, and in their upper reaches are of rock and have a rapid fall due to vertical drops or series of rapids. On the streams on this side of the Range, two low water periods exist; on those whose head-waters are entirely supplied from glaciers and melting snow, the low water period is in January or February, and in the others it occurs usually during September or October.

The largest company now operating power plants in this District is the Stone & Webster Company, who own or control three water power plants, with an installation of 35,334 HP, and three steam plants with an installation of 23,566 HP, a total of 58,900 HP, controlled by this company out of a total installation of 73,067 HP in the Puget Sound country. The only other operating plant is the Seattle Municipal Power Plant on the Cedar River, with an installation of 14,167 HP. The estimated population served in the Puget Sound section is 646,000. Next to this company in point of size is probably the Portland Railway, Light & Power Company, operating in and about the City of Portland, Oregon. The company owns two hydroelectric power stations of 20,933 HP capacity. They have steam power auxiliaries of 5,885 HP capacity.

The Puget Sound country is the largest market for electrical power in the northwest. The increase in the amount of power consumed has been remarkably large, particularly in the past few years. From load curves of the Seattle Electric Company, it is found that each year shows an increase of about 25 per cent over the preceding year. The company in the fall of 1909 was carrying an average load of 18,000 kilowats, with a peak load of 31,000 kilowats. The increase is also well illustrated in the City of Tacoma, which purchases wholesale all current needed for lighting purposes and retails it to the consumer. A city ordinance prohibits any individual or corporation from selling current for lighting purposes. In 1902 but 335,000 kilowat hours were consumed, while in 1909, 1,150,000 kilowat hours were used. At the present time, Tacoma is constructing a municipal plant in order to supply the demand made for lighting and power purposes.

The Seattle Municipal Plant has been very successful. It has been enlarged on two different occasions, until at the present time the city has over $2,000,000 invested in it. It furnishes both light and power to consumers, and has served admirably as a regulator of rates in that city, in having one of the lowest rates, with the exception of Tacoma, for lighting purposes of any city in the United States.

In 1902 the Census Bureau reported a total dynamo horse-power for the State of Washington of 18,377. For 1907 the same Bureau reported a total of 126,649 HP, an increase in five years of 591 per cent. Of this total, 64 per cent were in operation on the west side of the mountains. In 1902 the same Bureau reported a total dynamo HP for the State of Oregon of 14,967; the 1907 report gives a total of 43,556 HP, an increase in five years of 193 per cent. Of this total, 86 per cent were in operation on the west side of the Cascades.

A careful reconnaissance of the field in Washington west of the Cascades for electrical power has been made, and a conservative estimate of the additional power which will be required by 1920 is 118,000 HP. In this territory there is now a total installation in central stations, both steam and water power, of 81,120 HP. In manufacturing plants using steam as a motive power there is approximately 200,000 HP.

In Oregon west of the Cascade, it is not thought that there will be any large demand for aditional power in the next few years unless unusual markets are created. The operating plants in this part of the state have a total installation of 42,703 HP. Plants whose construction is proposed total 184,860HP, including two railroad developments of about 70,000 HP, and there are de-velopements possible within reach of markets to the extent of 131,200 HP, making a total available west of the Cascades of 358,763 HP.

A market for electrical power which, up to the present time has received but scant attention in this portion of the country, is to be found on the east side of the Cascade Range, and is the use of electricity for pumping purposes. There are hundreds of thousands of acres of land that need only water to make them as valuable and productive as similar lands more advantageously located for irrigation purposes. The introduction of electricity for pumping water on to such lands has been demonstrated at several points with good results. It is thought also that parts of the Willamette Valley and of western Oregon south of the Willamette Valley can be irrigated to good advantage by the same means. This matter is being thoroughly investigated at the present time by different parties, and it is certain that within a very short time, possibly during the present season, one or more plants will be constructed principally to supply markets of this kind.

Another market which has not been utilized is in the sawmills and in the logging operations. Owing to the elimination of the fire risk and the freedom from water troubles in the woods, and the saving of a friction loss of from 40 to 70 per cent in the drives in the mill, careful attention is being given to it by different lumber companies. If found to be feasible, many operators will undoubtedly construct small water power plants of their own on or near the scene of their logging operations, and it would seem that the construction of small plants where power can not be had from commercial companies, will revolutionize to a certain extent the present method of logging. It would seem that on the larger tracts of timber, where water power could be developed, that stumpage would have an increased value over that on similar tracts where water power was not available.

The State water law of Washington, unfortunately, is a very poor one in that it does not provide for complete State control, and is so inadequate that advantage is constantly taken of it. It is proposed to remedy it in the near future by the introduction of a code similar to the one adopted in Oregon during the past year. The present Oregon water law pertaining to water powers, went into effect May 22, 1909. It provides a charge of 25 cents to $2 per annum for each and every theoretic horsepower represented by an appropriation of water. Allowing for losses in the conduit, water wheels, generators, transformers, transmission lines, and the distributing system, there is approximately 50 per cent of the energy in the falling water delivered to the consumer. Assuming the charge of $2 per theoretical HP, then each HP delivered to the consumer is taxed $4 per year. Again, no plant operates to its full rated capacity 24 hours per day. It we assume that they operate to 60 per cent of such capacity, the tax would be still further increased and would amount to about $6.70 per HP per year.

This might be compared with the charge made by the Department of Agriculture for water power developed on the National Forests. At the end of the fifth year when the Department's charge is 10 cents per 1,000 kilowat hours on energy actually generated, the charge per annum, assuming a 30 per cent loss between the generator and the consumer and an operation to full capacity for 60 per cent of the plant's time, would be 56 cents per HP per year. This small charge should have but little appreciable effect on a company's earnings as compared with the value received.

In the northwest the value of water power is keenly appreciated. With numerous possibilities where thousands of horsepower can be generated, there is still needed, before plants can be built, a demand for their product. With the influx of people and manufacturing plants, the demand for power is rapidly increasing. Given the market, there is no question but that the development of the many possible plants will proceed with such rapidity that there will never be, for any length of time, an unfilled demand for large blocks of power.

FORESTRY IN OHIO.

By E. C. Hirst.

Ohio like most agricultural states has been slow to develop a forest policy. As the virgin timber has been removed most of the land has been converted into farms and yields a good return in crops. This condition, coupled with the facts that the state has no large bodies of scenic mountain land and that erosion has not done the damage here that it has in some other states, has retarded the development of forestry sentiment in Ohio.

In recent years, however, the rapid disappearance of valuable timber trees and the consequent high price of forest products has developed public sentiment to an extent which, in 1906, warranted the General Assembly in establishing a state forestry department under the Board of Control of the Agricultural Experiment Station. This law provides for forest investigation work such as the state could well undertake. The Assembly of 1908 placed $8,000 per annum for two years at the disposal of the department of forestry.

In the following pages the general conditions and problems in the state and methods of meeting them are to be discussed.

Surface Features.—The surface of Ohio is hilly in the eastern and southern part and level or somewhat rolling in the western and northern part. The southern extension of glacial drift crosses the state in a general northeast and southwest direction and roughly marks the boundary between the hilly and level parts of the state.

The eastern and extreme southern part is a very old and well dissected region. It is the western and northern extension of the Alleghany Plateau and is very much like the adjacent parts of Pennsylvania, West Virginia and Kentucky. The topography in some places is very rugged, in others is rolling and in very few places are there extensive stretches of level land. The prevailing rocks here are sandstone and shales. The glacial boundary borders on this region by a series of terminal moraines, which in some places have modified the topography by partially filling the valleys and in other places have piled up the drift in rough irregular hills. This belt of rough land along the glacial boundary for our purposes should be considered with the eastern and southern hill section of the state.

The western part lies wholly within the glacial boundary and is covered with a mantle of drift varying in depth from a few inches to over a thousand feet. Enough investigations have been made to show that this region was once well dissected and that the hills have been planed off and the old stream valleys filled by glaciation. The present surface is level except where too thin a drift cover was left to hide the old topography or, where it has been left in low morainic hills. The prevailing rock here is limestone.

The drainage of the state is in two general directions, north into Lake Erie or south into the Ohio River, a low divide crossing the centre of the state. In the eastern and southern part the rivers have eroded deep valleys and the land is well drained. In the western part the streams have been greatly modified by glaciation; the drainage is young and there is considerable land which has required artificial drainage to make it arable.

The soil conditions are very different in the two regions. In the eastern and southern part the best agricultural land is in the stream bottoms. Some land on side hills is also suitable for cultivation where slopes are not too steep, and where ridge tops are broad there may be considerable agricultural and grazing land. However, taking this region as a whole, there is a large per cent of absolute forest soil, and on account of its hilly character probably one-half of it should always be under forest cover. The western part contains some of the best agricultural land in the Ohio Basin. It is uniformly good over large areas and probably ninety per cent is capable of raising profitable agricultural crops. If we estimate this as comprising three-fifths of the state and the hill region as three-fifths, the true forest soil will be about one-fourth of the entire area of the state.

Forest Conditions.—Considering the state as a whole, the general forest conditions do not differ radically. The forest generally occurs in woodlots and has the character prevalent in the Central States, though in parts of south-eastern Ohio it closely resembles the Appalachian region. With a few notable exceptions the same species prevail over the entire state. Differences are found in the arrangement of the species into types, as well as in the character of ownership of forest land, problems of protection and economic considerations, and in discussing these things the south-eastern hill country and western level land will be considered separately.

Species and Types.—The rugged topography of the southeastern part serves as a good basis for type classification. Here we find Chestnut Oak and Black Oak prevailing on the ridge tops. These trees run down the south and west slopes and are often succeeded by rather open uniform stands of White Oak. Chestnut is the characteristic tree of the north slope and with it in varying proportions are found Red and White Oak, Soft Maple, Beech, Hickory, and variable but small percentages of other hardwoods. In the stream bottoms, swales and moist, lower slopes are found in various mixtures Tulip, White Ash, Walnut, Hickory, Black Cherry, Bur and Swamp White Oak, Elm and others, and sometimes an understory of Hemlock, Maple or Beech. It is not to be understood that these types over small areas contain all the species mentioned, nor that they are so distinct as farther south in the Appalachians; indeed many of these trees may be entirely wanting over large areas while some will be found on all three situations; but they represent the general character of tree growth that would be encountered in going from ridge top to stream bottom in eastern and southern Ohio.

The original types have been greatly modified by lumbering, fire, grazing, etc. In the swale type many openings made by loggong or fire have come up in a temporary stand of Aspen. Under ordinary circumstances, this would soon change over to the original type, but here grazing comes in to reduce the per cent of Tulip Tree and increase the inferior species such as Elm and Soft Maple. Moreover, where this type has not been cleared for stand.

On the slopes and ridges the same general difficulties are found. farming land the inferior species are the ones left to seed up the ground, the constant tendency being to lower the quality of the Lumbering tends to decrease the White Oak, while grazing reduces the amount of both seedling and sprout reproduction and makes many crooked trees among those which survive. But the conditions here are more hopeful on account of the sprouting capacity of the Chestnut. In some places where fire has succeeded cleanings on the upper slopes good reproduction has been prevented and scrubby growths of inferior trees or dense brambles and berry vines have occupied the ground. In other places clumps of Black Locust have come in over considerable areas. In these situations the tree will probably never become larger than tie size but it enriches the ground and prepares the way for a better crop of trees.

In the southern part of the state some cut-over hardwood tracts have come up in pine. Some south slopes are covered with stands of Pitch and Scrub Pine, either pure or mixed with hardwoods. Shortleaf Pine also occurs, but is unimportant.

In the east-central part of the state, along the Walhomding River and adjacent territory are found good stands of White Pine. The soil here is sandy and the pine grows well on the south and west slopes where the better hardwoods will not do well. Although confined at present to a small part of the state this tree may become very important and its range extended by planting where the character of the soil will permit its growth.

In the western part of the state the same species prevail, with the exception of Chestnut and the pines which over large areas are absent or only of botanical interest. Where old valleys remain only slightly modified by the drift the conditions in stream bottoms and on slopes are in a general way similar to those of eastern Ohio. But the greater part of the region is level or only gently rolling and hence topography is a less important factor in the distribution of species. The character of the soil, whether sand, loam or clay, has an important influence on distribution, but both it and topography are reflected to a greater degree in the character of tree growth than in distribution of species. The same species may prevail on different soils and on different degrees of slope, but the difference in rapidity of growth, length of life and form of bole and crown varies markedly on the different situations. There is little sand soil and only patchy areas of stiff clay, the prevailing drift being loamy with enough lime to make rapid growth and not enough to form karsts. White, Red and Black Oak, Hickory, Maple, Beech, Elm, Ash, Black Walnut, Black Cherry and others attain good size.

The original forest has been greatly modified. The greater part of the land has been cleared for farming and the small patches which remain have been heavily culled, leaving inferior species like Beech, Ironwood, Black Gum and Soft Maple to seed up the ground. Nearly all this woodland is used as pasture and this presents a serious problem. In fact many of these tracts have been *'grazed to death'* and are nothing more than than open woodland pastures. Most of the forest of western Ohio is in very bad condition and the greater part of it is constantly deteriorating.

Ownership and Economic Considerations.—Most of the forest land of Ohio is in farm woodlots. Their size varies inversely with the soil quality and averages much larger in the eastern and southern hill section. Here, the steeper slopes and most of the ridges are forested, and where the land is rough the woodlot may constitute a large per cent of the farm. Away from the stream valleys there is not a great deal of good farming land, and in comparison with the western part of the state, this is a poor agricultural region. Extensive stretches of woodland broken by small farms are frequent in eastern Ohio, and farther south toward the Ohio River are found tracts of five to twenty thousand acres under single ownership with a small per cent of farm or pasture land. With the increase in population intensive agriculture will make more of this land profitable for farming, but it is safe to say that a high per cent of the present forest land will always remain wooded.

The market in this section of the state is good for lumber, construction timbers, ties and poles, and near the main valleys fence posts are in demand. Mine timbers are needed locally. The making of charcoal for furnaces was formerly important and many clear cuttings were made for this purpose. The even-aged coppice stands resulting from these cuttings are unique in a country where culling has been the rule. Since the great development of the Lake Superior iron mines, however, the local need for charcoal has fallen off. There is little or no profit in cordwood on acocunt of the great amount of coal produced by this region. The main difficulty in the way of forest management is the lack of demand for small products.

In the western part of the state there are few extensive bodies of timber. The farm woodlots are much smaller and as a rule more heavily culled. There is ready sale over most of this area for nearly anything the forest will produce and very intensive methods can often be used. Most of these woodlots are on true agricultural soil, and while their area is being gradually reduced, it is probable that this will not continue long. Most farmers will always keep a small part of their farms in woods, for fence posts and timbers are always needed, and whatever else is raised will find ready sale. In any case more intensive methods will be followed.

Work of the Department of Forestry.—The object of the law of 1906 was for an investigation of the forest conditions of the state and a help to owners in handling their timber land at a profit. The work of the department of forestry in carrying out the provisions of the act, may be divided into three classes: Woodlot investigation, co-operative planting and collecting data and issuing bulletins.

Woodlot Investigation.

Field parties have been sent to different parts of the State and in each section visited, enough woodlots are investigated to show the average conditions of that section. The available funds will not permit every woodlot to be inspected and judgment must be used in getting the best results. If possible the owner is interviewed first and if he manifests enough interest in the work to accompany the forester the latter generally feels justified in spending considerable time in the woodlot. A brief explanation is made to the owner of what the State is doing, and the good and bad features of his woodlot are pointed out to him. A description of the woodlot is made, and if the owner is sufficiently interested, a report will be mailed telling him the condition of his woodlot and how it can best be handled. If the owner will agree to carefully follow instructions, a detailed working plan will be made. But few owners so far have shown sufficient interest to warrant a detailed investigation and working plan.

The educational feature enters largely into this kind of work. The woodlot owners are shown the bad effects which grazing has on both sprout and seedling reproduction. Few of them have realized this, nor do they seem to take into consideration the reproductive capacity of the forest. Coupled with this is the difficulty with which they can be induced to cut out overmature trees. It is a peculiar fact that most owners in trying to preserve the woodlot will allow old overmature trees to remain and decrease in value, and at the same time will take no thought of the injury to young growth caused by the presence of these old trees and by grazing. If an owner desires to co-operate with the State in the management of his woodlot, the terms of the contract forbid grazing. This is often the greatest difficulty in securing co-operation. The habit of pasturing the woodlot is hard to eradicate and many farmers claim that stock need shade in summer. When this is apparent the owner is advised to fence off a part of his woodlot for pasture purposes and use it simply as pasture, the rest of it may then be used for timber growing and the whole will yield a better return in money than where the forestry and grazing are attempted on the same tract.

The problem confronting the Department of Forestry is to educate the woodlot owners and bring the timber areas as quickly as possible up to a point where they yield good returns.

In eastern and southern Ohio, clear cuttings are not advisable on small woodlots, because the owners want a constant supply, and also on acount of the poor market for small material. On many of these tracts a selection forest is all that can be hoped for, but if inferior species are cut out and grazing stopped these woodlots will become valuable sources of income to the farms. The inferior species should be removed, even if only a small price can be obtained for them; it may even be advisable to girdle them if removal is expensive. The predominance of Chestnut insures good conditions for most woodlots on north and east exposures, where cattle and sheep are kept off. On the ridge tops the Chestnut Oak should be favored in cutting and the Black Oak reduced. On south and west slopes if the soil is fairly good, White Oak should be favored. Poorer situations will often require planting to bring them up to normal conditions. The large tracts generally present a more difficult problem than the small woodlot, for their size and market conditions will not warrant intensive methods. If it is possible, as in regions where charcoal is in demand, the best method of handling the tracts is by clear cutting and natural reproduction. Where the markets are poor, the tracts must be handled on the selection system.

The same general treatment is necessary in western Ohio, but here the greater amount of culling and grazing has brought the woodlots to a poorer condition and the absence of Chestnut will make the regeneration more difficult than in the eastern part. In some cases, a judicious thinning of overmature trees and inferior species will put the woodlot in a productive state, but in general interplanting is advisable or necessary.

Co-operative Planting.

This is the most distinctive feature of forestry work in Ohio. Seedlings are furnished free of charge to land owners who will set them out and agree to protect them against grazing. Each owner is interviewed before trees are furnished him and a forester inspects the site for the proposed plantation. The work is carried on in connection with woodlot investigations and good results have been attained both educationally and in the plantations themselves. It is surprising how much more easily the average farmer can be interested in planting than in care of his woodlot. The former however, often becomes an educator which finally interests him in the work. Where reproduction has been interfered with in a woodlot, interplanting is often necessary and if the owner adopts this plan, he becomes directly interested in the woodlot. Co-operative planting is not confined to farms, but institutions owning timber land often take it up both from the standpoint of revenue and preserving scenic features. The latter are very desirable co-operators since their land is under more permanent ownership than that owned by individuals.

The Department of Forestry is developing nurseries to supply the demand made by co-operation. The principal species which have been advised on the different situations will now be discussed.

1. *Bur Oak.*—On swampy ground the tree is set out in pure plantations, also used in small open spaces in swampy woodland. It is thought that part of the swamp areas, which will not be drained for agriculture, may be rendered productive by Bur Oak plantations. In eastern and southern Ohio it will be used in river bottom swamps, in the western part of the state more in upland swamps.

2. *Tulip and Ash.*—Neither of these are planted pure, but a mixture of the two is often used on moist soil. Open spaces in bottom land forests, which have been heavily culled, are planted up with this mixture. The ash has been tried with Black Walnut, in the hope that a density may be produced, sufficient for the Walnut, which makes poor growth in pure plantations.

3. *Catalpa speciosa.*—This tree is advised in pure plantations on fresh loam. Where soil conditions are right, it makes good growth and is very useful in bringing up the yield of a depleted woodlot by interplanting. The department has been very successful in its Catalpa plantations, principally because it has not permitted the use of the tree on poor soil. The best results were obtained in a plantation where most of the trees attained post size in four years. No attempt is made to raise large timbers, but in smaller dimensions it has proved very profitable. Its rapid growth in early life is beneficial in an educational way in getting observers interested in forestry, and those who have started Catalpa plantations will often plant other species. The width of planting is variable according to soil conditions and cultivation of the soil is advised for the first two or three years.

4. *Chestnut.*—On north and coast aspects throughout eastern and southern Ohio this tree grows well in pure stands. On account of the large area which it covers, both in pure and mixed stands, it will probably not be planted as much as some other species. However, it is recommended on fresh sandy loam. It will not do well on a lime soil. In small woodlots it may be seeded in spots to fill up open spaces in coppice growth.

5. *Red Oak.*—This tree may be planted on about the same conditions of soil and moisture as Chestnut, but it does well on lime soil and ranges all over the state. It will probably be used extensively in plantations in the future and good results may be expected.

6. *White Pine.*—This tree is advised in pure plantations on sandy soil throughout eastern and southern Ohio. It may also be planted in a few localities in the western part of the state. There is a great deal of land with scrubby stands of hardwoods where White Pine could make rapid growth. In some areas where intensive forestry cannot be practiced, the best plan will be to start White Pine in patches, gradually increasing it as the hardwoods are taken out. Where markets are good, large plantations of White Pine will be profitable. It is expected that this tree will bring up the yield on many of the south and west slopes, where the present stands of hardwoods are very poor.

Besides pure plantations the White Pine is advised with Chestnut on sandy loam soil on sites about midway between the best chestnut and the average white pine soil. It is also advised with

Red Oak on similar situations, where the soil is limy. In these mixtures the two species are planted alternately and a good yield is expected.

7. *Black Locust.*—The locust borer will limit the use of this tree in plantations. In localities where the borer is not present the tree is advised in pure plantations on medium or good situations. It will grow rapidly to post size and is profitable in short rotations. Where the borer is present the tree should not be planted.

8. *Chestnut Oak.*—Plantations of this tree will be of use on ridge tops and upper slopes. In woodlots on such situations the Black Oak should be removed and Chestnut Oak planted. It will be used in planting up open spaces on ridge land.

Collecting Data.

In connection with woodlot investigations and co-operative planting, growth figures are being taken on the most important trees. The most valuable data secured has been that of the volume of natural even-aged stands of different ages. These are taken for the different trees on different sites so that a rough prediction may be made as to what these species will do in plantations. So far, White Oak, Chestnut and White Pine have been well worked up for several sections. This work will be continued as rapidly as possible, the idea being to ultimately obtain for each section of the state figures on the growth of the species common to that section on the different qualities of site.

The present policy of the Department of Forestry is farsighted but none the less definite. It is intended ultimately to establish state reserves, but in an agricultural state like Ohio, the woodlot work is more important. The first reserves established will probably be small demonstration forests, where experiments can be carried on in planting of different species and different mixtures. In some sections the forest land of state and private institutions which is under state management serves this purpose, but these areas should be well distributed over the state and on this account the power to acquire land by purchase is needed by the department. Large reserves are impractical at the present time, for with the present small force the Department of Forestry cannot assume the management of large areas on which it will have to exercise police power. There are some extensive areas of wild land in the state, notably along the Walhomding River in the east-central part and along Paint Creek in the central part and around the head waters of other streams where reserves should be established. These reserves would help to regulate the stream flow and would provide a place where the surplus stock from state nurseries can be used to advantage. The revenue from timber sales also would be considerable and on many of them water power rights could be leased as an additional source of revenue.

The people of Ohio are rapidly being educated in forestry, and as public sentiment warrants further legislation, the department will be enlarged and the scope of its work increased.

NEW JERSEY FORESTS AND FORESTRY.

BY GRACE E. LYON.

The virgin forests of New Jersey have been removed during the past two centuries, so present woodlands contain few large trees; however the same species of trees have been preserved. Originally almost the entire upland of New Jersey was wooded. The early settlers made clearings for settlements, but neither they nor succeeding generations have destroyed all the forests. New Jersey is still a forest state and always will be, for the land is especially well adapted to the growing of trees. The land always reverts to forest when not regularly cultivated or too often burned. Rainfall, altitude and soil favor comparatively rapid growth. Every acre of forest land is so near a market that nearly all products are saleable.

Forty-six per cent of the area of New Jersey is wooded. According to the census of 1900 as to farms and forests, and the census of 1905 as to population we may say that there is one acre of farm and one acre of forest for each inhabitant of our state.

Only 13,838 acres of woodland are owned by the state government; while some of the remainder is held by rich property holders, most of it is divided into small tracts and owned by farmers. Forty thousand acres of forest land in the Upper Passaic Valley are held by five people. Governor Fort proposes that the state buy this and protect its water rights.

The character of the woodlands varies in different parts of the state, both topography and soil being influencing factors. In the north the land surface is broken or mountainous. The rich valleys have been cleared, and are now occupied by farms, villages, and cities, while forests are found only on the mountain tops and connected with some of the farms. In the south the surface is nearly level, the soil is less suited to agriculture, and, as a result, large tracts are naturally adapted to trees.

There are two contrasting types of forest in New Jersey,—the deciduous and the coniferous. The deciduous zone is north of an irregular line drawn from a point east of Metuchen to Trenton. The coniferous zone extends south of an imaginary line drawn from Long Branch to Salem. Between the zones is an area about 16 miles wide where the flora of both regions overlap, and each species constantly struggles for the advantage. This difference is clearly identified with a difference in geologic formation.

In the northern deciduous zone there are farming districts where each farm has its own woodlot, the size of these woodlots varying from an acre to two or three hundred acres. The largest and best timber of the state is found in these woodlots. Thrifty growths of oak are found on the limestone and slate of the valleys in Sussex, Warren and Morris counties, on the red shale in Hunterdon, Somerset, Mercer and Middlesex counties, and on the red shale and glacial drift soils in Bergen, Essex and Union counties. The Chestnut is the species most found in the clay and green sand marl belt, or the tension region where the coniferous and deciduous strive for mastery. Very little pine timber is found in these woodlots. These forests are less exposed to fire, in that they are situated apart from each other; but the owners are indifferent to the kind of timber and the density of the stand of the trees. Scientific forest management at this point would make the crop more valuable. Hence the plea that forest owners be induced to become more interested in forestry and its principles.

In the truly mountainous districts of the state the kind of timber varies less. There is a mixed growth of coniferous and deciduous trees on the Kittatinny Mountain and on the more rocky parts of the Bearfort and Green Pond Mountains. The Kittatinny Mountain is one of the natural subdivisions of the state adapted to forest; the surface is too rocky and the soil too thin for making farms on it; and the lack of roads and the distance from market make it ill suited to agriculture. Here is a considerable area of the deciduous forest of the state; but the greatest body lies on the northeastern Highlands, nearly co-extensive with the Wanaque, Pequannock, Rockaway, Upper Musconetcong watersheds. The terminal moraine from Morristown west to Hackettstown and then to Belvidere marks the southern limit of the more densely wooded part of the Highlands. Trees of this forest are mainly of the broad-leaf kinds, the Chestnut predominating. There are very few coniferous trees. The growth on the trap-rock ridges is more mixed and poor in quality. The woodland in these mountainous districts is held in large tracts from several hundred to several thousand acres. Fires burn over large areas, especially where there are pines in the growth. Cattle and trespassers also cause damage. The whole area has been cut over since the first settlers came, and there have been repeated cuttings in some places for fuel, so that very little of the timber is mature or old.

The wooded zone of southern Jersey is known as "The Pines," being an almost unbroken coniferous forest. It covers practically all of that part of the state southeast of a line drawn from Seabright to Glassboro and thence through Bridgeton to Delaware Bay, comprising about 1,200,000 acres in all. Here in the pines are sharp contrasts between the coarse, sandy soils, covered almost exclusively by Pitch Pine, the heavier soils with mixed oak and pine, the White Cedar swamps, and the mixed swamp lands. In this section as everywhere, poor soil carries few species, the ones mentioned, being practically all that are found. Fires and severe cuttings have left almost no large timber, and there is none of the original forest left on these wide stretches of pine land and cedar swamps. As a result of the frequent fires the timber is oak coppice and stunted pines. The cedar springs up quickly after cutting.

The most completely deforested sections in either part of the state are not, as might be expected, where there is the thickest population, but in the agricultural regions. The Raritan Valley in Somerset and Hunterdon counties and thence southward in a belt about twelve miles wide along the Delaware River in Mercer, Burlington, Camden, Gloucester, and Salem counties is a continuous cleared area. "The plains" in Burlington county, comprising over 14,000 acres of sandy and gravelly uplands, is the largest region incapable of producing timber. Most of the top of Bearfort Mountain, some parts of Green Pond and Copperas Mountains, and the main crest and steep eastern escarpment of Kittatinny Mountain are too bare of soil to produce timber of much consequence. Other deforested regions are the Musconetcong, Pohatcong, and Delaware Valleys, in Warren county and about the Navesink and Shrewsbury Rivers in Monmouth county.

There are several ways in which the value of New Jersey forests may be measured. The estimate of the worth of standing timber is necessarily an approximation. The older timber is more valuable than the younger. In the Kittatinny Valley and the Highlands, where very few trees exceed fifty years in age, an average value for all the forest is $25 per acre. In the red sandstone region the timber is worth about $40 per acre, while that of the clay and marl region is valued at $35. The pine forest has much smaller value, averaging less than $10 per acre. In certain localities this pine forest is worth more for other purposes than forest products. The value of cedar swamp is uncertain, being estimated, however, at $90 per acre. The pine and deciduous swamps is worth $20 per acre. According to these estimates, the average value of the whole forest is $20.60 per acre. This is exceeded by only a few states.

Since so much of the wood is used directly on the farms where it grows, it is difficult to arrive at an accurate valuation of the forest product of the state. According to the census of 1900 the forests of New Jersey yielded in that year $2,328,069 worth of crude products, lumber, shingles, ties, poles, fuel for domestic consumption and for brick and tile manufacture, etc. This is greater than any other year since 1870, and may show that forests of the state are increasing while those of most states are becoming exhausted. On the whole the forest product, not including manufactured material is worth nearly $4,000,000 annually. This product consists of logs, bolts, railroad ties, telegraph, telephone, and trolley poles, piling for wharves, fuel, and fencing. Under present conditions it is not best for the state to attempt to produce high grade lumber.

The question of forests in relation to water supply is of extreme importance in New Jersey. As a result much study has been given to the effect of forests on the run-off of the streams. These conclusions have been reached:

1. Forests have no important effect upon the total evaporation from the stream catchment, or area which collects the water supply for the stream.

2. Forested country sustains springs better, since the humus and soil absorb the rainfall more readily; consequently, the forest streams are more equable and less liable to long periods of extreme low water.

3. Floods are less frequent in forested streams, due partly to causes already mentioned and partly to the slow melting

of snow and ice which accumulate during the winter; nevertheless, forest streams sometimes have high freshets.

4. Forest streams do not carry much mud and silt in suspension. Satisfactory conditions for water supply are found when about three-fourths of the catchments is covered with forest while that near the stream lines is in grass.

These facts have been verified with much care, especially those which differ from popular opinion.

The waters of the Pequannock, Rockaway, and Ramapo Rivers which rise in the well forested Highlands are of much better quality than the Musconetcong and Raritan whose headwaters are in the more cultivated portions of the Highlands. The 40,000 acres of watershed in northern New Jersey and a slightly greater area in New York are of great importance to the water supply of New Jersey for the streams which furnish that supply rise in New York. This area in New Jersey is now held by five people. Governor Fort recommends that the two states get possession of this acreage in order that the hills may be protected; this protection of the forests there would conserve the water supply and prevent its pollution.

The pine belt of southern New Jersey is important to the public water supply, for the cities and towns on the Delaware River and the seaside towns on the ocean front get their water from the streams fed from this zone of pure sand and gravels.

The same region is valuable also as a health resort. Playgrounds or park forests are needed by the people, especially those in crowded cities. There is no reason why timber forests should not be used for this purpose; the great forests in England which are used for parks are cut over at certain periods.

Incidentally it may be stated, that forest preservation is of importance educationally. The text-book cannot supply all that nature does. Forests are needed near the schools so that students of botany may study nature to the best advantage. Again, forests should be preserved for the protection of the flora and fauna of our state. The extensive clearing threatens many typical species of plants and characteristic grouping; also, this deforestation means the disappearance or extinction of some of the species of wild animals.

The state authorities of New Jersey realize the necessity of forest preservation; and since the creation of the Forest Park Reservation Commission, March 22, 1905, and the Forest Fire Service, April 18, 1906, the people's interest in forestry has grown greatly. The governor is ex-officio chairman of the organization and the state geologist is the executive officer. A professional forester is retained to advise forest owners in the proper management of their woodlands, to outline the proper policy to be pursued on the state reserves, and to investigate proposed purchases.

The forestry problem in New Jersey concerns, mainly, woodlots, watersheds, and playgrounds; lumbermen are involved only in a limited way. However, the possible lumber product is of importance. The product of the pine areas in southern Jersey would find an easy market. Since the land capable of growing first class timber is needed for agriculture, it pays better to grow trees for railroad ties, electric poles, box-boards, and rough building stock. Systematically managed forests can best regulate the run-off and prevent the pollution of streams and at the same time furnish lumber. Park forests should be provided and made to yield an income in the form of timber.

The most important work of the Forest Commission is the prevention and extinguishment of forest fires; second, the education of the public in forestry; and third, the acquisition and management of forest lands.

Until forest fires can be controlled it is useless to spend money in planting trees and to urge private owners to practice forestry. The Forest Fire Service was organized under the Forest Commission, April 18, 1906. This organization consists of a state fire warden, 99 township wardens, 120 district wardens and 81 railroad wardens. The township and district wardens receive $20 and $10 per year, respectively, and pay per day for actual time spent in fighting fire; the railroad wardens receive no pay from either the state or township; instead, they are hired by the railroad companies. The salary and expenses of the state warden are paid by the state, while the pay of other wardens and bills for fighting fire are divided equally between the townships and the state. Several railroads have agreed to pay the cost of extinguishing fires caused by their locomotives; with other roads the matter is still pending.

Five hundred and thirty-three fires occurred in New Jersey during one year, November 1, 1907, to November 1, 1908; these were extinguished and reported by the fire wardens acting under the orders of the Forest Commission. Besides these there were others, mostly along railroads, which were extinguished by railroad employees and not reported to the Commission. These 533 fires burned 52,978 acres, doing damage estimated at $64,536 and costing about $7,530 to extinguish. Reports show that the fire wardens did good work, especially if we consider the fact that there were long and severe droughts that year. In ordinary years the latter part of March, April, early May, late September, October, and early November are the dangerous months as far as forest fires are concerned.

There are many causes of the fires in New Jersey. The state is much exposed to fires, for there are many miles of railroad through the forest areas; and city visitors, campers, berry pickers, and hunters are found in the woodlands during the summer and fall, and they very carelessly cause conflagrations. Brush fires caused only 7 % of the whole number of fires in 1908, this being much less than former years as a result of the permit system. Twenty-one fires are known to have been caused by smokers and there is good reason to believe that many more were started in this way, but the cause was not reported. Hunters have caused some fires, one notable one having been in Bass River Township; this was started by smoking out a coon. The greatest percentage of fires is caused by the railroads. In 1908, 28% of all the fires were set by railroads. These fires show that spark arresters in smokestacks are not wholly efficient. Some more effective measures must be devised if this danger to our forests is to be done away with.

Fire may be extinguished by beating with a bough or brush; cedar is the best for this, and pine next best. Sprinkling with a watering pot is effective on mountains or any place where water is accessible. Shovels and sand are much used in south Jersey. Fire lines or cleared strips check ordinary fires; they also afford ready access by wagon to any part of the property, and may be used as bases for back firing when that is necessary. Back firing is very good for stopping a large conflagration. This last means should not be employed if any other will avail; for it means added destruction. It must be remembered that a true back fire is one that *backs against* the wind.

Forest fires do harm in several ways. As to damage to standing trees, young hardwoods are hurt severely, but often recover promptly. Larger hardwoods resist fire very well. The Pitch Pine in southern Jersey is able to resist fire and recovers easily after injury. The Short-leaf Pine has not so much of these qualities. When there is much litter on the forest floor the damage is greater. The butt of severely burned timber is a place for decay to gain an easy hold. White Cedar is easily killed but, as a rule cedar swamps are so damp that they burn only in late summer. The thin and delicate bark of young trees makes them more sensitive to fire than older ones; and when a tree is small, even a low fire will injure the crown, and kill the life of the tree.

Another damage that forest fires do is the injury to the soil. Continual burning prevents humus from forming and sometimes destroys the humus that is already there. This is disastrous to forests in south Jersey, for the humus under the conifers holds a great amount of moisture, and without this moisture in the soil all other factors count for little. Humus adds to the proper consistency of soil and acts as a reservoir from which food materials may be obtained.

The most serious injury from fire in New Jersey is the harmful effect it has on the reproduction of the forest. Still another harm of forest fires is the encouragement of the spirit of lawlessness and disregard of property rights on the part of the people.

The whole cost of the Forest Fire Service from November 1, 1907, to November 1, 1908, was about $12,000, or 6 mills for every acre of forest land. Woodland property is of much greater value when free from damage by fires. The Forest Fire Service is valuable from every point of view, and returns to forest owners many times its cost.

The woodlands of New Jersey are held mainly by farmers, so forestry must be practiced chiefly by individuals and not by the government. Therefore, the work of the Forest Park Reservation Commission next in importance to the prevention of forest fires is the education of the woodland owners to a clearer understanding of forest methods and forest values, and the education of the general public to the importance of forced conservation. The forester has direct charge of this work. Much has been done to help in this way; lectures have been given before farmers' institutes, clubs, boards of trade, and bodies of students; letters of advice have been sent to woodland owners, their tracts have been inspected, and plans for the better management of their woodlands have been prepared. Lectures, often illustrated by lantern slides, have been given to children. Women's clubs have been active in awakening the interest of local organizations. Demonstrations of improvement fellings have been made on the Bass River Reserve. The State Forester has prepared plans for protection against forest fires, explaining the making of fire lines.

Forests grow spontaneously in New Jersey and need be planted only where the ground has been so cleared by fire or by farming that no seed trees are left. When it is advisable to plant trees, it is usually best to use conifers, or evergreens, instead of the so-called fast growing deciduous trees. There are three reasons for this: 1. they produce more per unit of land; 2. most planting will be done in north Jersey, and this part of the state needs them to balance the hardwood forests already there; 3. the pines, especially, thrive better on poor soil than any broad-leaf tree. There is no record of the number of trees that have been planted in the state, because much of this work has been done privately; but undoubtedly the entire quantity is considerable. The Forest Commission has knowledge that 142,400 trees have been planted on the New Brunswick Tract, the Bass River Reserve, the Newark Watershed, and in Warren County.

The Forester has done something in field study, even though the continuous demands upon his time have left but little chance for it.

Work in the plantations and nurseries now established has been continued, and there have been some experiments to determine how the barren areas in the pine section can best be reforested. Some of these trials with conifers are being done in co-operation with the United States Forest Service and with the Forest Department of the Pennsylvania Railroad. On July 17, 1908, a formal agreement was signed with the trustees of Rutgers College for the systematic conduct of the New Brunswick Tract, and experiments there have been carried out under the direction of Prof. Voorhees. There have been some plantings of trees, only part of which tests have proved successful, however. Thirty-one species of forest trees were set out on the grounds of the Agricultural Experiment Station to accord with Prof. Smock's plan of establishing an arboretum which would be valuable commercially.

Most of these have grown well. All of the nursery work carried on by the state itself has been to learn what trees are best adapted to our conditions, so that planting may be done to the best advantage. It will require some time to come to any very definite conclusions, however.

Among recent tree diseases the chestnut blight or canker has made its appearance and has spread rapidly throughout the state. Pruning the trees is the only remedy suggested. That often seems to be of little use, for after removing the affected parts the disease appears in other portions of the tree. The reason for this is that the disease extends from the extremities backwards, and not from the stem outwards, as is true in most other diseases. It is helpful to repeat the pruning. The best thing to do when a forest tree is attacked is to fell it and utilize the timber. The white pine disease does not seem to be spreading any more at present. There are many animal enemies as well as other vegetable foes but these fungi mentioned have caused a great deal of damage recently, the chestnut canker being at present the most serious of all fungous diseases of trees. The harm it has already done in the eastern part of the United States reaches many millions of dollars.

New Jersey has six state reserves. The May's Landing Reserve in Atlantic County contains 373 acres. Unsuccessful efforts have been made to add more land to this. Nothing has been done here except to allow the natural growth to come on. There are 1,633 acres in the Bass River Reserve, which is in Burlington County. Fire lines have been constructed here and considerable planting and experimental work has been done. The Edward C. Stokes Reserve was formerly called the Kittatinny Mountain Reserve but was renamed in honor of former Governor Stokes who did so much for the cause of forestry. This reserve contains 5,432 acres situated on Kittatinny Mountain in Sussex County. The Forest Commission has done nothing to this tract of land. The Lebanon Reserve, comprising 3,510 acres situated in Woodland Township, Burlington County, became the property of the state in 1908. This is mainly pine land with small areas of young cedar and many tracts of oak. The warden here spends most of his time opening fire lines. The Mount Laurel Reserve, southeast of Moorestown, Burlington County, consists of only 20 acres We find in this tract a mixed growth of various hardwoods, chiefly oaks and chestnuts, with some Jersey Pine. The Forest Commission intends to use this as a demonstration area. A new reserve of 2,870 acres has recently been acquired in the eastern part of Burlington County.

Many cities and towns of the state are evincing great interest in the planting and care of shade trees, and they are establishing Shade Tree Commissions under the Act of 1893. This work should be supported more actively by the state, and should have co-operation with the Forest Commission. Aid has been given to citizens of the state through some papers prepared by the Forester. The requirements of a street tree are given as follows: 1 form, 2 hardiness, 3 rapidity of growth, 4 shade production, 5 neatness, and 6 beauty. For streets less than 60 feet wide between building lines, the trees best suited are ginkgo, red gum, red maple, honey, locust, hackberry, green ash and Norway maple; for average streets—60 to 90 feet between building lines—the best trees are Norway maple, red gum, pin oak, red oak, scarlet oak, red maple, sycamore, basswood, hackberry, white ash, ginkgo, honey locust, horse chestnut, and sugar maple; for streets over 90 feet wide between building lines, use white elm, red oak, scarlet oak, sycamore, white oak, tulip poplar, basswood, red gum, and ailanthus. Early spring is the best time for planting. Trees should be spaced uniformly along the streets. A newly planted tree needs a stake to keep it upright and a guard to protect it from injury by horses biting it and wheels scraping against it.

It is a noteworthy fact that people are realizing more and more the value of forests. Without forests around the stream heads in northern New Jersey the water supply of the cities might be endangered. Property entirely deforested would be much less valuable, and, in some places unfit for agriculture and settlement, the land would be of little use.

This aroused interest in forest preservation has created a demand for trained foresters. A forester must possess self-reliance, resourcefulness, tact, good judgment, power to direct others, perservance, and, above all, a love of nature. Courses in forestry are now given at Yale Forest School, Harvard, the Biltmore Forest School, Biltmore, N. C., and at other institutions in the west.

Public schools can give assistance by instilling a love of nature study in the children and by giving a thorough course in it. The children may be made to realize more fully the use and value of trees. Here Arbor Day may be made to count for something definite. If the children plant a tree, have them do it properly, and have it planted where it will be of some value. Too often Arbor Day is thought to be "a holiday" and has little or no significance aside from that. But let us hope that with the awakening of the people to the fact that forests are of vital importance, Arbor Day will have some real influence on the children, and help to further the aims of forestry.

FOREST AND SOILS OF CALDWELL PARISH, LOUISIANA.

By J. A. Larsen.

Caldwell Parish, La., presents three main woodland types. The shortleaf and hardwood lands on the lower ridges and second bottoms; the pure longleaf forests on areas distinct from the former and generally on higher flats and ridges; the bottom-lands chiefly of black and red gums and various oaks. There are two elements of the population; namely, the earlier settlers who have always cleared and cultivated the shortleaf and hardwood lands, and the new comers who cultivate the bottom lands in the wake of the lumber jack.

The indigenous who are of English and Scotch stock came from the neighboring Eastern states during the early part of last century. Being placed under their roof one is immediately carried back one hundred years in American frontier history, with the exceptions that the stockades and Indians have vanished and the telephone come in. Living serenely isolated by miles of dense forest in adherence to a faith that bread will be provided by diligence and prayer. They have allowed improved methods to suffer long years of exclusion. Thus it was only three years ago that they learned to make their furrows follow the contours. But like all isolated unprogressive communities they have a body of collected facts governing their activities—axioms which they do not explain to anybody's satisfaction but their own.

In addition to their isolation they have had the misfortune to settle where the application of any but the best methods of farming gives bad results. The soil consists of the very finest silicious sand which is deep and uniform. An abundance of iron with some lime, magnesia and alumino gives it a decided clayey character which makes it hard and tenacious when dry. This clay occurs everywhere but on the longleaf soil; it fosters hardwood growth and renders the sand better fitted for agriculture. Consequently, before clearing, the presence of hardwoods is the only indication of the farming qualities of the land. It is in this type of the forest on hillocks and gentle slopes, that their clearings of a forest raises the water table so as to produce swamps it is are made. Here the real difficulty lies, for unfortunately when the forest is removed the sparse accumulation of humus decomposes rapidly, a process hastened by shallow plowing. Then four or five consecutive crops of corn rob the soil of all available nitrogen, while every spring the warm torrential rains which come where there is no binding frost and before the crop is in the ground cause heavy leaching and erosion. The later heavy rains effect a packing of the leached soil which has now lost the constituents necessary to maintain an ideal physical condition. Where this packing occurs rapid growth is prevented by loss of proper aeration and percolation; the water and air, often failing to penetrate, remains within the soil in small vesicles. A few have learned to rotate their crops, to plant cow-peas and to use artificial fertilizers—they do not have stock enough to supply sufficient manure—but many continue poor methods and resort to new clearings when the farms have run down, leaving the old farms to restock with pine.

On this soil the competition between Shortleaf Pine and hardwoods is very keen. The pine maintains itself in dense clumps on the slopes, low ridge tops and high flats, coming up in openings where the timber is insect-killed or wind-thrown. In the swales there may be four or five Shortleaf to the acre, but these are rapidly disappearing and the hardwoods would drive the pine out entirely on this soil were it not for the clearings and storms.

In their code of axioms these people know that the soil packs, that it is deficient in plant nutrients; but the climate and their methods ruin it. It is also a well known fact to them that the deadening of timber in summer when the sap is up is bad practice. Such soil *sours*. Besides, the ground where timber is summer-killed does not become as fertile as that where the timber is killed in winter. At first thought this may seem absurd; but upon a second consideration it bears directly upon Deleano's* observation, namely that vegetation absorbs minerals from the soil which are not incorporated into the plant tissue but are merely employed as agents in the protoplasmic activities and may be returned to the soil. It is possible that the poverty of the soil here would reveal this fact better than most places.

Another point of minor importance advanced is that slash must be burned after logging to ward off malaria. While the cutting

* Forestry Quarterly, Volume VII, p. 194.

easy to see how logging will increase malaria; but the increased activities of infectious insects by clearing can only be of a temporary nature.

From these conditions in general it seems reasonable to deduct or further substantiate conclusions that even in the presence of good markets—for the small towns and lumber camps buy all they will raise—a soil which is not a true forest soil cannot be claimed for farming by a population unable to maintain its fertility, for it remains forested in spite of their claim. and that ignorance of improved methods of tilling invites useless destruction of forests.

There is much splendid Longleaf Pine on the higher ridges making up about one-quarter of the forested area. Here the soil is purer sand with often a layer of red clay forming a stratum underlying the surface. This may be explained by deposition from solution of materials carried upward by percolating and evaporating waters. Down to within a foot and a half the organic acids from the roots have dissolved and prevented the accumulation of this sticky red clay leaving pure sand below the layer. This process improves the site by bringing the minerals within the root spheres and by increasing the capacity of the soil to hold water, both of which factors seem to favor the extension of hardwoods and Shortleaf upon longleaf soil, the first of the advancing species being Scrub Oak. This land will eventually remain the only true forest and grazing areas of the Parish.

The bottomlands may have a portion flooded during a part of the year. Its silt is subject to packing in absence of humus and fertilizers. Newcomers raise sugar cane, rice and cotton, the last named only by application of poison such as arsenate of lead to kill the bole weevil. Good returns from these lands are realized and the vegetable crops find ready markets in the small centers of population not far distant.

On the whole the future promises great activities in farming. When most of the timber has been cut and more people have come in it is safe to assume that the bottom lands and lower slopes will enable their owners to grow opulent, while the indigenous who remain on the shortleaf and hardwood lands and who are loath to leave their old places and who are satisfied with a meagre hand to mouth existence will remain poor as before.

HEIGHT AND DOMINANCE OF THE DOUGLAS FIR.

By T. C. Frye.

To the thinking man in our northwest the questions must often arise as to why our Douglas fir is so tall and so dominant. This article contains some observations and thoughts bearing on the subject.

Among the tall trees of the world are the Eucalyptus of Australit, 425 ft. (Engler and Prantl); the Sequoia, 325 ft. (Sargent); and the Douglas fir, 300 feet. The Sequoia is a vanishing species and is not considered here. But why have we so tall a tree? Is our soil so rich? Is our climate so fine? Is it the nature of the tree? If these things are so excellent for the Douglas fir, why not for other plants? The following are a few related facts. The common brake grows here to a height of 14 feet; it reaches the same height in the Eucalyptus region of Australia; in the eastern part of the U. S. it is 6 feet tall or less. We have the Giant Cedar, an arbor-vitae, reaching a height of 200 feet; as compared with the cedar of the eastern U. S. with a maximum height of 60 feet. We have a species of wintergreen, the salal, reaching 14 feet; while Michigan has the other, reaching 1 foot. We have the Red Alder, a fair-sized tree; while in the eastern United States the alder rarely grows over 18 feet high. The northwest is not only a region of great Douglas firs, but a region of tall species of other genera, represented in other parts of the world; the same is true of the Eucalyptus region of Australia. Apparently it is not alone the nature of the Douglas fir which makes it a tall tree.

Consider now the effect of the chief factors affecting growth. Turgidity is necessary for growth. This means that water must be abundant in the plant at the growing points. Hence great evaporation unless with abundant absorption is not favorable. Heat varies in effect with the plants. Most of the rapid growers are in the tropics, but some are in the cold ocean water (Bot. Gaz. 42: 143, 1906), so we cannot ascribe the height of Douglas firs to heat or cold. Decrease in oxygen causes an increase in elongation, but the effect is so slight that ordinary changes make no appreciable difference. The soil is important, but we do not possess a very high quality. Light retards elongation, the optimum for elongation being total darkness. This effect we all know from observing potatoes grown in a cellar; also from comparing trees in dense forest with scattered ones of the same species. Of all these, dampness and light seem to be the determining factors, outside of the nature of the plant itself. The fact that one species of plant grows taller than another under the same conditions we cannot explain. We are too ignorant of the nature of the forces controlling the activities of the cell.

Our atmosphere is much more moist than that in most other regions, thus favoring the growth of forest trees. But several other things affect the dampness of the cells; damp air may mean damp cells and it may not. Near Ocean Beach, north of the mouth of the Columbia River, the action of the waves and wind has raised up ridges of sand parallel to the ocean, which have become grass-covered and behind some of which trees have taken root. The prevailing wind is from the ocean, since the land breezes coming over the forest shoot over the shore. On the land side of these ridges the trees have their tops leveled with the sand ridge just as if cut with a mower. It is well known that this is due to the drying action of the wind. The twigs cannot withstand the evaporation. It is evident, however, that a sea breeze is not a very dry one. On the southern shore of the San Juan Island between Victoria and Bellingham, the winds from the strait predominate. They have a clear sweep over the water, and where they strike the islands fairly there is no forest on the wind side of the hills. The forests are all on the lee side. The same humidity combined with wind-velocity prevents trees on south slopes of the San Juan archipelago, which without much wind makes our great forests possible. Atmosphere in motion, whether very dry or even fairly damp, kills twigs and is thus destructive to trees. The fact that we have a moist climate along the northwest coast does not alone account for large trees.

Species of plants probably vary in their ability to lift water; and for a given species, one would infer that the taller a tree became the more difficulty there would be in supplying the tip with water. Evidently in a forest the tree tops are not "in the woods." Here both wind and sun have the most drying effect. That the top of a tree is under greater conditions of drought than the other parts is borne out by observation. It is known that scarcity of water increases reproduction in most normal plants. Cutting of roots of grapes growing in regions of great moisture, kinking of coffee twigs to increase yield, driving nails into apple trees which will not bear well, are examples of the use of this principle. The Douglas fir on the San Juan Islands growing on dry exposed places where there is a thin layer of soil over the rocks reproduces very abundantly. It is estimated that a tree on one of these places will bear 50 times as many cones as a tree of the same diameter on damp soil. Those standing alone are apt to bear cones too near the ground, because the branches are drier when the wind and sun can get at the tree from all sides. Firs in dense forests have cones mostly in their very tops. We are thus led to conclude that the tops of Douglas firs are the driest parts of the trees.

Dr. I. D. Brandel of the University of Washington tells us that an analysis of the leaves from the tops of the Douglas fir shows that the chemical compounds in the upper leaves are largely the dehydrated products of the compounds found in the lower leaves. The inference is that the easily decomposable compounds are dehydrated in the upper leaves to help out in the call for water. We are thus again led to conclude that a fir finds more difficulty in supplying its upper leaves with water than its lower ones. It seems, then, that the supply of water which a tree gets from the soil and the amount it is able to hold against evaporation by wind and the dryness of the air, exercises a strong influence in determining the height to which a given species shall rise.

There is one element in tree growth which is usually overlooked. We have much dark cloudy weather along our northwest coast, and are far from the vertical sun, hence have darker days. This darkness we believe to be a very much more important factor than is supposed. Douglas firs in the open will grow only about 75 or 100 feet high, while those densely bunched will grow to 300 feet. This seems to indicate that light is a most potent factor producing in tree height.

Wiesner found the sunlight in the open was to the light in the shade under a horse-chestnut tree about as thirty to one. Now anyone who has handled a camera knows that on a cloudy day he must make a time exposure of approximately one-third of a second or longer. An instantaneous exposure is usually 1/100 of a second, and suffices on a clear sunshiny day. The light on a cloudy day, and the light in the shade under a tree, are then roughly not greatly different. The effect upon growth then ought to be somewhat the same. If crowding, through shading, will stretch a tree to two or three times the height that it would naturally have in the open, then we would expect that cloudy weather would have a similar and equal effect if acting alone; also that it would aid crowding in producing taller plants, when the two act in conjunction. We believe, therefore, that we have a tree tall by nature, aided by the damp atmosphere, and stretched by darkness due to crowding and due to our dark cloudy weather. The effect of the cloudiness has, we believe, been entirely underestimated. In fact, we do not know of a single instance in which it had been taken into account in getting at the reasons for tall forest trees, yet when trees shade each other, everybody admits that it makes them grow taller.

The distribution of the Douglas fir is dependent upon another factor quite aside from those already mentioned. The root tips are either slightly swollen but smooth, or they are covered with a felt-like mat of fungal hyphae. These hyphae seem to be surface fungi, at least on the young trees. On old trees the rootlets are swollen and have hollows which may prove to be abiding places of these fungi within the roots. It is known that such root fungi are the sole source of food in some plants, *e. g.* Indian pipe. It is also well known that many green plants, *e. g.* beeches and the eastern hemlock, are largely dependent upon these root fungi for their water supply. The Douglas fir must be placed with these latter. This means that in its distribution, this tree is limited to those regions which fungi find agreeable; also that the roots are best supplied if they remain in that portion of the soil where fungi can live, which is near the surface.

The need for fungi seems to be at least one factor which causes the roots of the Douglas fir to remain near the surface. It is also evident that a moist shaded soil covered with leaves and protected by brush is a better region for fungi than a dry one. Taking these facts into consideration, we have at once the reply to the question as to why clearing under Douglas firs is apt to cause them to grow less vigorously or die. Theoretically, if we want to create a good condition of soil for a Douglas fir, we should create under it a fungus bed. Also in a wind-swept area the soil is more liable to be dried, hence less favorable for fungi, and for this reason also less favorable for Douglas firs. This and the increased evaporation from twigs by wind tend to keep the Douglas fir from the windward slopes in such a region as in the San Juan Islands.

A phenomenon which has long attracted attention is the presence of prairies in the vicinity of Tacoma and Olympia. Everyone knows that we have a forest climate, which is true also for these prairies. We must look for soil factors for their explanation. These prairies are uniformly gravelly, more gravelly and freer from loam than the forested areas. In some regions the gravel is almost clean from clay and humus above the upper foot. It must be evident that such a soil is not fitted for fungi. Douglas firs would then have difficulty in getting water from this soil, because there are no fungi to aid in absorption, and because there remains but little water to absorb.

These prairies bear usually scattered oaks (*Quercus garryana*), and often these are abundant enough to make these regions savannahs rather than prairies. But the oaks have no mycorhiza. Further, oaks have a deeper root system, possibly because they have no fungi; and thus can absorb water where a fir would find difficulty in reaching it. The oaks are rough of bark and have no pitch. It is well known that pitch is quite disagreeable to many of the lower forms of plant life, as bacteria, fungi, lichens, algae, liverworts and mosses. The red fir is therefore relatively free from these epiphytes, while our maples, oaks and even our cultivated apple trees are much crippled and hindered by them. This fact undoubtedly has much to do with the scarcity of rough-barked deciduous trees in our region. We find therefore that the Douglas fir is encroaching upon the prairies as rapidly as the oak prepares the soil for it. Evidence of this encroachment is found in the young firs among the oaks, but absence of young oaks among the firs; in the dead standing oaks among the over-topping firs and the absence of dead firs among the oaks; in the presence of decaying oak logs in the pure fir woods.

In the scattered patches of oaks on the very driest soil, we have good evidence that the oak was once a common tree from Vancouver, B. C., to the Siskiyou Mountains of Oregon in the valley between the coast mountains and the Cascades,—possibly was the chief tree. The oak has the advantage of deep roots and independence from mycorhiza. The Douglas fir has the advantage of evergreen leaves, height and freedom from epiphytes. The Douglas fir will then occupy the soil where it can get mycorhiza, leaving to the alders and maples and to other conifers the swamps and springy hollows, and to the oak the regions of extremely summer-dry soil. Epiphytes unfit the deciduous trees for competition with the fir where the fir does well.

Summary.—We believe the Douglas fir is a tall tree because (a) it can keep its twig-cells wet. This is its ability to lift water and to hold it; the nature of the tree; the damp climate in which it grows. Also (b) because it grows in semi-darkness. This is due to crowding, and perhaps equally as much to dark days during its elongating season.

Its local distribution is largely a matter of the distribution of mycorhiza, aided here and there by strong winds. Its predominance over deciduous trees is largely due to their difficulty with epiphytes.

University of Washington.

CURRENT LITERATURE.

Annual Report of the Department of Forestry. Forest, Fish and Game Commission. State of New York. By C. R. Pettis, State Forester. Pp. 109.

This publication is an extract from the Fourteenth Annual Report of the Commission, and covers the subjects of trespass, forest fires, annual forest production, reforesting operations, the Forest Preserve and investigations. Under the subject of trespass on the Preserve a list is given of the cases submitted to the legal department in 1908. A brief summary of the results of prosecution by that department would have been of interest in connection with the list.

The discussion of forest fires in detail and statistics are presented in a form that is clear and concise. The comparison by graphic method of four principal causes of forest fires 1891 to 1908 is of particular interest in connection with the treatment of this subject in the text. The author's statement of the deficiencies of the law is worth quoting since the same facts are of importance in protection of forests from fires in every state.

"The gravest danger in our present system lies in the fact that the law does not provide sufficient means for preventing fires. Its purpose is to handle fires after they are once started. During the past year $189,661.51 has been spent for fighting fires which caused a loss of $802,135, making a total loss of $991,798.51, a sum which would provide an ample patrol for the ordinary routes of water, road and railroad travel for a long period of years, and would reduce the fire losses to a minimum."

The report states that better remuneration for wardens is needed, but does not make specific recommendations for amending the law. The establishment of lookout stations is recommended, and a letter on this subject from the Maine Forest Commissioner is quoted.

For twenty years New York has gathered annual statistics on forest products of the State. Under "Annual Forest Production" the statistics for 1907 are given in a number of tables. A graphic chart gives the annual production from 1890 to 1908. The text furnishes an explanation of various facts in the tables and concludes with a plea for the practice of forestry. The author states that the present demand on the forests is greater than the annual growth, that to meet the demand non-agricultural lands not in use or remote should be forested and that the present forests should be increased in productivity.

The subject of nursery and planting work occupies twenty-five pages, and in technical details presented it is the most important part of the report. New York excels any other state and the U. S. Forest Service as well in this line of forest practice. Statistics are presented concerning state nurseries and the distribution of trees. The description of nursery practice with its accompanying illustrations is of special value to foresters and nurserymen. The statements in regard to fertilizing, sowing, seed bed frames and transplanting deserve special attention and commendation from technical foresters.

The report is concluded with a statement of the area and condition of the State Preserve, and mentions studies that have been made of the willow industry and wood distillation.

S. N. S.

The Commercial Hickories. Bulletin 80, Forest Service, U. S. Department of Agriculture. Pp. 64. Issued October 27, 1910.

The hickory has many properties which make it especially valuable for purposes for which no satisfactory substitute is known. The supply of first growth hickory is rapidly approaching exhaustion and it will soon be necessary to depend entirely upon second growth. The total consumption of hickory in 1908, excluding fuel, is estimated at 335 million feet board measure, while fuel and waste would increase the amount to 450 million. In spite of the waning supply the waste of commercial hickory cut each year is fully 40 per cent.

Pignut is considered the best hickory for all purposes. Those of the pecan group—bitternut, nutmeg, pecan and water hickory—are inferior species and should not be planted for wood production.

The present stumpage value of hickory is too low to justify extensive planting but there is reason to expect that it will soon bring more adequate returns and make it a valuable tree for the woodlot. "Planting will in many cases be worth while and sprout reproduction can be successfully practised in the case of pure stands. The most important method, however, will be the growing of hickory in uneven-aged, mixed stands, in which the reproduction of hickory is already very good."

The technical properties of the wood are variable, but in general the wood put on by a thrifty tree during the period of its greatest vigor is the best, and the wood from the butt cuts is better than from the upper parts of the tree. There is no foundation for the prejudice against sound heart wood, which, weight for weight, is just as strong and tough as sap wood. Young trees are tougher than old trees, therefore to obtain the best wood the trees should not be allowed to become overmature. Numerous tests seem to prove that Southern hickory is as tough and strong as Northern hickory of the same age, though the trees in the South are usually large and old and have a greater tendency to be wind-shaken and grub-eaten. Iron streaks and bird pecks of small size seem not to effect the toughness of hickory and it is strongly recommended that the grading rules be revised to prevent unjust discrimination against wood showing them. The best criterion of the value of hickory wood is its dry weight since the results of all experiments show that the strength and resilience of the wood increase in proportion to the weight.

The text of the bulletin is replete with plates and tables which add greatly to its clearness and value.

S. J. R.

Wood Preservation in the United States. Bulletin 78, Forest Service, U. S. Department of Agriculture. Issued Nov. 11, 1909. Pp. 31.

One of the most important factors in the conservation of our waning forest resources is the prevention or retarding of decay, thereby prolonging the duration of timber, reducing the annual drain on our forests and affording use for so-called "inferior" species. It is estimated that nearly 10 billion feet board measure of structural timber are destroyed each year in the United States and of this amount nearly 8 billion, or 81 per cent, is due to decay. "If all the timber were treated which it is practicable to treat and which could be treated at a profit, nearly 6 billion feet board measure, or over 60 per cent, could be saved. This saving would represent the annual growth on 20 million acres of well stocked timber land."

Chemical impregnation of timber to retard decay has been in process of evolution for considerable time and its practicability is no longer a matter of argument. The questions to-day refer only to the choice of processes and preservatives. Of the innumerable treatments devised and recommended only a few have withstood the tests of time and become standard.

Creosote and zinc chlorid are the only preservatives in common use in this country, and while both are excellent antiseptics, creosote is considered superior, mainly because of its insolubility in water. Zinc chlorid will in time leach out of treated timbers and its use is thus largely restricted to wood in comparatively dry situations. Creosote has an additional advantage of offering effective protection against the marine borers which cause immense damage to wharves.

There are two general methods of injecting preservative into timber,—"pressure processes" and "non-pressure processes." Sometimes the two are combined. These classes may be subdivided into (1) "full cell" treatment, in which the cells and intercellular spaces are completely filled with the preservative; and (2) "empty cell" treatment, where only a film of the preservative is left around the cell walls. The "empty cell" treatment requires smaller amounts of preservative, is cheaper, and can be secured either with or without artificial pressure.

Successful attempt has been made by the Forest Service to combine the pressure and non-pressure processes into a low pressure process so as to secure the advantages of both. The timber is first subjected to a hot bath and after the expansion and partial expulsion of the air and moisture is secured, the cold bath is applied. Instead, however, of depending solely upon atmospheric pressure to drive the preservative into the wood, a moderate artificial pressure—not over 70 pounds per square inch—is applied usually by the same pump which transfers the preservative.

The low pressure and non-pressure processes are not adapted to the treatment of non-porous woods and are rather slow, but for comparatively small quantities of easily impregnated woods they offer a cheap, simple and efficient treatment.

S. J. R.

Eucalyptus, Its History, Growth and Utilization. By C. H. Sellers, formerly Assistant State Forester of California. 93 pp. illus. Issued September 15, 1910. Price $1.00. A. J. Johnson Co., Printer, Sacramento, Cal.

This comprises a brief history of the introduction of Eucalyptus into the United States; the strength, durability, and uses of California grown Eucalyptus; and directions for the propagation, care, and planting of seedlings. Yield tables for specific plantations show the production of one 24 year stand to be 213,967 ft. B. M. per acre while several others, 9 to 20 years old, average above 100,000 ft. B. M. per acre.

A list of Eucalyptus growing in California is given near the close of the book. The author in conclusion calls attention to the increasing demand for hardwoods and the future shortage of desirable material. He offers the Eucalyptus as the remedy for this condition in California and cites the different regions in which it may be grown profitably.

The volume savors somewhat of the voluminous literature sent out by Eucalyptus promotion companies during the past few years.

Forestry of Japan. Bureau of Forestry, Department of Agriculture and Commerce, Tokyo. 1910. Pp. 127.

This book gives a concise and authoritative statement of forestry conditions and work in the Japanese Empire. It brings to date the information contained in the work with a similar title published in 1904. Since that time a large area of unexploited forest has been added to the empire by the acquisition of Saghalien. The total forest area is now 75 million acres, or 67 per cent of the land area; and the ownership is divided as follows: State 60 per cent, Imperial 7 per cent, Communal 11 per cent, Private 22 per cent. The forests of Saghalien, Hohikaido and

Formosa are not only unmanaged but just opening up to systematic lumbering. A description of the four climatic forest zones, and of the characteristics and uses of the principal species in each, forms an important part of the book.

The largest part of the work of the State, which is described in detail, has been the survey of its forest lands and in connection with that work, small tracts comprising in 1907 about 10 per cent of the surveyed area, were ordered to be disposed of in order to round off the state holdings and to provide revenue for the survey. Working plans of 7 per cent of the state forests had been completed in 1907 and plans are laid for finishing both surveys and working plans within definite periods of less than 15 to 20 years. Working plans have been similarly prepared for Imperial forests, with production of revenue as a main object. Private forests are usually in poor condition and government aid is applied in several ways, viz: Subsidizing nurseries, giving seedlings or subsidies to those planting forests, establishing model forests and nurseries and giving public lectures.

Silvicultural methods vary with the ownership; private forests being mostly coppice, producing wood for fuel and charcoal; Imperial forests, timber forests with short rotation; and State forests, mostly timber forest with longer rotation to produce the largest sizes of timber. Natural regeneration is used only in protection forests and on steep slopes. Seed sowing is used to a limited extent with certain species, mostly to assist natural regeneration. Planting of 2-3 year old seedlings is the prevalent method. On state lands in Honshu nearly 400,000 acres were planted in the decade previous to 1907, and extensive plans are laid for future work. On sandy and eroded lands engineering work has been combined with planting. Fire lines are constructed on the larger tracts and burned over in autumn. Permanent roads and river improvements are being built by the State. A detailed statement of the administration, particularly of the State Forester is given. The forests of Formosa, Hohikaido and Saghalien are managed by special departments under the Minister of Home Affairs, and the Imperial forests by the Department of the Imperial Household. The Bureau of Forestry controls the State forests of Honshu and also the commercial and private forests. The Forest Law of 1897 revised in 1907, outlines the method of control. The number of employes of the Bureau is now about 2,500; the greatest recent increase having been made in the number of rangers. Schools teaching forestry number 47 of which 41 are industrial. The chief experiment station is at Tokyo and has broad lines of investigation laid down. Experimental work is also carried on at 4 district offices.

The Japan Forest Association of 4,000 members carries on propaganda work and publishes a magazine. Co-operative societies are being organized under regulations introduced into the Forest Law in 1907; the purpose being to facilitate the management and utilization of the products of small private forests.

T. W. D.

A Manual of Botany for Indian Forest Students. By R. S. Hole, F. C. H., F. L. S., F. E. S. Calcutta, India. 1909. Pp. XI×250×XXI. 22 pls.

As stated in the preface, "This Manual has been prepared primarily for the use of the students of the Imperial Forest College, Dehra Dun. In the absence of a suitable text-book a great deal of the time of the instructors has hitherto been spent in dictating and copying lecture notes, respectively." The book contains five parts: Part one deals with the external morphology of plant organs; part two takes up the anatomical structure of plants; part three is devoted to the physiology of plants; part four, under the heading of classification, considers the whole vegetable kingdom from a taxonomic standpoint; part five comprehends the principal elements of our knowledge regarding wounds and diseases of plants; and part six, entitled "Geography," concludes the book with two chapters on ecology, followed by a third applying its principles to Indian forests.

A. H. G.

The Life History of Lodgepole Burn Forests. By F. E. Clements, U. S. Dept. Agr. Forest Service. Bulletin 79, Washington, D. C., 1910. Pp. 56.

In this Bulletin Professor Clements of the University of Minnesota gives the results of painstaking studies of forest replacement on burned areas in Estes Park in northern Colorado.

The dates of the various fires were discovered by the age of the fire scars in the wood of the surviving trees, and by the presence of bark scars on the trees killed and the wood scars on the trees barkless at the time of the fire. This evidence was checked by determining the age of the oldest trees, shrubs and perennial herbs, which came in after the fires. If the fire occurred before the growing season was over, the scars and root suckers would show one more annual ring than the subsequent trees. If it were after the growth ceased, the scars, root suckers and subsequent trees would agree in the number of rings. Therefore, to determine the year of the fire the investigator subtracted the number of rings of the scar, or the number of rings plus one of a seedling or tree, from the year in which the count was made.

Clements found that the area studied had suffered fires in 1707, 1722, 1753, 1781, 1842, 1864, 1872, 1878, 1891, 1896, 1901, 1903, 1905. The fire of 1864 is the oldest one that can be mapped with accuracy. These fires cover a period of 201 years, (the study being completed in 1908). It will be seen that the forest was burned on the average once in 15.5 years. No data are given in regard to the settlement of the region, but, suppose it began in 1864, then the five fires preceding that date had an average interval of 31.4 years, while the five fires succeeding it had an average interval of 6.4 years, and the interval between the more recent fires is still farther reduced—a frequency that should absolutely exclude forest management in the region unless these conditions can be changed.

The present condition of the burned areas, back to those of 1842, is presented in detail. From the study of the more recent burn forests, it was found that the best reproduction of Lodgepole Pine took place on the most complete burns, surpassing by far that of the half burns, both in respect to the number and the vigor of the seedlings. The seedlings were also more uniformly distributed on the complete burns, since the fallen logs and exposed boulders prevent the rolling of the cones, and the washing of both cones and seeds to the bottom of the slopes, a result characteristic of the half burns. The maximum germination occurs within the first two years after the fire. Periodic fires tend to perpetuate the pure stands of aspen, since the vigorous growth of root suckers preëmpt the ground before the pine gets a chance to establish itself.

The last half of the Bulletin gives the results of ecological experiments and observations upon the Lodgepole Pine, the main conclusions of which follow. The cones do not usually appear until the tenth or twelfth year. There is no fixed relation between the amount of seed and the number of cones. "The majority of them open in the first few years after ripening, or when they are about ten years old." Only a few seeds are released at a time. Seeds fifty and seventy-five years old are successfully germinated. Fire does not seriously impair the germinating power of the seeds in the cones unless the latter are thoroughly charred. The great reason why fire makes adequate reproduction possible is that it drives away the rodents for a number of years and thus saves the freed seeds for germination. The minimum light intensity is 0.1 of full sunshine. Fair reproduction may occur at 0.2, although it is much inferior to that in full sunshine. The light in a mature forest ranges from 0.12 to 0.05, a sufficient explanation for the entire absence of seedlings. The maximum water content is 35 per cent in loam and about half as much in sand and gravel. The optimum water content is between 12 per cent and 15 per cent. The minimum may fall below 5 per cent in gravel without injury to the tree except decreasing the rate of growth.

The rôle of fire as a silvicultural agent is five-fold through: the opening of closed cones, making a large number of seeds available; the removal of the cover, thus preventing its competition; the preparation of a favorable seed bed, although this may be little more than the removal of competition; the renewal of the proper conditions of sunlight; the removal for a time of the seed eating squirrels and birds.

It is a pity that the title is linguistically not more precise. The term Burn Forest to mean a forest succeeding a fire will do well enough; but to use Lodgepole without the addition of Pine is hardly commendable. The statements on pages 16 and 17 in regard to the reproduction of Lodgepole Pine in standing burns and in bare burns are confusing if not contradictory.

C. D. H.

Wholesale Prices in Canada. Special report by R. H. Coats, Department of Labor, Ottawa, 1910. Pp. 509.

From this report we glean some interesting information about the trend of lumber prices in Canada during the last twenty years.

Part I of this report contains records of actual price quotations representing the complete body of statistical matter secured in the case of each commodity and forming the groundwork of the whole report. Part II includes a series of tables in which the average annual prices shown in Part I are expressed in the form of index numbers. Part III contains a series of charts showing in a graphic manner the more important features of the price movement of the various commodities during the twenty year period.

The Index Number of any article at a given date is the percentage ratio of the price of that article to the price of the same article at another date or period selected as a standard. In the report referred to the standard period selected is the decade 1890-1899. The reason for selecting this period as a base or standard was that it represents a period first of falling and then of rising prices. Between 1890 and 1896 prices were probably lower than at any time in the closing quarter of the century, but from 1897 to 1900 the recovery was very rapid—thus rendering the decade chosen as available as any, within the limits of choice, for the reflection of normal conditions. The use of index numbers greatly facilitates the work of comparing the price fluctuations of the several commodities from year to year on a similar basis and enables us to combine them so as to show the movement of related groups. These numbers also supply an analysis of current prices in Canada similar to that furnished by the United States Department of Commerce and Labor or the London Economist's index numbers for Great Britain. The advantage of such contemporary analysis is obvious, because the prices of many important Canadian products are fixed in the world market. With the completion of the Grand Trunk Pacific and Canadian Northern Railways (in about two years time) Canada will have three well equipped transcontinental lines. She will also have a government owned line from the Saskatchewan River to a port on the west shore of Hudson Bay. These improved transportation facilities and the opening of the Panama Canal later on will play an important part in the establishment of world prices for her wood products.

Some difficulty was experienced in selecting grades of lumber that would actually represent the great lumbering industry of Ontario and Quebec. For pine, high, medium and low grade products from the Ottawa Valley and Georgian Bay districts were chosen. Though the quality of the logs may have varied in different years, thereby entailing variation in the apportionment of grades, the figures in question were based on the output of several mills, with the result that this tendency was probably obliterated. The figures show a rise from $12.00 per M in 1890-2 to $21.50 per M in 1907, the high year. With the increase in the price of pine, hemlock as a cheaper substitute has come into extensive use, and is added for this reason, though it reflects closely the tendency of lower grade pines. In the maritime provinces of New Brunswick and Nova Scotia the tendency of prices was based mainly on the quotations for spruce deals, which form the great bulk of the output. The statistics for British Columbia fir, cedar, hemlock and pine were not received in time for publication, but the trend of prices may be seen by an inspection of the following table, showing the average prices paid for lumber removed from Dominion lands in the Railway Belt. From 1884 to 1902—$10.00 per M feet B. M.; in 1903, $15.27; in 1904, $15.30; in 1905-6, $14.95; in 1907, $16.25; in 1908, $17.00; in 1909, $14.20.

From the report referred to, the following table has been compiled for the decade 1900-1909. This period shows a steady rise in prices which will doubtless continue for some time. In explaining the pronounced advances in a product so important as lumber, the manufacturers point to several agencies which have combined to enhance operating expenses. Supplies for the camps have advanced. Wages have also been increased, while the supply of experienced help has greatly declined, so that at the higher rate a less efficient staff of employees is available. Moreover, the timber is not as good as formerly, the logs being smaller, entailing a greater loss in driving, and a less return for a like amount of handling. The merchantable timber is also found at ever-increasing distances from the main streams. Added to this there has been a marked advance in stumpage rates; limits that sold at $3-4 per M in 1890 now bringing $8 to $10 per M.

WHOLESALE LUMBER PRICES AND INDEX NUMBERS FOR DECADE 1900-1909.

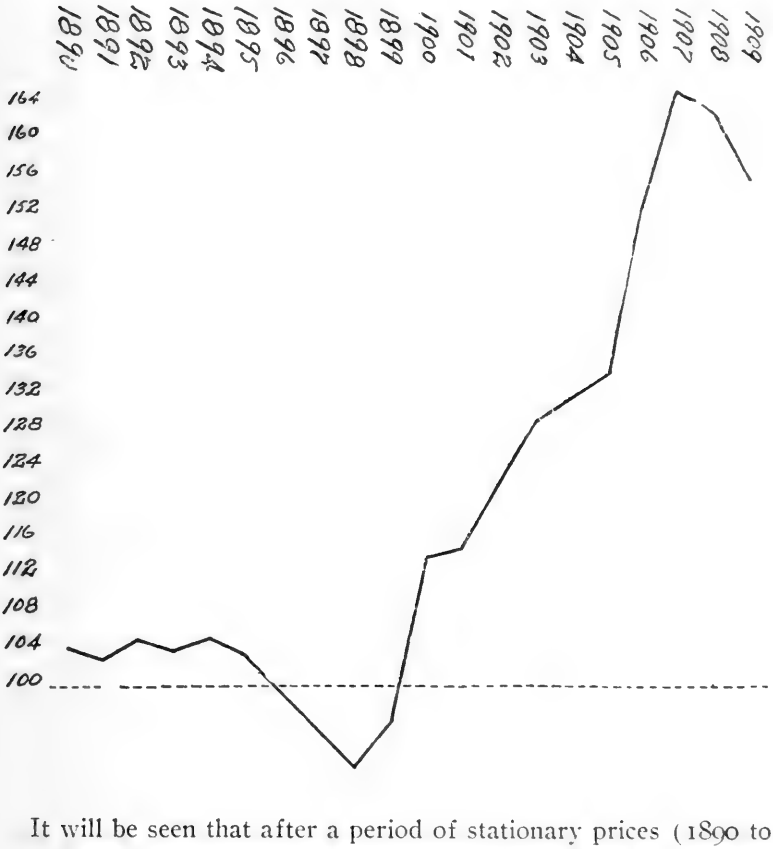
(INDEX NUMBER FOR PERIOD 1890-1899=100)

PINE.	*1900*	*1901*	*1902*	*1903*	*1904*	*1905*	*1906*	*1907*	*1908*	*1909*
Good Sidings, ...	$36.83	$36.50	$35.29	$40.66	$42.16	$40.66	$41.75	$42.00	$42.00	$43.20
Index No.	105.7	104.7	101 2	116.7	121.0	116.7	119.8	120.5	120.5	123.9
No. 1 Cuts and Better, ...	33.00	33.00	34.87	45.00	46.42	48.66	50.08	50.00	46.08	43.42
	99.5	99.5	105.1	135.7	139.9	146.7	151.0	150.8	138.9	130.9
Shipping Culls, Sidings, ...	15.56	16.00	15.96	17.25	18.25	18.31	21.29	25.87	26.50	25.04
	111.8	115.0	114.7	123.9	131.1	131.6	153.0	185.9	190.4	179.9
Box Boards, ...	12.00	13.25	13.25	13.25	13.25	13.37	15.41	21.08	21.25	17.50
	92.0	106.0	106.0	106.0	106.0	107.0	124.3	168.6	170.0	140
All Grades of Pine, ...	16.50	16.50	16.50	17.00	17.00	17.50	18.50	21.50	20.50	20.50
	135.2	135.2	135.2	139.3	139.3	143.4	151.6	176.2	168.0	168.0
SPRUCE. Deals, ...	11.68	11.52	12.78	13.66	12.20	13.64	14.89	14.56	14.81	15.20
	117.6	115.9	128.6	137.5	122.9	137.3	149.9	146.5	149.1	153.0
HEMLOCK, ...							13.25	14.41	14.75	13.75
RED OAK. Firsts and Seconds, ...	28.75	30.50	32.00	32.25	38.54	45.12	48.00	48.33	50.17	50.00
	106.2	112.6	118.2	119.1	142.3	166.6	177.3	178.5	185.3	184.7
BIRCH. Common and Better, ...	19.00	19.00	19.00	19.45	22.79	22.54	24.67	24.50	24.42	24.21
	98.2	98.2	98.2	100.5	117.8	116.5	127.5	126.6	126.2	125.1
MAPLE. Common and Better, ...	17.50	17.50	19.00	20.00	22.83	21.25	22.08	22.17	21.50	21.10
	106.0	106.0	115.1	121.2	138.4	128.8	133.8	134.3	130.3	127.9
CEDAR. Shingles. Clear, ...	1.72	1.62	2.13	2.22	2.07	1.99	2.08	2.56	2.76	2.43
	95.0	89.5	117.3	122.4	112.3	110.0	114.5	141.4	152.0	134.0
PINE. Shingles. Clear, ...	1.67	1.67	1.91	2.32	2.48	2.50	2.84	3.00	3.00	3.03
PINE. Lath, ...	2.76	2.62	2.98	2.87	2.56	2.52	4.10	4.25	3.72	3.40
	187.1	178.0	202.9	194.9	173.7	170.9	278.3	288.1	252.1	230.9
Average Index Number, ...	114.0	114.6	122.0	128.8	131.3	134.1	152.7	165.2	162.6	154.6

The use of this table may be illustrated by referring for instance to the price and index number of good pine siding, in 1900. During that year, our table shows that the average wholesale price was $36.83 per *M*, and that the index number is 105.7. This means that the price during 1900 was 5.7% higher than the average price for the decade 1890-1899. By dividing 105.7 into 3,683 we get $34.84 for the average price of the decade preceding the one shown in our table.

By combining the index numbers of the above table we obtain a set of numbers showing the general rise of prices for all classes of lumber since 1900. If these numbers are extended backward to the year 1890 we have a clear picture of the fluctuation of prices for the twenty year period between 1890 and 1909. Expressing it graphically we get the following diagram.

CHART SHOWING RELATIVE PIECES OF LUMBER 1890-1909
(Average Prices 1890-99-100)



It will be seen that after a period of stationary prices (1890 to 1895), the lumber prices declined somewhat in 1896, 1897 and 1898. Since the latter date there has been a very pronounced upward movement, which reached its culmination in 1907. Subsequently there was a falling off until the closing months of 1909, when some recovery was made. In the case of pine the increase has amounted to fully 70 per cent. The higher grades have been steadier, but the lower grades have mounted very rapidly. New Brunswick lumber has advanced 50 or 60 per cent between 1899 and 1909. The highest rise in price is shown in the case of pine laths, which more than quadrupled in price between 1897 and 1907, and in 1909 were 130 per cent above the average of 1890-1899. In the hardwoods, the rise, as compared with the ten year period, has been between 25 and 30 per cent, except in the case of oak, which has advanced over 80 per cent.

A. H. D. R.

The Plant Life of Maryland. By Forrest Shreve, M. A. Chrysler, Frederic Blodgett and F. W. Besley. Maryland Weather Service, Special Volume III. Johns Hopkins Press, Baltimore, 1910. Pp. 533.

The objects of the work were to present a picture of the vegetation of Maryland and to discover the relation between natural vegetation and the crop possibilities of definite areas. In the first object the authors have succeeded to a remarkable degree. The careful reader would feel, however, that the second object was not so clearly and constantly before the minds of the observers as the first. Undoubtedly the limitation of time in the field is responsible for the obviously weaker presentation of the second object, for the two phases of the investigation do not lend themselves to the same methods of field work.

Topographically Maryland may be divided into the Coastal Zone, the Midland Zone and the Mountain Zone. The floristic plant geography and the ecological plant geography of these zones are discussed by Shreve, Chrysler and Blodgett. The Coastal Zone is further divided into the Eastern Shore District and the Western Shore District. Shreve shows that the Eastern Shore District has two prominent topographic features, the Talbot terrace rising gently from tide water to an elevation of not more than 35 feet; back of the Wicomico terrace which, being longer exposed is more undulatory in character and reaches a maximum elevation of 85 feet. Both of these terraces are deposits of the Pleistocene. Their drainage is not well established and they consequently contain frequent swamps and marshes, totaling over 270,000 acres. The vegetation of the Talbot terrace is similar to that of the Coastal Plain to the southward, while the vegetation of the Wicomico terrace is related to that of the Piedmont plateau of the southern states. The various associations of vegetation are discussed in detail as to composition, soil and drainage.

The Coastal Zone west of Chesapeake Bay is fringed by the Talbot and Wicomico terraces from which arises quite abruptly an undulating plateau having an elevation varying from 120 to 300 feet. The vegetation of this district is discussed by Chrysler who found the mixed forest, the pine-oak association, the most common. He believes the pine-oak association represents a sort of adolescent stage in the development of the forests, being preceded by the pine association (mostly *P. Virginiana*) and followed by one in which the pines are absent, the oak-hickory-chestnut association. The author gives considerable attention to the succession of forest associations and he also presents a table of frequency of forest trees in various habitats.

The Midland Zone is subdivided into the Lower and Upper districts. The Lower District is a portion of the Piedmont plateau of uniform topography and of underlying crystalline rocks. In sharp contrast to the Coastal Zone, lakes, ponds and marshes are absent. The vegetation of the district is discussed by Shreve under the titles: Vegetation of the loams (mostly Cecil, derived from granite, gneiss and diorite); vegetation of the Cecil clay (derived from gabbro); vegetation of the serpentine barrens: vegetation of the Susquehanna gravel. On the topland loam, Chestnut is the prevailing tree, representing 35 per cent of the stand, White Oak 20 per cent, Mockernut Hickory 15 per cent, Black Oak and Pignut Hickory, each 10 per cent. On the loam slopes Tulip, Beech and White Oak form from 40 to 60 per cent of the stand. The composition of the Cecil clay forest does not differ markedly from that on the Cecil loam, but as a rule, White Oak, Tulip, Swamp White Oak, are much more abundant and the Chestnut Oak is rare on the Cecil clay. The serpentine barrens are occupied almost exclusively by an open stand of Black Jack Oak, Post Oak and Red Cedar. Chestnut and Chestnut Oak form from 60 per cent to 90 per cent of the Susquehanna gravel forests.

The Upper Midland District, although not definitely so stated, is apparently composed of the foot hills of the Alleghany Mountains. Both topography, and geological formation are much diversified. The valleys of the district are from 250 feet to 880 feet above the sea, while the ridges vary from 850 to 2,000 feet in elevation. Blodgett describes the vegetation of the district under four groups, that of Parr's Ridge, the limestone valleys, the sandstone ridges, and the shale ridges. The forests of Parr's Ridge are similar to those in the western portion of the lower district. The limestone valleys are almost entirely under cultivation. The ridges capped with sandstone support Chestnut Oak, Red Oak, Chestnut and Scrub Pine. The steeper slopes of the shale ridges are dominated by Pitch Pine and Chestnut Oak, while the more gentle slopes are controlled by a mixed forest in which White Oak is conspicuous.

The Mountain Zone includes those portions of Maryland lying above 1,500 feet. The forests are discussed by Shreve under seven types, those of the slopes, ridges, valleys, rocky slopes, glades, swamps and bogs. The White Oak is the dominant tree on the slopes and in the valleys, and it is second in importance on the ridges which are controlled by Chestnut, Chestnut Oak and Red Oak. Hemlock forms 75 per cent to 90 per cent of the stand on the rocky slopes. The glades, the bottoms of broad valleys, were formerly occupied by pure stands of White Pine. Black Spruce and White Pine were originally dominant in both the swamps and bogs.

Besides the topics mentioned above, the volume contains chapters on the relation of natural vegetation to crop possibilities, the agricultural features of Maryland, the forests and their products, and concludes with a list of plants collected or observed by the four investigators. The volume is abundantly illustrated with excellent photographic reproductions and with various explanatory maps and charts, yet for a work based so much upon geology and topography, the absence of geological and topographic maps is rather unfortunate.

C. D. H.

Soil Fertility and Permanent Agriculture. By Cyril G. Hopkins. Boston, Ginn and Co., 1910. Pp. 653.

The reviewer knows of no book on soils that contains so much statistical data, interpreted and presented in a readable manner, as does the volume of the above title by Dr. Hopkins of the University of Illinois. The various topics are discussed under four groups. The first group, Science and Soil, in addition to the matter usually considered in this place in soil text-books, contains a soil map of the United States and brief descriptions of the 86 soil series and 715 soil types as classified by the Bureau of Soils.

The origin, application and cultural methods in regard to the three soil constituents necessary to maintain or increase the productive power of soils, namely, lime, phosphorus and organic matter, are considered under Systems of Permanent Agriculture. The now well-known theory of the Bureau of Soils that practically all soils contain sufficient plant food for good crop yields, and that the deterioration in crop production is due to improper cultural methods rather than to exhaustion of plant food stuffs, is met by some thirty pages of data to the contrary. The author leaves no one in doubt of his position in the matter when he says that the theory is advanced with no adequate foundation of fact and is in direct opposition to practical experience. He invites the Bureau of Soils, without the aid of chemical fertilizers to transform sterile soils like the Leonardtown loam worth $1.00 to $5.00 per acre, into soils worth $150.00 per acre like certain of those rich in plant food stuffs.

The summary of the Rothamsted experiments, as well as that of the field experiments in various states of the Union and Canada, is of exceptional value to soil students. In the third group of subjects, besides these summaries, there is an interesting chapter on pot cultures versus field experiments, in which the author shows that the disagreement between the twenty-day laboratory tests of the Bureau of Soils and the nine years' field results of the Ohio Experiment Station, is so nearly perfect as to render the short time culture experiments of no value.

The fourth group of topics, Various Fertility Factors, contains such chapters as commercial fertilizers, farm manure, factors in crop production, losses of plant food from soils.

While the book is intended primarily for the agriculturist, yet it contains much information valuable to the silviculturist and the student of forest ecology.

C. D. H.

OTHER CURRENT LITERATURE.

Sixth Annual Report of the State Forester of Massachusetts: 1909. By F. W. Rane. Boston, Mass. 1910. Pp. 109.

Massachusetts Wood-Using Industries. By H. Maxwell, F. W. Rane, and H. S. Sackett. Boston, Mass. 1910. Pp. 38.

Parasites of the Gypsy and Brown-Tail Moths Introduced into Massachusetts. By W. F. Fiske and F. W. Rane. Boston, Mass. 1910. Pp. 56.

Forest Nursery and Reforestation Work in Massachusetts. By R. S. Langdell. Boston, Mass. 1910. Pp. 36.

How to Make Improvement Thinnings in Massachusetts Woodlands. By H. O. Cook. Boston, Mass. 1910. Pp. 21.

A Report on the Chestnut Tree Blight. By J. Mickleborough. Harrisburg, Pa. 1909. Pp. 16.

Natural Revegetation of Depleted Mountain Grazing Lands: Progress Report. By A. W. Sampson. Circular 169, U. S. Forest Service. Washington, D. C. 1909. Pp. 28.

Engelmann Spruce in the Rocky Mountains. By E. R. Hodson and J. H. Foster. Circular 170, U. S. Forest Service. Washington, D. C. 1910. Pp. 23.

Pasturage System for Handling Range Sheep: Investigations during 1909. By J. T. Jardine. Circular 178, U. S. Forest Service. Washington, D. C. 1910. Pp. 40.

Lumber Saved by Using Odd Lengths. Circular 180, U. S. Forest Service. Washington, D. C. 1910. Pp. 5.

Consumption of Firewood in the United States. By A. H. Pierson. Circular 181, U. S. Forest Service. Washington, D. C. 1910. Pp. 7.

Forest Planting Leaflet: Shortleaf Pine. Circular 182 U. S. Forest Service. Washington, D. C. 1910. Pp. 4.

Forest Planting Leaflet: Loblolly Pine. Circular 183, U. S. Forest Service. Washington, D. C. 1910. Pp. 4.

The Forests of Alaska. By R. S. Kellogg. Bulletin 81, U. S. Forest Service. Washington, D. C. 1910. Pp. 24.

Protection of Forests from Fire. By H. S. Graves. Bulletin 82, U. S. Forest Service. Washington, D. C. 1910. Pp. 48.

Injury to Vegetation and Animal Life by Smelter Wastes. By J. K. Haywood. Bulletin 113 (revised), Bureau of Chemistry, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 63.

Eleventh Annual Report of the Canadian Forestry Association. Ottawa, Canada. 1910. Pp. 141.

Oil of Turpentine. Bulletin 211, Laboratory of the Inland Revenue Department. Ottawa, Canada. 1910. Pp. 19.

A Study of the Wisconsin Wood-Using Industries. By F. H. Smith. Madison, Wisconsin. 1910. Pp. 68.

Forest Conditions in Central and Western Kansas. Bulletin 165, Kansas State Agricultural College. Manhattan, Kansas. 1910. Pp. 61.

Forest Fires in North Carolina during 1909. By J. S. Holmes. Economic Paper No. 19, North Carolina Geological and Economic Survey. Raleigh, N. C. 1910. Pp. 52.

Shade Tree Laws of Massachusetts. The Massachusetts Forestry Association. Boston, Mass. 1910. Pp. 24.

Fifteenth Annual Report of the Forestry Commissioner of Minnesota: 1909. St. Paul, Minnesota. 1910. Pp. 154.

Fortieth Annual Report of the Entomological Society of Ontario: 1909. Ontario Department of Agriculture, Toronto. 1910. Pp. 144.

Contains several papers on insects injurious to forest trees.

Thirtieth Annual Meeting of the Society for the Promotion of Agricultural Science: 1909. Portland, Oregon. 1909. Pp. 137.

Contains following forestry papers: The Relation of the Experiment Station to Forestry, by C. E. Thorne; Forestry in the Northwest, by J. B. Knapp; The State in its Relation to Forestry, by L. G. Carpenter.

Fifteenth Annual Report of the Forest, Fish and Game Commission: 1909. Albany, N. Y. 1910. Pp. 426.

Yearbook, 1910 of American Society for Testing Materials. Philadelphia, Pa. 1910. Pp. 308.

Contains standard classification of structural timber.

The Fight for Conservation. By Gifford Pinchot. New York. 1910. Pp. 152.

Report of the Chief Conservator of Forests for 1909. Cape Town, Cape of Good Hope. 1910. Pp. 25. Illustrated.

Some Effects of a Harmful Organic Soil Constituent. Bulletin 70, Bureau of Soils, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 98.

The Wood-Using Industries of Maryland. By H. Maxwell; with a chapter on *Maryland's Timber and Timber Cut and the Timber Supply*, by F. W. Besley. Baltimore, Md. 1910. Pp. 58.

Proceedings of the Society of American Foresters. Vol. V, No. 1, 1910.

Contains the following articles: The Selection System, by H.

S. Graves; The Log Scale in Theory and Practice by H. D. Tiemann; Experiments in Sandhill Planting, by C. G. Bates; Management of Loblolly and Shortleaf Pines, by W. W. Ashe; Regulating the Annual Cut of National Forests, by S. L. Moore; The Growing of Eucalypts, by F. G. Plummer; Forests as Gatherers of Nitrogen, by T. Cleveland, Jr.; Basket Willow Culture in Germany, by C. D. Mell; Obituary—Samuel Bowdlear Green, by L. C. Miller.

Report of the Oregon Conservation Commission to the Governor. Salem, Oregon. 1910. Pp. 38.

Official Proceedings of the February, 1910, Meeting of the Oregon State Board of Forestry, including Forest Fire Report for 1909 and Committee Report on Insect Depredations. Salem, Oregon. 1910.

Report of the Forester for 1909. By Gifford Pinchot. Washington, D. C. 1909. Pp. 45.

Sixth Annual Report of New Jersey Shade Tree Commission for Year 1909. East Orange, N. J. 1909. Pp. 12.

Wisconsin Arbor and Bird Day Annual. Department of Public Instruction. Madison, Wisconsin. 1910. Pp. 104.

Report on the Forest of the Soudan (2nd edition). By C. E. Muriel. Cairo Al'mokattam Printing Office. 1910. Pp. 35.

Relationships of the Ivory Palms. By O. F. Cook. Contributions from U. S. National Herbarium, vol. 13, pt. 5, Smithsonian Institution, U. S. National Museum. Washington, D. C. 1910. Pp. 9.

Annual Progress Report on Forest Administration in the Lower Provinces of Bengal for the year 1903-1909. Calcutta, India. 1909. Pp. 53.

Administration Report of the Forest Circles in the Bombay Presidency for the year 1908-1909. Forest Department, Bombay, India. 1910. Pp. 176.

Progress Report of Forest Administration for 1908-1909, Coorg, India. Forest Department, Bengalore, India. 1910. Pp. 25.

Progress Report of Forest Administration for the years 1908-1909. Forest Department, East Bengal and Assam. Shillong, India. 1909. Pp. 67.

Annual Administration Report for the Twelve Months ending 30th of June, 1909. Forest Department, Madras Presidency. Madras, India. 1910. Pp. 240.

Reports on the Forest Administration in Burma for the year 1908-1909. Rangoon, India. 1910. Pp. 225.

Petwin or Trincomali Wood (Berrya ammonilla, Roxb.) By R. S. Troup. Pamphlet 12, Imperial Forest Research Institute, Dehra Dun, Calcutta, India. 1910. Pp. 8.

Burma Padouk (Pterocarpus macrocarpus, Kurz.) By R. S. Troup. Pamphlet 14, Imperial Forest Research Institute, Behra Dun. Calcutta, India. 1909. Pp. 41.

Notes on the Best Season for Coppice Fellings of Teak (Tectona grandis). By R. S. Troup. Pamphlet 16, Imperial Forest Research Institute, Dehra Dun. Calcutta, India. 1910. Pp. 29.

The Prospects for the Match Industry in the Indian Empire. By R. S. Troup. Indian Forest Memoirs, Economy Series, vol. 2, pt. 1, Imperial Forest Research Institute, Dehra Dun. Calcutta, India. 1910. Pp. 172.

A Note on the Fissibility of Some Indian Woods. By R. S. Troup. Superintendent Government Printing. Calcutta, India, 1910.

Report of the Year ending June 30th, 1909. Forestry Branch, Department of Agriculture, New South Wales. Sydney, N. S. W. 1909. Pp. 9.

Notes re Timbers of Western Australia Suitable for Railways, Engineering Works and Constructional Purposes Generally (2nd edition.) Minister for Lands and Agriculture, Perth, W. A. 1908. Pp. 36.

Yellow Pine Creosoted Blocks, the Modern Perfect Pavement for Streets, Bridges and Crossings. Yellow Pine Manufacturers' Association. St. Louis, Mo. 1910. Pp. 29.

Irrigation in Colorado. By C. W. Beach and P. J. Preston. Bulletin 218, Office of Experiment Stations, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 48.

The Use of Windmills in Irrigation in the Semi-arid West. By P. E. Fuller. Farmers' Bulletin 394, U. S. Department of Agriculture, Washington, D. C. 1910. Pp. 44.

Official Proceedings of the 17th National Irrigation Congress Held at Spokane, Wash., Aug. 9-14, 1909. Spokane, Shaw & Borden Co., 1909. Pp. 546.

Eighth Annual Report of the U. S. Reclamation Service, 1908-1909. Washington, D. C. 1910. Pp. 22.

Descriptive Meteorology. By Willis Moore. New York and London. 1910. Pp. 344.

Report of the Conservation Commission of Maryland for 1908-1909. (Forest Resources Pp. 119-135.) Pp. 204.

The Forest and the Sawmill. Official Report of Eighth Annual Convention of the National Lumber Manufacturers' Association, April 1910. Chicago. 1910. Pp. 269.

Record of Wholesale Prices of Lumber for July, August and September, 1910. List A, U. S. F. S., Washington, D. C. 1910.

Relation of Good Roads to Economic Forestry. By J. S. Holmes. Southern Appalachian Good Roads Association. Chapel Hill, N. C. 1910. Pp. 6.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Forests of Caucasia.

According to an official investigation by Fock, the forests of Transcaucasia comprise altogether over 12½ million acres, about 25 per cent of the total area. Of this a little less than one half are privately owned. Nearly 40 per cent of the area is beech forest, which is little valued since there are no means of transportation. Similarly, the blue beech, used preferably for fuel, with 15 per cent of the area, occupies inaccessible territory. Oak, occupying 20 per cent, is to some extent exported. Besides these principal broadleaf trees, there are found birch, chestnut, ash, maple, alder, aspen and willows, a few basswood, and walnut. Palms occur on the shores of the Black Sea.

Of conifers, spruce. and two firs (*pectinata* and *nordmanniana?)* are found on 25 per cent of the area; on small areas a tree juniper grows which is liked for its durability. Curiously enough spruce is an article of importation, home supplies not being accessible.

Of forest management little is known, although an annual income of about 2 million dollars is secured from the State forests. The forest is burdened with servitudes, and in addition stealing of wood not only but of farmlands is general. Robber tribes make peaceful development hazardous; the population is still too small to furnish a basis for improvement.

The country is mostly mountainous, the highest peaks rising to 18,000 feet (Elbrus); a small area of steppe lies in the southeast corner, while Ciscaucasia is mostly plain.

Die Wälder Kaukasiens. Forstwissenschaftliches Centralblatt. July, 1910. Pp. 404-407.

Lumbering in Texas.

The original forests are estimated to have covered 41,980,000 acres with a stand of 80,000,000,000 feet while the present forests are said to cover 20,000,000 acres with a stumpage of 42,000,000,000 feet of which yellow pine amounts to 34,000,000,000 and the remainder is hardwoods. The lowest annual output was in 1880 when 328,986,000 was cut, while the highest cut before 1909 was in 1907 with 2,229,590,000 feet. The highest average mill price for yellow pine was in 1906 when nearly $16 was received.

Approximately 50 per cent of the yellow pine is marketed in Texas and the principal outside markets are in Chicago, Kansas City, and St. Louis. A large amount goes abroad and Mexico imports more yellow pine than any other lumber.

There are about 500 sawmills cutting yellow pine and 25 mills cutting hardwoods exclusively which are of sufficient importance to have financial rating, while there are about 125 mills in the state too small to be rated financially. There are about 100 planing mills operated independently of sawmills.

The smallest mills with financial rating have a cut of 10,000 feet daily while the largest plant in the state is a double mill with a capacity of 300,000 feet in 10 hours. The largest mills and the majority of middle class mills are equipped with band saws while the mills with a capacity of 10,000 to 40,000 feet are supplied with circular saws. In 1904 large tracts of yellow pine stumpage were sold for 50 cents per thousand while in 1909 the value is given at $5.00.

"The Lumber History of Texas," Southern Industrial & Lumber Review, July, 1910.

Louisiana Forest Conditions.

Mr. J. H. Foster of the U. S. Forest Service divides the forest types of the state into shortleaf pine uplands, longleaf pine region, alluvial region, bluff region, prairie region and sea marsh.

The shortleaf pine uplands occurs on both sides of the Red River in the northwestern part of the state and to a limited extent east of the Mississippi river where it occupies nearly all of East Feliciana parish and portions of adjoining ones. The forest consists of pure stands of shortleaf on dry ridges with various oaks, red gum, ash, hickory, beech, maple, yellow poplar, sassafras, holly, magnolia, loblolly in mixture with shortleaf on intermediate sites. Formerly cypress brakes occurred on overflow land but have almost entirely disappeared. Underbrush is usually dense. The stand east of the Mississippi has been more severely cut over and fully three-fourths of it is cultivated or in pasture.

The longleaf pine areas occur over two widely separated sections; the larger being located in the west central portion of the state between the shortleaf uplands on the north and prairie on the south. East of the Mississippi river the longleaf pine area occupies more than half of the so-called Florida parishes extending from Mississippi state line to Lake Ponchartrain and from Pearl river to the upland regions further west. The longleaf pine occurs on sands and clays with a more or less impervious clay subsoil and covers nearly one-fourth of the state, including the largest remaining bodies of this species in the country.

Cypress and tupelo grow on alluvial lands almost to the exclusion of other species. It is estimated that more than one-half of remaining cypress in the United States is to be found in the lower parishes of the alluvial region. Most of the brakes north of Baton Rouge have been cut and the future supply will not last more than 15 years according to lumbermen.

The bluff region has a typical deciduous forest of oaks and hickories. Originally the best white oak and hickory in the state was found on this area, but now the stand is very inferior second growth.

Ash stumpage frequently sells in small quantities for $9 to $12 per thousand feet while oak ranges from $6 to $8. Shortleaf stumpage is generally worth $5 per thousand while longleaf is rated at $4 or less, since shortleaf is less affected by red heart and because of lighter weight costs 50 cents less per thousand in shipping. Cypress stumpage is valued at $6 to $8 but can hardly be bought at any price while cut over cypress lands are sold for $2 to $10 per acre depending upon the distance from bayous, amount of cull lumber left, and ease of draining. Cottonwood for headings, slack cooperage, and box boards has a stumpage value of $3.50 to $5.00 and over. The rapidity with which the lumber business has beveloped and the almost startling rate at which these forests have been cut indicates that the supply will hardly last more than two decades more.

"Timber Resources of Louisiana," Lumber Trade Journal, June 1, 1910.

BOTANY AND ZOOLOGY.

Ecology of Pine.

In a very exhaustive, painstaking study of historic sources by Dr. Dengler, he attempts to establish the natural limits of the field of distribution of the Scotch Pine, which through interference by man have been considerably changed. We can only quote his conclusion: The limit of the natural field of distribution of the pine and the occurrence within this field in North and Middle Germany is in the first place determined by soil conditions; the climate has only in so far an indirect influence as under more favorable temperature and rain conditions the broadleaf species especially beech, which compete with the pine have a better chance of crowding out the pine in such soils as under less favorable climatic conditions are today still dominated by the pine naturally grown.

Neues zur Frage des natürlichen Verbreitungsgebietes der Kiefer. Zeitschrift für Forst- u. Jagdwesen. August, September, 1910, Pp. 474-495; 519-539.

Heartwood Formation in Pine.

The important fact that the pine fungus *Trametes pini* attacks only the heartwood has been amply proven, although apparently exceptions have been noted in young trees. Kienitz points out that the exceptions are due to a misunderstanding as to what "heartwood" means and also to the belief that young trees and branches do not form heartwood. Physioligically, heartwood is that wood of the interior which does not contain living cells, while technically only discolored parts are so called. Such heartwood is, to be sure, without living elements.

In an investigation of 134 sections he made the discovery, that the heartwood formation in the branches which in the development of the stand gradually came under the shade and died, always began earlier than in the part of the bole from which the branch proceeds. In the crown itself this law is not so certain. Here the heartwood forms later, because the branches live and conduct water through their whole cross section.

Every branch, however, forms heartwood as soon as it ceases to grow vigorously, no matter in what part of the crown it is located; in a whorl, often one branch is all heartwood, while none of the others show any. In one case, a 3-year old branch had begun to form heartwood, and 6 to 7-year old ones are frequently in that condition. Often the basis is all heartwood, while its outer layers have still the color of sapwood and the branch must then be fed by means of the cambium layer.

Beiträge zur Frage der Kernholzbildung bei der Kiefer. Zeitschrift für Forst-u. Jagdwesen. October, 1910. Pp. 620-629.

Adventitious Roots.

Vogtherr brings together references to the literature of this subject and adds own observations on the subject of the formation of adventitious roots, *i. e.,* roots which originate endogenously on older parts of the plant—not root—distant from the vegetation points and without order, under the influence of increased nutrition. The development of such latent roots occurs on cuttings, but can also be stimulated by withdrawal of light or water on uninjured plant parts. All broadleaf and coniferous trees are capable of striking roots from branches if covered with moist soil. In regions of high relative humidity (alpine and northern sites), branches creeping on the ground are apt to strike root and make new vertical shoots, especially willows and Cupressineae in the first years, others after several years.

A large number of special examples of such root formation is cited and a few new ones are described and pictured. Among these there is a 150-year old beech which, having been injured at about five feet from the ground developed a large number of finely branched roots under the injured bark. On a basswood, 50 years old, such roots were formed at the end of a broken branch.

Altes und Neues über Adventivwurzeln. Forstwissenschaftliches Centralblatt. June, 1910. Pp. 305-316.

Teratological Phenomena in Beech.

A number of peculiar forms of beech is recorded by Oppermann, namely, with creeping branches, climbing habit, forked, many-stemmed, crooked, two-legged, with one-sided branch system, pendulous with many branches. Altogether 128 forms are pictured and described with careful notation of location in Sjaelland (Denmark). An experiment with seed from a mother tree with pendulous branches, leads the author to consider these features hereditary.

Vrange Boege in det Nordostliche Sjaelland. Meddelelser udgivne ved Forsoegs-Kommissionen. 1908. Pp. 29-256.

SOIL, WATER AND CLIMATE.

Classification of Forest Soils.

In a suggestive article, Busse points out that so far a satisfactory soil classification based on constant factors does not exist.

The usual classification into site classes is based either on heights of stand or volume production (comparing with normal yield tables). He cites several cases where from either of these points of view a soil would from the character of the actual stand be classed I, while owing to accumulations of raw humus and the beginning of moor formation, due to mismanagement, with a new generation, when the surface conditions are of moment, it is bound to fall into an inferior class; and vice versa by change of the crop a soil of class IV may have to be classed higher. This classification is one-sided and does not consider sufficiently actual soil conditions.

Chemical constituents do not seem to furnish a safe basis, as is shown by analyzing soils of different site classes as determined by the yield, and finding them when arranged according to the contents of different minerals not at all in proper relation. Since such chemical analysis leaves out of consideration soil water and soil air, it is evident that it cannot satisfy. A proposition to treat soils with hydrochloric acid to extract minerals is based on the assumption that the roots do it in the same way.

Physical soil conditions are those which the practitioner accentuates. Yet they are influenced by management and hence in a given case it may be very difficult to decide whether the physical deficiencies are permanent or temporary and where to class such soils.

It is foreshadowed that the study of the micro-organisms may eventually furnish a basis for classification. So far all classification has been mere trial. Site classes based on conditions of the stand, should merely be called stand classes; yield class is also a less definite name.

Zur Klassifikation der Waldböden. Zeitschrift für Forst- u. Jagdwesen. September, 1910. Pp. 568-572.

Bog Iron Ore Formation.

The causes of the formation of bog iron ore are discussed by Dr. Albert of the soil laboratory of Eberswalde, partly by citing the extensive literature on the subject, partly by adding personal investigations conducted in field and laboratory.

The study was made in a district near the Baltic Sea of sand dunes covered with pine forest, the dunes running east and west, hence giving opportunity for studying soil differences and processes of humification, namely carbonic acid and humic acid decomposition, on the two aspects. The mechanical analysis (tabulated) shows considerable differences in clay contents, the soil of the southern slope for the first 8 inches containing considerably more than that of the north slope; it also contained considerably more plant food in this upper layer, especially lime and phosphoric acid being almost entirely leached out in the soil of the north slope, this upper soil layer containing 16,000 lbs. less of minerals soluble in acid than the same layer on the south slope.

Further analysis of the total mineral contents to a depth of 16 inches—the usual depth of bog iron ore formation—discloses that the loss of minerals has been really four times as large, showing that on the north slope the reserve materials have been greatly exhausted. This is due partly to the leaching of the clay particles, partly or largely to the chemical decomposition of the silicates of alumina. This can also be seen with the naked eye, the red grains of feldspar being readily seen on the south side but absent on the north side.

Further investigations show that these enormous quantities of minerals have not been leached away entirely but are to a large extent gathered in the subsoil, so that even a larger mineral content may be found there than on the south slope, 90% of the 16,000 lbs. are gathered in the bog iron ore zone, but only clay, iron oxide and phosphoric acid, the other minerals being leached out even here. On the whole, altogether 40,000 lbs. of minerals per acre are lost to the soil on the north side by leaching.

The author here calls attention forcibly to the danger of the dry or raw humus formation, which leads to this leaching. "On the north slope of the dunes are found many small spots a few square yards in extent on which sphagnum mosses have located themselves, growing vigorously and forming 8 to 12 inch high bolsters above the dry humus and in consequence of a regular moor formation cause the death of pines, and this on the dry dune sand in a climate not favorable to the formation of high moors."

After referring to various theories for the formation of bog iron ores and making reference to the same formation as a cause of the swamp conditions of the celebrated Landes in France, he develops his own theory.

Considering the exterior conditions, the fact that raw humus and bog iron ore formation occur on the north side and not on the south side of the dunes, the difference of aspect leading to two extreme soil types, raises the question whether difference in temperature and hence higher humidity is to be considered the cause of raw humus deposits or whether the difference in soil flora, due to climatic differences, is primary cause.

The author inclines to the latter alternative on the basis of an analysis of the character of the dry turf under such lightneeding species as pine, which consists largely of roots and dead parts of the soil flora, with decayed needles imbedded. Berry weeds, especially if they have conditions of vigorous and exclusive development, form this dry turf and the much dreaded Calluna which on account of its greater light requirements develops specially on south sides, does not at all produce undesirable humus. Only when invading existing dry turf deposits does it add to this class of humus.

As to the chemical processes the author raises doubts regarding the accepted theories but does not come to very definite conclusions which admit of brief statement.

Speaking of forest culture on such bog iron ore soils he admits that where the impermeable layer does not lie deeper than 20 inches the breaking through of the layer may be practicable, but not when the layer lies deeper, because too expensive. Draining and mixing the turf with the mineral soil are here indicated.

Even where the layer can be broken through agricultural use of the soil (potatoes) with manure should precede the planting to forest. Very successful results have been secured in the district referred to after fertilizing with 180 lbs. of Thomas slag and potash and 100 lbs. Chili saltpeter an average in three years of half a ton of potatoes per acre was secured representing a return of $112 which deducting total cost for three years of $78, leaving therefore $24, and the soil in excellent condition for forest planting.

Beitrag zur Kenntniss der Orsteinbildung. Allgemeine Forst- u. Jagdzeitung. June, 1910. Pp. 327-341.

SILVICULTURE, PROTECTION AND EXTENSION.

Virgin Woodlands.

Of especial interest to American foresters is a discussion by Dr. Cermak on virgin woodlands which have not been affected by the interference of man, as exemplified in Austrian woodlands.

The author shows the necessity of distinguishing between a virgin woodland and a selection forest. The main difference is in the proportion of the age classes. In a selection forest all classes are represented, while in virgin woods the younger age classes are commonly lacking and the stand is either made up of mature even-aged trees, or a sort of two-storied wood, each story of about the same age. This is the result of an uninterrupted struggle in which the tolerant species have gained the ascendancy and formed a complete crown cover. In the two-storied wood the dominated must be of a species more tolerant than those of the dominant stand, but even the suppressed stand has been found to be approximately even aged.

Virgin woods always have a soil rich in humus so that from this point of view the conditions for tree growth are ideal in a biological sense.

The exploitation of virgin woods leaves the stand in bad condition if all the mature timber is removed at one time because most of the trees are in the higher age classes. This makes the time of waiting for the second cut and the period of conversion into a regulated forest with a sustained yield both disproportionately long.

Where virgin woods are on sites requiring protection of the soil the problem of conversion is still further complicated by the necessity of leaving uncut in order to prevent soil erosion many trees silviculturally mature and liable to deterioration.

Einiges über den Urwald von waldbaulichen Gesichtspunkten. Centralblatt f. d. g. Forstwesen. August, September, 1910. Pp. 340-370.

Waste Land Planting.

Fricke relates experiences with reforesting abandoned sandy farmlands with pine on thousands of acres. Each time the success of plantations for the first 20 to 30 years was satisfactory, but then with the arrival of *Polyporus annosus* a dying out of stands began, and it appears from investigations of Dr. Albert that this dying out on farm soils continues through the second generation.

The question whether such plantations improve the soil has been negatived by Albert, and a series of recorded analyses by Dr. Vater supports the same finding, namely that the compactness of the soil, the reduced pore volume, the lack in aeration and in oxygen contents is not improved by forestation.

The analyses show that an increase of humus and nitrogen *in* the soil did not take place. No gradual improvement in the quarz-sand soil was noted. To be sure, if the soil cover is also considered, two to three times as much humus was found, but, the writer asserts that for the present tree generation this is not a very important source of food materials, especially of nitrogen. Only when artificially mixed with the soil would a second generation be benefited.

Lumbricids (angle worms) were not found in this humus, and hence no improvement from this point can be expected.

On the contrary, reforestation on lime, slate, fresh loamy sand and other soils in the hill lands which have lost their granular structure merely by exposure, produced a most decided improvement in soil structure and most excellent stands, the fungus not producing the dying out of groups as on farm soils, but it is liable to produce red rot.

Veränderungen des Bodens durch Aufforstung bisheriger Ackerländereien. Zeitschrift für Jagd- u. Forstwesen. May, 1910. Pp. 259-264.

Good vs. Poor Planting.

Dr. Moeller discusses the value of careful planting on the basis of an exact experiment, in which he proved that with Scotch Pine it did not matter at all whether roots were braided into a strand, or tied into a knot, bent any way, bunched together and crowded into a shallow hole. Provided the root has not been allowed to dry out, none of this bad treatment was liable to kill the plant or impede its growth. Especially the claim that roots so treated were liable to fungus diseases was entirely disproved. The most careful planting did not protect plants against infection, just as seeded plants do not escape.

Yet Dr. Moeller does not mean to imply that careless planting should be recommended. Only any unnecessary costly care is to be avoided. What is needful is to bring the roots fresh into the ground and into as natural arrangement as possible without excessive care, for the long root renders it practically impossible to secure the ideal position.

That method should in each case be chosen which at least expense surely secures practical success. Hence, on some soils split planting has proved perfectly successful; on other sites has led to miserable results.

He then discusses two modern planting tools, namely Spitzenberg's plant stick (see *F. Q.* Vol. IV, p. 94) which avoids the compacted wall of the split planting and makes a perfect tool, technically speaking; and Splettstoesser's borer (see *F. Q.* Vol. VII, p. 467), which has proved itself as another technically perfect tool. Since it also performs its work as cheaply as any other, except split planting on unprepared soil, it is to be recommended on all soils where the latter cannot be employed.

Where for special reasons previous preparation of the ground is necessary, mere dibbling probably is best, and cheaper.

Versuch zur Bewertung von Kiefernpflanzmethoden. Zeitschrift für Forst- u. Jagdwesen. October, 1910. Pp. 629-632.

Silviculture of Spruce.

In *F. Q.* vol. V, p. 185, a description of the Bohemian Bohdannecky's method of growing spruce in open crowncover was briefed.

This is a revolutionary method, giving up as it does the demand for a close crowncover from early youth, the planting to be spaced 5 to 6 feet apart, the thinning to be begun after the fifteenth year; clear boles are considered of less importance than rapid diameter growth.

Forstmeister Tiemann points out that this method, practised now for 30 years at Worlik forest, is based upon the well known law that the diameter growth is proportional to the feeding area of the foliage. The close grown stands produce an insufficient, unnatural, reduced crown and root system and hence diameter, volume and value increment are lagging. Instead of one inch in 12 years, this method attempts to produce one inch in four years. The advantages of the new proposition are:

1. a larger total increment and a more favorable interest rate, since the increased increment occurs on a smaller stock capital; hence probably a lower rotation is possible;

2. greater protection against wind and snow pressure due to open position, so that each stem becomes firmer;

3. reduction of fire danger, since not as much inflammable brush can accumulate due to early thinning;

4. reduction of insect damage and disease on account of greater vigor of each individual;

5. reduction of damage by game because of the deeper crowns persisting to the 20 to 40 year;

6. earlier, more frequent and larger seed production;

7. on account of this and of greater wind firmness the possibility of a natural regeneration under nursetrees;

8. easier logging;

9. smaller number of plants needed in plantations, using 3 to 4-year old transplants, spacing 4½ foot.

A disadvantage is found in a reduction of quality, since the method produces coarse-grained, branchy, more tapering trees, the opposite of what close stand would produce. It is, however, questionable whether in the sale of large quantities really a better price is secured for the better quality in proportion to the greater expense of its production. A quotation from an article of Weinkauff makes "the close position the source of all evils in the forest" "To secure standing room and that from early youth is the most important requirement of silviculture. The accentuating and the frequently-heard demand of excessively clear boles is significant for the dilettante ideas of many so-called professionals. Has any one figured, how many millions this requirement costs annually?" Other similar quotations are made. Regarding the influence of the method on soil conditions, it is asserted that they are better preserved than under dense cover, which has the tendency to diminish soil humidity by interception of the rain, besides impeding air changes and warming of the soil. According to Bohdannecky, a moss cover is inimical because absorbing much moisture from the soil; this moss cover vanishes under his practice, giving place to a cover of needles much more abundant from the well developed crowns, than would be the case from the many poorly developed crowns of a close stand; their shading also is superior.

The author, then, agrees that it is necessary to warn against quick generalization in adopting this method and proposes systematic experiments to test its value; some six such experiments are detailed.

Bemerkungen zu der Bohdannecky'schen (Worliker) Methode der Erziehung der Fichte im lockeren Kronenschluss. Forstwissenschaftliches Centralblatt. August, September, 1910. Pp. 454-466.

Growing Spruce.

Careful and interesting experiments in support of Bohdannecky's method are reported from the Austrian Experiment Station. Dr. Schiffel some four years ago published a longer article (briefed in *F. Q.*, vol. IV, p. 326) on a number of silvicultural problems on which opinions diverge. From this article he summarizes the rules laid down for the growing of spruce, the basis for which he formulates as follows:

1. The shaft form as regards both dimensions and technical quality on given site depends on the density of crowncover. Open stands favor height and diameter growth at the expense of quality and the reverse. Hence it is the task of the silviculturist to secure by regulating the density the best financial result.

2. Since spruce forms naturally a straight stem and clears more readily than other conifers, a dense stand in the juvenile stage for purposes of shaft form is not necessary.

3. It suffices from the point of view of shaft form if on poorer sites the crowncover is closed with a height of 16 feet, on good sites with 25 feet.

4. During the period of greatest height growth openings made

by thinning are relatively quickly closed up. During this stage dense cover produces rapid height growth and hence reduction in diameter increment. Hence in that period adequate thinnings which may remove half the trees leaving the best in as even as possible distribution are to prevent the crowns from becoming shorter than half the tree height.

5. After this period, in order to secure cylindrical clear boles only moderate thinnings are required; but even then the crown should not occupy less than .4 of the total height, to avoid loss in diameter increment.

Schiffel now brings the results of experiments to prove the correctness of these positions. These were instituted in the garden of the Austrian Experiment Station in 1900, by planting 4-year old transplants, spaced .5 *m*, and leaving them 2 years alone. Then the area was divided into four plots and each differently treated. Area I was changed to a spacing of 1*m* by .5*m*, and left in this condition until 1909; Area II was brought to the same spacing, the plants were, however, not cut out at the base but at 30 *cm* above ground so that the lowest branches were left, and these plants could vegetate and act as soil-cover. After one year it became evident that these beheaded plants could not persist without further light, and the spacing was changed to 1 *m* square, again leaving the beheaded plants. This underwood developing luxuriously was kept sheared down to 60 *cm* as soil-cover. Area III was first brought into spacing of 1 x .5 *m*, then, in 1903, into square spacing of 1.5*m* and left in this condition till 1909. In area IV the number of plants was also reduced to one-half in 1902, as in area III. In 1903, however, it was thinned out not schematically but according to the principle of selecting the best stems, élite, to be left, leaving 1,336 trees per acre in as even distribution as possible.

In area I, the crown cover was closed up at the end of 1902; in area III, at the end of 1907; in area II, not until 1909; in area IV the tips of the lower branches touched in that year.

A table shows the progress in height growth, which in 8 years was for area I 2.50 *m*, with a total height 3.56 *m*

area I	2.50 *m*,	with a total height 3.56 *m*
area II	2.46 *m*,	with a total height 3.56 *m*
area III	3.49 *m*,	with a total height 4.49 *m*
area IV	3.89 *m*,	with a total height 5.19 *m*

This result clearly showing the advantage (45%) of the open position. The average height of the 10 highest trees in area I was 4.89 *m*, in the open area IV 5.52 *m*, showing since these were originally of the same height that not the selection of the best, but the growth conditions account for the difference.

The following interesting table gives the conditions in the year 1909, when the trees were 14 years old.

				Per ha.				*Average Tree*				
					Volume						*Volume*	
Area	*Stem Number per ha.*	*Average Height*	*Diameter*	*Cross Section*	*Volume Shaft*	*Tree*	*Crown Length*	*Weight Green Branches*	*Largest Crown*	*Diameter*	*Shaft*	*Tree*
		m	*mm*	*m*²		*m*³	%	*kg*	*m*		*m*³	
I	18500	3.56	34	16.39	50.	90.6	2.45	69	2.6	1.55	.00270	.0040
II	2500	3.56	45	3.92	11.1	24.	2.85	80	6.5	1.70	.00447	.0096
III	4450	4.49	55	10.60	36.5	80.1	3.60	80	10.7	2.2	.00820	.0180
IV	3300	5.19	62	10.42	34.3	77.2	5.00	97	16.9	2.4	.01040	.0234

These figures show the great differences which the early change—when six years old—in the crown cover has made. While area I shows by far the largest volume, with its excessive numbers it exhibits small height, small crowns, small diameter, the average tree containing one-half to one-quarter the volume of the average tree of any of the other positions. The close relation of crown to diameter is apparent. To show that the uncertain diameter measurement in such small trees is not responsible for the differences a careful analysis of cross sections is made and tabulated, and pictured so that the history of progress in increment is also clearly brought out.

In the first three areas, in 1901, when six years old, the average tree in all had the same diameter, hence the subsequent variation must be explained by the difference of treatment. In area IV, in which only élite trees were left, the average stem had, of course, already a larger diameter.

In area I, the very next year after the thinning had been made and a close crown cover had reëstablished itself, a reduction in annual ring width, annually accentuated, is visible. While in area II, the diameter growth is less than in III and IV, and is reduced after 1906, it is larger than in area I. The competition of the roots of the soilcover part of the growth accounts for the retardation. Area III shows a reduction after 1908, when the crown cover had reëstablished itself and lower branches had begun to die. Area IV showed an absolutely even progress, but since crown cover was established in 1909, a reduced ring width is to be expected.

In 1904, both height growth and diameter growth showed in all cases a relative reduction, explainable by dry summer. This and other data establish a direct relation between height and diameter growth in young stands, with one exception in area II which was explained by a difference in water capacity of the soil.

Another series of plantings with different spacing, namely, 3, 4.5, and 6.5 feet, of 17 to 22 years standing, shows the same relation between height, diameter, crown length and density.

The crown cover, *i. e.* touching of lowest branches, had established itself here in the first area in the 9th year with a little less than 4,000 plants to the acre; in the second area with 1800 trees in the 12th year; in the third area with only 1,000 trees in the 14th year.

The fear that the most widely spaced, namely 6.5 feet, plantation will not clear itself in proper time the author dismisses with the remark that the lowest branches had already begun to die in the 22nd year up to 4.8 feet, when the height was 25 feet, and the diameter close on 4 inches.

This result with say 1,200 plants to the acre, an open stand from the start, shows that this spacing *on best fresh to moist loam soil,* is, for spruce, most advantageous.

Another experiment, also tabulated, refers to the effect of a thinning made in a stand on first class site, a plantation spaced 4.25 feet square. When 15 years old one part was thinned removing about half the trees without selection so as to leave those left in a schematic spacing.

At the age of 25 the following conditions were found:

	Height	*Average Diam.*	*Number* p. a.	*Volume*
Area I	34	3¾	2060	6742
Area II Thinned	37	4¾	1090	6568

The second area, with almost half the number of trees, showed nearly the same volume, with an average diameter 27% larger, the height being practically the same.

From a comparison of the 400 stoutest trees it appears that the crown length in the first area had decreased from 92% to 48% of the total height, in the thinned area from 92% to 56%, that is to say clearing had progressed satisfactorily even in the open position.

This experiment shows that even severe openings on good sites during the stage of greatest height increment fill up rapidly and exercise an advantageous influence on diameter and height growth without depreciating the volume increment.

Age	*Stem Classes*	*No. p. a.*	*Height ft.*	*Diam. in.*	*Height Growth Last 5 years in.*	*Crown Length Percent. of Height*
		AREA I.	NOT THINNED.			
	I	444	25	2.3	13.8	23
	II	445	31	3.	18.6	39
28	III	444	36	3.6	20.	46.
	IV	445	40	4.3	22.4	47
	V	445	44	5.6	24.8	49
	Average	2223	38	3.5	20.8	47
	I	143	57	5.	6.4	26
	II	144	61	6.	10.	26
48	III	143	66	7.	11.6	37
	IV	144	73	8.2	14.0	37
	V	144	80	10.3	18.0	45
	Average	716	66	7.6	12.	34
		AREA IV.	SEVERELY THINNED.			
	I	311	31	2.9	17.6	37
	II	312	36	3.5	19.6	47
28	III	311	39	4.	22.4	48
	IV	312	41	4.8	23.6	48
	V	312	44	6.	24.8	52
	Average	1559	40	4.4	22.0	49
	I	102	60	5.7	7.2	28
	II	102	69	6.9	11.6	31
48	III	102	74	8.	14.4	39
	IV	102	77	9.	16.4	40
	V	101	79	10.7	18.4	42
	Average	509	73	8.2	14.2	38

That thinnings which do not interrupt the crown cover remain without influence on the development of the stand is shown by another experiment on four areas, 28 years old, thinned moderately in varying degrees.

The tabulations show that the difference in volume of the stand with a larger number of trees is to be found in the subordinate tree classes *i. e.* in the less valuable portion. The stoutest 400 trees were in 20 years not affected in any way by the moderate thinning. The ring width had already begun to be reduced.

Another table shows the small difference which has resulted in the more severely thinned area in comparison with the least severely thinned stand.

What increases are noted are to be accredited to the automatic increase of the average height and crown length by the removal of the inferior stems; the same stem classes show in both cases the same height growth; the crowns developed alike in both cases. Influence on diameter development and even on ring width can only be secured by opening of the crown cover in the stage of maximum height growth, when the length of crown has not yet sunk under one-half of the height of the trees.

The conclusions are:

1. The growth of spruce in open position furthers height and diameter growth. On best sites 1,000 plants in even distribution suffice to secure a closing up sufficient for the clearing process and taper.

2. Diameter growth is in close relation to crown development expressed in not abnormal crown by relation of length of crown to length of shaft. A reduction of crown length produces reduction of diameter increment.

3. In the period of maximum height growth the crown length must not be allowed to sink below half of the shaft length. In this period even severe openings are quickly closed.

Beiträge zur Begründung der Lehre über die Erziehung der Fichte. Centralblatt f. d. g. Forstwesen. July, 1910. Pp. 291-309.

Results of Heck's Thinnings.

Dr. Heck reports at length on the increment and other conditions of several experimental plots in beech on which he has been practising his "free or individualized thinning method" (see *F. Q.* vol. III, p. 40). Some of the areas have been under treatment since 1877, others only since 1905, and one since 1908.

Heck classifies the trees, not only into crown classes, but into form classes, namely, *a,* straight, longboled, clear stems; *b,* medium, shortboled stems; *c,* crooked, branchy and rough stems, and several other inferior classes. He finds in all areas, that the best forms have the largest increment, the increment percents even in the area which has been under observation only for the last five years showing for the *a* trees 3.09%; for the *b* trlees 2. 12%; for the *c* trees 1.92%.

Comparing two areas, the one of which had been thinned in the E-grade of the experiment stations 11 years ago, and then again in 1906, with the area thinned once according to Heck's method in 1905 in a stand 86 years old, the total increment of the former, to be sure, was larger, namely 3.25 square feet as against 2.62 square feet; but, if the increment is compared by form classes, the advantage of the Heck method is apparent, the *a* trees in his area showing 44% increment over those of the other area.

Comparing the older sample plots in beech, it is found that in a stand thinned according to Kraft's prescription the 39 *a* trees of crown classes I to III represented 23.4% of the total cross section area, as against 24.8% in 1897; while the 39 trees in the Heck area of the same form and tree classes represented 35.3% as against 29.5% in 1897. That is to say during the age of 58 to 70 years the former area did not develop its workwood per cent. while the latter, although stems of the I to III classes had been removed, was considerably improved. In 1909 the cross section area increment of the two areas for these three tree classes of the best form was 27 and 47.3%, respectively, of the total increment, accentuating the advantage of favoring the best forms as against the crown classes.

The author then discusses in great detail similar experiments in Ash stands. Various incidental matters having to deal with the method are also discussed. Among them the question of the practicability of measuring annual increments, as the author does. He admits the difficulty but contends that with a Friedrich magnalium caliper and always reading the lowest measurement, even the monthly growth can be ascertained.

In meeting the objection that the two areas, now longest under observation and hence most relied upon to show the superiority of

Heck's over Kraft's thinning practice, are not comparable because of difference of site quality as expressed by heights, the author points out that there is only one year difference in age, and that the height difference was originally only 26 inches and ten years later only 39 inches, while according to Eberhard's height-yield curves a difference of nearly 120 inches may occur in the same site class. Various methods were used to determine the average height, none of which exceeded the above stated differences.

Aus dem forstlichen Versuchswesen. Allegemeine Forst-und Jagd-Zeitung. August, 1910. Pp. 279-293.

Spruce with Red and Green Cones.

The variation of Norway spruce and probably of other spruces is great, and is also found in the color of cones; red and green and striped ones occur, but not mixed on the same individual tree, one or the other color being persistently produced on the same individual. Red cones prevail in Alpine situations, green ones more frequently in the plain and lowlands. Under the same climatic conditions the green-coned trees leaf out later than the red-coned trees. The expectation that the progeny of an individual with one or the other variety would behave like the mother-tree was not verified in an experiment by Zederbauer, who sowed 20 beds with seed from 20 trees in 1907. In the spring of 1909 and 1910 they leafed out quite similarly in about two weeks without regard to their derivation.

The author therefore expresses doubt whether it would be practicable to grow the late-leafing variety exclusively in order to avoid the damage by the Nun, as proposed by Wachtl (see *F. Q.* VIII, p. 361).

Grün-u. rotzapfige Fichten. Centralblatt f. d. g. Forstwesen. July, 1910. Pp. 310-311.

Willows by Seed.

Up to the present time it has been the custom to reproduce the basket willow and others by cuttings. The reason for this was the extreme difficulty of collecting willow seed and the impossibility of storing the same. A continuous reproduction by this unnatural method, however, tends to deterioration in quality and short duration of life. In order to prevent this and maintain full vitality and quality regeneration by seed from time to time is essential. When mature, the minute seeds are imbedded in a white tomentum and are disseminated with the same. If collected in the tomentum, they may retain their vitality for several days, but if separated from it, they will hardly keep for a day.

An interesting method of collecting seed and sowing it in the nursery, which may also be used for artificial fertilization, was suggested in a note by Grams.

A cylinder 30 cm. in length and five cm. in diameter, constructed of wire and muslin is slipped over a twig with female flowers and tied at both ends. For artificial pollination, this cylinder should be put in place before the female flowers are fully developed. As soon as this condition is attained, a flowering branchlet of a male tree is gently thrust into the cylinder and the male catkins brought in contact with the female flowers. To insure fertilization the male branchlet can be kept in the cylinder for a few days. As soon as fertilization is observed by a swelling of the ovary, the cylinder is removed to allow the seed to ripen. The capsules turn yellow at maturity and to prevent dissemination the cylinder is slipped on again. The small greenish-black seeds must remain in the tomentum until the time of sowing, which should take place immediately after the seeds leave the capsule. The seeds still covered with tomentum are spread out on the moist soil of the seed bed and pressed down firmly. Germination takes place in twelve to twenty-four hours. The seedlings should be kept moderately moist and protected from wind, hot sun, and heavy rain. They could be transplanted in a few weeks, for which purpose a light sandy soil is best adapted. A height of eighteen to forty inches is obtained the first year. Unless cross breeding for new varieties is to be undertaken, the process of artificial pollination is not needed; the cylinders are then attached just before the seed capsules begin to turn yellow.

It is evident that this method is more expensive than reproduction by cuttings, and would only be resorted to at intervals, when a superiority of stock is required to prevent deterioration. Regeneration by cuttings is and will remain the cheaper and simpler method.

Vermehrung der Weiden durch Aussaat. Allgemeine Forst-und Jagd zeitung. July, 1910. Pp. 265-66.

New Experiences in Seed Extracting.

Forstmeister Wiebecke publishes an article full of interest on the methods of extracting seed of pines as practiced, or to be practiced, in Eberswalde.

He first deprecates the fact that while in the price lists for clover, which may cost not more than $20 to $30 per 100 lbs., 10 different sorts, coming from 8 different localities with guarantees, percentages of germination and of cleanliness and ranges of prices are given, for pine seed, no guarantee of cleanliness, no guarantee of place of supply, no price differences (except as to quantity), besides relatively low germination per cents are noted.

He points out the difference in the latter respect between the material furnished by small collectors who use bake ovens or merely room heat as against that from large extracting plants.

Pointing out the disproportionate lack of success with seed of lower germination per cent (see *F. Q.* Vol. VII, p. 328) he advocates the gathering of supply on own account in years of plenty, which occur every two or three years, and then gives a very full detail description of how an ideal small or large seed extracting plant should be constructed and run, supporting certain arrangements by citing experiences which suggest their adoption.

We regret that lack of space prevents the giving of the details which do not admit of briefing.

Die Anwendung neuen Erkennens und Könnens auf die Kiefernsamendarre. Zeitschrift für Forst- u. Jagdwesen. June, 1910. Pp. 342-360.

Frost Effects.

A novel experimental plot to study causes and effect of frost has been established by the Danish Forest Experiment Station, namely in a frost hole on a meadow. The forms of beech planted in this hole are described with illustrations. The cause of the frost hole resulting in the killing of young shoots is accredited to the high ground-water table together with the action of the winds.

Nattefrostens Visking i ung bogeskov. Meddelelser udgivne ved Forsoeks Kommissionen. 1908. Pp. 1-28.

Damage by Obnoxious Gases. The importance to which the appraising of damage due to smelter fumes has lately assumed makes every contribution to the subject of value. Dr. V. Rusnov reports in detail four careful expert investigations in different localities of Austria.

He states that in the present stage of our knowledge the chemical and macroscopic investigations are of primary, the microscopic investigations of the foliage of secondary importance. The value of Wiehler's method of directly determining the sulfurous acid contents of leaves is doubted, since too small quantities of $BaSO_4$ (of 80*g* dry needles .0044*g*) are weighed, and the minimal contents of SO_2 (.0015 per cent) are too unconvincing evidence. Various proof has been brought that the sulfurous acid very rapidly changes into sulfuric acid in presence of moisture, and it is likely that sulfuric acid plays an important role in the damage. The author concludes that the determination of the total sulfuric acid contents in the plant gives the best judgment of the degree of the damage.

In his analyses the needles, cleaned of dust, soot and sand, were dried until no loss of weight occurred, then finely ground, treated with a solution of chemically pure, entirely sulfur free soda and incinerated carefully over gas absolutely free from sulfuretted hydrogen. In the ash the sulfuric acid was determined as usual by the use of chloride of barium.

We can here give only the summaries of the four investigations in the following tabulation of the chemical analyses leaving out other data.

District I

Location of Sample	*Distance from Factory*	*Direction*	*Spruce*	*%SO_3*	*Fir*	*%SO_3*	*Degree of Damage*
a	750*m*	S.	1a	.72	1a	.69	severe
b	2500*m*	S.	1b	.27	1b	.44	light
c	3100*m*	SSW.	1c	.24	1c	.29	very light
d	3100*m*	SE.	1d	.19	1d	.20	healthy

District II—(Scotch Pine).

Location	*Distance*	*Direction*	*%SO_3*	*Appearance of Needles.*
a	adjoining	S.	.43	severely damaged, partly dead
b	400*m*	E.	.68	very severely damaged, mostly dead
c	600*m*	SE.	.34	quite severely damaged
d	700*m*	SE.	.23	very little damaged
e	900*m*	SW.	.22	normal, healthy

District III

Location	*Distance*	*Direction*	*Spruce*	*Part of Crown*	*%SO3*	*Degree of Damage*
a	500-600*m*	NW.	1a	top	1.23	very severe
	500-600*m*	NW.	2a	top	1.21	" "
	500-600*m*	NW.	3a	top	1.27	" "
b	500-600*m*	NW.	1b	middle	.85	severe
c	1500*m*	NW.	1c	top	.19	perfectly sound

District IV

Location	*Distance*	*Direction*	*Elevation*	*Black Pine*	*Age of Needles*	*%SO3*	*Degree of Damage*
	100*m*	SW.	20*m*	1a	one year	.53	slight
					two year	.94	"
a	300*m*	SW.	70*m*	2a	one year	.67	"
					two year	.59	"
					three year	.61	"
	400*m*	SE.	70*m*	3a	one year	.71	more severe
					two year	.96	" "
	400*m*	SSE.	70*m*	4a	one year	.65	" "
					two year	.86	" "
	2500*m*	S.	150*m*	1b	one year	.24	perfectly sound
					two year	.19	" "

The four examples unquestionably prove the existence of chronic damage from fumes, a macroscopic investigation on the forest limit showing that for some time the increment had been retarded. How long the damage by SO_2 and SO_3 can exist without killing the individual was shown by a decided retardation of annual rings for 10 years.

Quality of soil and climatic conditions influence the resistance of a species. This difference of behavior of species is strikingly shown in the Scotch and Black (Austrian) Pine. Spruce also shows greater resistance than Scotch Pine and Fir.

The examples show also the necessity of and the reliability of a sample of healthy foliage for comparison, without which no sure judgment of the damage can be formed.

Uber die Feststellung von Rauchschäden im Nadelwald. Centralblatt f. d. g. Forstwesen. June, 1910. Pp. 257-268.

Forest Fire Insurance.

An article by Gärtner which gives also reference to a number of similar articles discusses the possibilities, difficulties and methods of introducing an obligatory forest fire insurance.

In a table he works out results for the government forest area in Hesse on the basis of the statistics of actual fires from 1881 to

1906, and shows that if a compulsory premium of 4 cents per acre had been paid, as advocated by Keiper (see F. Q. vol. VII p. 472), the damage having been about $650 per annum, a loss in excess of insurance premiums of $845 per year would have been experienced.

Since the author foreshadows the publication of a longer article on the subject we can leave the rest of the discussion to be briefed from the larger article.

Waldbrandversicherung. Allgemeine Forst- und Jagdzeitung. June, 1910. Pp. 224-227.

MENSURATION, FINANCE AND MANAGEMENT.

Rapid, Accurate Method of Measuring Stands.

On this subject we have briefed articles of Schleicher in vol. IV, p. 166, and in vol. V, p. 221. These articles advocating the use of the space number in ascertaining volumes of stems led to a controversy in which Forstrat Schubert and Forstrat Dr. Wimmenauer take part.

Schubert objects that, since the elements for determining the cross section area by means of the space number are secured through sample areas, it might as well be found directly from the sample area. Incidentally the merits of Zetzsche who was the first to propose the circular sample area are defended, which method Schleicher has discredited. The failure of Schleicher's method is found in the faulty construction of the space table (see F. Q. vol. V. p. 221) by having based it on the number of trees not in the circle, but in the square circumscribing the circle of the sample area, which furnishes a result 27.3 per cent different than the circle itself.

The conclusion of Wimmenauer is that with certain changes the method is not entirely wrongly based, but for practical use too cumbersome and artificial.

Abermals "Neue Methode zur raschen und genauen Ermittlung des Holzgehaltes ganzer Bestande." Allgemeine Forst- und Jagdzeitung. June, 1910. Pp. 199-205.

Bark and Volume of Spruce.

Dr. Borgman publishes an exhaustive article on the loss in volume and value by measuring spruce timbers (full boles) when barked. According to v. Guttenberg the bark of spruce on best sites represents 7 per cent to 8 per cent, on poor sites, 10 per cent to 12 per cent, of the total stem volume. Borgman's investigations show still greater per cents, further, that the loss increases from the stoutest to the lower stem classes; and that the bark per cent increases more rapidly than the middle diameters, namely from 10.9 per cent for 5 inch diameters to 15.4 per cent for 3 inch diameters. A very elaborate value calculation shows for three sites losses of 8, 9, 10 per cent in volume, 11, 12, 13 per cent in value for logs, and 16, 17, 18 per cent for long poles. Then introducing the cost of peeling, he comes to the conclusion that the price of peeled log material must be increased at least 15 per cent, of poles 30 per cent to account for loss in volume, reduction in class or sortiment and cost of labor.

Ueber den Verlust an Masse und Wert, etc. des Fichtenlangholzes in entrindetem Zustande. Allgemeine Forst- u. Jagdzeitung. October, 1910. Pp. 583-620.

Yield Tables of Thinned Pine Stands.

In Vol. VI, p. 432 we give a sample of the yield tables for Scotch Pine, managed under a system of severe thinnings with underplanting, based on some 125 sample plots. Dr. Wimmenauer now publishes, in a series of tables, the base material and method of constructing these tables. Again he shows that to secure best results the cut should from the 40th to the 50th year, be so made that always about 130 square feet of cross section area are left standing per acre. He differentiates three stem classes: 1. final harvest crop, *i. e.*, the best stems which will probably last to the end of the rotation or felling age; 2. persisting intermediate stand, which is reserved for future thinnings; 3. subordinate stand, destined soon to be removed.

The number of the first class trees selected moves generally between 40 and 100, average 80 per acre. A table shows what cross section area of this class remains when a certain per cent of trees is removed and what the corresponding cross section area of the removed will be.

The increment was determined by Pressler borer with careful method, taking two borings on opposite sides and alternating from tree to tree the direction of the bore holes.

A most important result, the author states, is that by continued thinnings the width of the annual ring can for decades be maintained at the same amount. Thus, while on site III the unthinned area showed from decade to decade ringwidths: 1.72, 1.01, .90, .74, .68 mm, the corresponding series in the thinned stand ran: 1.29, 1.41, 1.21, 1.26, 1. 2 mm.

In dense stand a decrease of annual ringwidths is noticeable from the 30th year, while in the thinned the approximately even ringwidth or even increase continue to the 110th year, with variations, of course. The average ringwidth was finally calculated for the three site classes as, 1.75, 1.50, 1.25 mm, respectively.

Heightgrowth is not at all or very little influenced by the opening up of the stand, certainly not decreased. The form factor is not, as one might expect, reduce, but if anything increased.

In a comparison of a yield table for pine grown in close crown cover with that derived from the severely thinned areas it is learned that not only quality production but the total quantity production per acre was increased in the latter:

	Close stand	*Open*
On I site at 140 years	18,700 cub. ft.	21,050 cub. ft.
On II site at 140 years	14,600 " "	16,875 " "
On III site at 130 years	11,000 " "	12,560 " "

The applicability of the tables is, of course, confined to stands treated in the same way. They show the value of this management for the species in question.

Ertragstafeln fur Kiefern im Lichtungsbetrieb. Allgemeine Forst- und Jagdzeitung. September, 1910. Pp. 321-333.

Appraising Damage.

With the growing appreciation of the value of forest properties, the practice of appraising damage to it needs more and more careful consideration. Although damage by game will probably rarely come under discussion in the United

States or Canada for a long time to come, the methods and considerations that enter the determination of such damage are suggestive for other cases of damage.

In F. Q., vol. III, a long article by Fernow elaborates the general principles to be employed in determining damage, and in the same volume an article on the evaluation of damage by game (for which one might substitute "cattle") was briefed. Gretsch elucidates further the practice in the latter case as evolved in the government instructions laid down by the forest administration in Baden. It is interesting to note that until 1848 hunting in Baden was a legal right exercised either by the crown or the landed proprietors who exercised jurisdiction. At the same time by law of 1833 the owner of the hunting right was responsible to the owner of the forest or field for any damage over $2 which the game might make. This law of nearly eighty years ago prescribed with remarkable insight into proper finance calculation the manner of appraising the damage. When, by law of 1850, the right to hunt was finally, under restrictions, reserved to the owner, damage by game could only be assessed against renters of the hunting right if specially provided in the contract or lease under the law of 1833.

This law served its purpose till 1898 when a new law more definitely defined the assessable damage; and in 1904 the instruction in systematic form of evaluating the damage was elaborated.

After describing the different kinds of damage by game, and game birds, the principles of evaluation are stated.

If the damaged plant can recover, the damage consists in a loss of increment, which is experienced in the eventual final harvest, or sometimes in eventual thinnings. Hence the present value of such increment loss is to be the assessed damage. It is also to be considered that either this loss in material yield may be suffered, or a loss in quality, by mal-formation or rot.

If the damage is such as to call for replacement of the plant no matter whether the destroyed stand was created by natural regeneration or artifically, the cost of production from the time of origin is to be recompensed.

A proper description of the damage in all its detail is, of course, the basis for calculation.

In figuring the loss of increment by comparing the yield to be expected at final harvest from undamaged parts with that of the damaged parts, according to the well-known formula, $C = \frac{Cn,}{1.opn}$ it is recommended to use a somewhat moderate interest rate, namely, 2.5 per cent. Experience figures are used for determining the material loss, for prices the average of actual sales for the last three years in similar forest serves. Intermediate returns are figured, extended to harvest time and discounted, at 15 to 50 per cent of final harvest yield, the higher figures for higher rotations, better sites and more valuable species.

If the cost of the stand is to be figured for small areas the interest calculation may be dispensed with as too insignificant. Otherwise a rate of 3½ per cent is used in the formula: $(S+A+C)$ 1.opm— $(S+A)$ is employed; *S*, the soil value being the usual sale value of such soils; *A* the cost of administration is by experience found to lie between 5 and 8 cents per acre; *C*, the cost of planting is figured by present cost of plantmaterial and labor, keeping in view that repair planting is more expensive than original planting.

A schedule for reporting is given, and five examples show the detail of the procedure.

Der Wildschaden und dessen Ersatz im Grossherzogtum Baden. Forstwissenschaftliches Centralblatt. October, 1910. Pp. 541-556.

Practical Determination of Rotations.

It is well known that the determination of the time at which the forest crop is ripe, is one of the most important and at the same time most difficult problems with which forest management has to deal. The Prussian Forest Administration charged Dr. Martin with the task of determining rotations for the Scotch Pine on the basis of the elaborate yield tables by Dr. Schwappach.

He based the calculations on the well-known formula, which expresses for an annual management the soil rent $\frac{A+D-N\ .op\text{-}c,}{u}$ in which *A* represents the value of the final cut; *D*, the sum of the thinning yields; *N*, the value of the normal stock or wood capital; *c*, the annual expense of cultures; *u*, the rotation or number of felling areas of the normal management class.

The result of these calculations for different parts of the monarchy was that for regular pine stands in mild climate and good markets for all sortments (valley of the Main), a rotation of 120; in districts with poor market for small dimension and in cooler climate (Northeast Germany) a rotation of 145-150 years. For branchy stands unfit for better class of logs in both East and West districts at 60 years, and in coal mining districts, where mine timber is saleable, even 50 years show the equation at maximum.

To explain these remarkable variations is the object of the present article. Two facts and ruling conditions produce the results, namely, the persistence in value increment of pine on suitable sites, and the varying requirements of interest on the wood capital. As regards the first fact the author points out that nothing generally applicable accurate can be stated since quality changes are produced by small differences of site, especially depth and looseness of soil and difference of exposure. Excluding the 10 per cent to 20 per cent of small dimension wood which the final cut furnishes and limiting the discussion to workwood (logs) alone, even here quality and sale value are not always in relation and the grading of logs can only be made by dimensions in 5 to 7 classes. Prices too, are locally and in time limited and have value only for a limited area.

A table is then given of average prices which the author considers characteristic for various regions. All the figures show the very rapid increase in price with increased dimensions. Even stands with dry rot did not decrease their value increment until 140 to 160 years.

Thus logs of less than 18 cubic feet contents in Prussia bring from 7 to 12 cents, the best class of over 70 cubic feet contents 25 to 30 cents per cubic foot.

In Hesse the logs are graded by diameter classes (middle diameter) from over 20 inch, to 16 inch, 12 inch, 10 inch and below 10 inch with prices of 24, 22, 16, 12, 11 cents, respectively.

If these dimensions and prices are related to the age, difference in silvicultural treatment adds to the difficulty of applying them. The author bases his calculation on the dimension classes current in Southern Germany (Bavaria), which refer to a diameter at a given height. The time necessary for the formation of such a dimension class is that which is required to make the length or height and the diameter at that length or height. In his calculations he assumes for good sites an average ringwidth per year of 1/5 *cm* (which would make the rate about 6 to 7 years per inch). The author admits that this method of averaging is open to criticism, but gives good reasons for making the assumption.

The length-diameter classes, then, he finds to require the following years to attain the required sizes.

Stem class I	length	58 feet—60 years	
	diam.	12 inch—75 years	
			135 years
Stem class II	length	58 feet—50 years	
	diam.	9 inch—55 years	
			115 years
Stem class III	length	52 feet—50 years	
	diam.	7 inch—42 years	
			92 years
Stem class IV	length	46 feet—42 years	
	diam.	6 inch—35 years	
			77 years

Accordingly the value increment of the stems in two districts in Bavaria were found to progress as follows:—

	Age:	135		115		92		77 years
District I.	value:	38		28		25		19 MK
	Difference:		10		3		6	"
District II.	value:	34		27		22		"
	Difference:		7		5		8	"

In Hesse the place of measurement is uniformly taken at 3.25 feet (10m) height. A similar calculation for the whole of Hesse makes the value increment appear as follows:

Age:	167		142		117		97 years
Value:	36		32		25		18 MK.
Difference:		4		7		7	"

The figures show, like others, that up to 140 years the value increment is considerable but not uniform, and varies according to different sites and management.

After some further calculations the author concludes that in districts adapted to pine production the value increment per cent in the period 120 to 140 is still at least 1 per cent, while the volume per cent is also still 1 per cent, and it is to be expected that with improvement of silviculture and increase in prices the tendency will be that both values will rise.

The rest of the article is an illuminating expose regarding the proper choice of an interest rate on the wood capital which the appreciation of the soil rent theory requires.

He rehearses the well- known arguments for a lower interest rate in forest calculations, combats the theory of a difference of private economy and public economy, the latter as not requiring calculation of capital and interest, takes the proper position that no mathematical formula, without an intelligent choice of the values can be useful, and advocates (without referring to the originator of the idea, Baur! Ed.) different rates of interest for rotations of different length.

The important question of the ripeness, after having properly presented the general points of determination, must be solved by investigating it for limited districts of similar site and market conditions and within these management districts for the single stands or typical stand aggregations.

"Whatever the conditions, value must have a greater influence on rotation than volume."

Altogether the author concludes that the requirement of an adequate interest does for good stands of pine lead to high rotations, for poor stands to low ones.

Die Umtriebszeit der Kiefer, etc. Forstwissenschaftliches Centralblatt. June, 1910. Pp. 363-387.

Practice in Wood Sales.

Stephani points out that for best results the district officer who knows conditions and people in his district should be given considerable discretion in selling timber. He points out the difference of small and large owners, the latter being obliged to develop a sale policy and to sell at prices which would allow the dealer to live and make a decent profit so as to hold his market. For the government as owner general economic considerations also enter.

The largest possible number of people must be given opportunity to buy, struggling industries must be favored, without going too far in this direction.

As to sale conditions, no one-sided ones are justified which deliver the buyer to the mercy of the seller(as is the case of the timber limit sales of Canada!) Such condition as refusal of allowing for defects and undermeasure in its general statement is untenable in equity.

As regards payment, the author advocates a short credit system (not over six months, except in special cases) as is customary in other trades, in such a manner that cash payment is an advantage to the buyer, a discount being given for it.

The question of selling on the stump or felled material, and methods of sale whether by bid or auction or out of hand are discussed. Sale on stump he calls the child of undeveloped conditions. (It is largely the method in France!) It has the advantage to the seller that he can leave his stock standing if not advantageous prices are offered.

In selling felled material—the usage in most German government forests—the buyer has the advantage of thorough inspection of the material and hence of fair valuation, while the seller is more easily forced to accept a bid price, and cannot cut always to most advantageous lengths, as if for instance a brisk market for railroad ties would have given better profit by cutting to tie sizes. (From silvicultural points of view the felling on own account is, of course, preferable!)

Sale out of hand depends in its results on the capacity of the seller, who deals with a single buyer or group of buyers, unless a definitely settled price—government tax—is applied. For satisfying a local demand, especially of adjoining settlers this is the best method, especially to keep the local population friendly. It is also advantageous when it appears desirable to encourage woodconsuming industries, say a local sawmill. The advantage and the assurance under exclusion of competition to secure the necessary quantity of raw material permits the buyer to give a better price. This method is also the best for fighting the formation of rings, if it is known that an auction sale may be displaced by an out of hand sale. The dangers of this method of sale are that, if an official, charges of favoritism are apt to be brought, and that, if the method is continued as a rule, competition is destroyed and actual favoritism might occur.

Auction sales may be of four kinds, namely, a public, oral one, which may either be conducted by upward or downward bid, or a secret, written bid, which may be either unlimited as to number of buyers or limited.

The first of these, public and oral upward bidding, seems to satisfy the interests of buyers as well as sellers best, provided sufficient publicity is given. The buyers make the price, no charge of overreaching can be made against the seller, an advantage especially to government officials. The advantages of this form are, however, apt to be counteracted by the formation of rings, buyers agreeing to keep the price down, for which the public gathering, hence the knowledge of who is a competitor, gives good opportunity. Those not in the ring may be forced to overbid themselves. Such ring formations are especially apt to occur when times are poor; when they are flush, rings are apt to go to pieces.

These rings, which are a phase of modern business life, the author contends are quite natural phenomena and have some rights for their existence. They must be met not with the feeling of a sustained wrong but with quiet intelligence and tact. Sometimes it is possible to make reasonable arrangements with the ring. It is evident that in Germany these rings of wood handlers are thoroughly organized, which makes even the remedy of out of hand sale, which, if the auction does not produce a reasonable price, may be resorted to, nugatory.

The public downward bid—the seller proposing a highest price and gradually reducing it—is in vogue in France and some German government forests. The method may be useful in breaking rings, when a member of the ring falls out of his role seeing a specially desirable allotment come to a reasonable price. His incensed companions cannot punish him by further bidding. The special advantage of this kind of bidding is that the small man can compete with the large buyer and cannot be forced to the wall.

Sale by sealed bids has some advantages to the seller who if not securing highest prices is likely to secure fair value, but it can bring much damage to the buyer, hence should not be resorted to as long as auction sales are practicable. This method is, however, growing in Germany and many complaints are made by the handlers.

It appears a useful weapon against abuse of ring formations. although not an absolute remedy, when these are thoroughly organized. Even without these certain financially strong firms can under this method become masters of the market, keeping others out by controling for instance means of transportation.

Under circumstances, when for instance the amount is too small to call for general bids, a limited group of local buyers who are in position to use it, may be invited to bid.

Seeing that every method has its advantages and disadvantages the author recommends not to confine one's self to any in particular, but according to circumstances vary the method, public auction remaining preferable unless special reasons call for deviation.

Einige Betrachtungen über den Holzverkauf im Walde. Forstwissenschaftliches Centralblatt. October, 1910. Pp. 517-535.

Forest Reserve Funds and Sustained Yield.

In the desire to equalize the annual net returns of the forest management of Württemberg state forests the administration had proposed to create a money reserve fund from which deficiencies were to be eked out. The chamber went a step further and with unusual insight and good business sense authorized the administration to vary the cut from year to year according to market conditions, remaining behind or exceeding the annual budget. This, Eberhard considers the most important advance in economic administration.

In two years since this law went into effect it showed its value. The extraordinarily high wood prices of 1906 and 1907 produced not only the money reserve fund provided for the decade 1907-1917 by a cut of a round 10 million cubic feet netting $1,000,000 but also a further cut of 2 million cubic feet netting $200,000; altogether $1,200,000 to meet any decline in prices. In 1908-9 prices did drop for coniferous logs by 2/3 to 1 cent per cubic foot, but the management had not commercial sense enough to reduce the cut, as it should have done, at least in the coniferous districts. Next year, 1909-10 prices advanced again by 1 to 1 1/3 cents, and the fund if it had been drawn upon could have been easily replenished. Meanwhile it appears from discussions in the legislature that the reserve fund idea was launched mainly to promote the cutting of supposed surplus of old age classes and the question how to use this fund and a change in the law is under consideration.

This surplus has been variously figured at between 100 and 160 million cubic feet, including the expected increment of a 20-year period, the lower figure being more likely true. The author points out that on a property with over 1,800 million cubic feet stock and over 35 million cubic feet annual increment, which the state forests represent, 100 million is not such a very large surplus. If this surplus is not translated into money, but remains *in natura* it means the putting off of the cutting over each age class for only a few years. And even if by proper thinning practice the rotation were lowered, older age classes becoming overstocked, these not having grown up under such thinning practice really needed the longer time to produce the desirable dimensions.

The actual overmature stands in the Black Forest are pine, whose cut could be delayed without damage. Indeed, the author inveighs against the extensive artificial plantations of pine and spruce which have been necessitated by rapid removal methods, and thinks that with natural regeneration a longer regeneration period is desirable.

The main object of forest reserve funds in large administration is to be able to take advantage of market conditions. Theoretically this is a simple proposition, practically difficulties double and treble. Increased cut—in 1907-8 the cut was increased 15% in the average—is easily accomplished, but reduction has never yet been practised on a large scale, because consideration of the organization especially of labor, which in most places depend on this employment, is necessary. Yet the author thinks, 15 to 20% reduction would not be impracticable in Württemberg and in smaller administrations of 30 to 50%.

The author points out that forest management has the advantage that it can defer harvest several years without damage, moreover, it is favored by the fact that industrial or price movements proceed in undulations with a rising tendency in which depressions rarely last more than one or two years. Thus since 1891, the two years, 1902 and 1903, and the one year, 1909, were years of depression with price differences of ½ to 1.2 cents per cubic foot. Hence one may figure the amount of reserve on a probable depression of not over three years in succession, which would make the reserve fund needful for Württemberg conditions with 1.7 million dollars an ample one.

Dr. Eberhard then in no uncertain tones charges the administration with incompetency in recognizing the value of the law and in an illuminating manner discusses growth and management conditions in Württemberg. It would appear that during the last 100 years the stock on hand in the state forests has increased by 1% per year and the wood prices by 2% per year, the total stock capital having thus grown from 10 million to 100 million dollars in value. It was therefore ridiculous to talk of endangered sustained yield and stock decimation.

Improved technique to secure highest production is all that is needed.

Der Geldreservefonds der Würtembergishcen Staatsforsten, etc. Allgemeine Forst- und Jagdzeitung. August,1910. Pp.293-300.

Reserve Funds in Württemberg

Meanwhile the bill for a change of the law regarding the reserve funds has been submitted to the legislature and enacted. It reiterates the authority to make extraordinary cuts to the extent of 35 million cubic feet timberwood, and to make the needful expenditures for wood choppers, cultures, and roads. The expenditure for the latter two items are restricted to $3.60 and $7.20 per 1,000 cubic feet, respectively. The returns for these extraordinary cuts are to be invested at proper interest rates. From this fund any reductions in the regular cut due to unforeseen silvicultural causes are to be made good in the forest budget. The fund is also to be used for the purchase of additional forest land and for extinction of servitudes. The receipts for any sales of forest property are to be returned into this fund. The interest is to be used to make good any deductions from the fund or else be considered as current receipts of the forest administration.

At the same time the Minister of Finance is empowered to reduce the regular cut in case of sinking prices as long as the reserve fund can make up the difference in the annual budget.

These provisions are to be in force for 10 years.

Hitherto 10,600,000 cubic feet were cut in extraordinary utilization, and the fund with interest has grown to over $1,000,000. No need for using the fund has as yet appeared.

Die Reservefonds der Wurttembergischen Staatsforsten. Forstwissenschaftliches Centralblatt. October, 1910. Pp. 556-558.

UTILIZATION, MARKET AND TECHNOLOGY.

Wooden vs. Metal Ties.

So strenuous has the war against metal ties become, that a society for the furtherance of wooden superstructure has been formed in Berlin—no doubt stimulated by dealers in ties, and in opposition to the steel interests.

At a meeting one speaker claimed that numerous profiles of metal ties were still on trial as against the simple persisting profile of the wooden tie; that the metal tie requires more bed material and crushes the same sooner; that to equalize the expense of a wooden tie lasting 15 years would have to have a duration of 34 years; and since an equal duration of about 15 years is assumed by the railroad department the wooden tie was infinitely superior. Bolts, as fasteners, with accurate boring of the holes to receive the bolts in combination with improved impregnating processes would greatly extend the life of wooden ties.

A member of the Prussian parliament weakened the arguments by declaring that at least in localities where beech ties were produced, the metal tie should not be used, whatever were done elsewhere; he claimed that one million dollars could be saved by a return to wooden ties.

Allgemeine Forst- und Jagdzeitung. September, 1910. P. 352.

Metal Ties in Prussia.

Interesting data regarding the use of metal ties in Prussia were brought out in the discussions on the forest administration budget in the Landtag, when a member asked for more liberal use of wooden ties, apparently on behalf of dealers. He claimed that pine ties with all fastenings cost $5,080 per mile, including $200 for transportation to place of use, while iron ties cost $6,000 with an average cost of transportation of $365, hence the difference was nearly $1,000 per mile in favor of wooden ties.

Annually 10 per cent of wooden track was being replaced by iron; this to the detriment of Prussian forest revenue. The minister of railroads had stated to the dealers, that "*If* the economic superiority of the iron tie should make it necessary to extend the use of it, he would give time enough for wood dealers to adjust themselves and regard would be had for the forestry interests." The Oberland-forstmeister replied, that, as long as it was necessary as at present to import over 500 million cubic feet of wood, no fear of damage to forestry interests need be entertained from the change to iron ties. It was true since 1906 the call for wooden ties had decreased, but this decrease was general, including iron ties.

Die Etatsverhandlungen, etc. Allgemeine Forst- und Jagdzeitung. August, 1910. P. 302.

Wood Railroad Ties.

An article by Schneidt, formerly in charge of all the impregnation works of the Prussian Railroad Department, sings the praise of impregnated beech ties, which appear if properly treated with heavy oils of tar the most durable (24 to 30 years) and cheapest. They have proved so satisfactory that in 1908 70 per cent of all the ties used were of this description. It is the most easily impregnated wood, and can be most thoroughly filled with the preservative except the red or gray heart which is itself so durable according to 12 year tests as not to need the preservative. A first class beech tie takes up 80 lbs. of tar oil making it weigh 265 lbs. and giving it thereby unusual stability in the roadbed, while the ties of oak cannot take up more than 18 lbs. and weigh 220 lbs., ties of pine, treated, weigh 155 lbs. and those of iron 130 lbs.

In practice, however, only 35 lbs. of tar oil are left in the tie, the tie being first filled up and the surplus oil being pressed out by air pressure.

It is also claimed that tie plates are not necessary with the hard beech ties, a saving of 80 cents as against soft wood ties.

The tar oil is secured by distillation of gas and coke tar; the light oils, benzols and carbolic acid oils, which are not fit for this use, being driven off first, and the heavy oils which distil at a temperature above 235° being used. The residue, 50-60 per cent pitch, is used for making briquettes, largely fired in locomotives; the price of tar oil having in the last decade ranged from 40 to 80 cents according to the possibility of using the pitch.

It is admitted that beech after felling is liable to considerable shrinking and season checks. This is to be overcome by careful stacking under cover, by bolting the ends and other means, which, to be sure add to the cost.

Die buchene Eisenbahnschwelle. Forstwissenschaftliches Centralblatt. June, 1910. Pp. 360-362.

Durability of Wooden Ties.

Dr. Schwappach's report on a series of careful experiments on the durability of beech ties has evidently been used by the writer of the above briefed article.

In 1896-7 the Forest Experiment Station at Eberswalde, in co-oporation with the Railroad Department at Berlin, undertook seven series of tests with 70 railroad ties each treated differently, namely:

(1) sound, middle-aged wood without red heart, winter-felled, immediately treated;

(2) the same treated after 6 months;

(3) and (4) the same, summer-felled, treated immediately, and after six months;

(5) oldest possible yet sound wood, winter-felled, immediately treated; (only 3 ties used.)

(6) old wood with small red heart, winter-felled, immediately treated. All these to be treatel with creosote (carbolic acid tar oil).

(7) sound, middle-aged wood, summer-felled, treated after three months with zinc chloride, at least 11 lbs. per tie.

To prevent season checks, half the ties were bolted, the other half painted with a special paint, which latter was not only cheaper but more effective—they must, however, be 2 inches longer to allow for cutting off the ends before treating.

The provision of immediate treatment (proposed by Strassburger) was found practically impossible. Even after three months, under the treatment season checks developed, hence six months drying before treating was found necessary in all cases, except that in case (3) the trees summer-felled were left with their foliage for four weeks and then worked into ties and painted and left another four weeks when they could be treated without checking.

A yearly inspection is made, every tenth tie is dug out and carefully inspected, the other ties more cursorily, and the result carefully recorded in a ledger with an account for each tie.

Two other series were added to test the Hasselman process which consists in treating with a mixture of aluminium sulfate, ferrous sulfate, copper sulfate and kainit. The two series of tests of this process proved it a failure.

Of all the 455 other ties used after 12 years not one has had to be replaced!

Only in series (4) was in 1906 a partial rot noted in a few cases, which could be explained by insufficient treatment, the painting having caused wet spots to remain which the tar oil could not penetrate, so that in 1909 no progress of the rot was noted except in one tie. The ties from trees summer-felled and left in the leaf—a usage from the 18th century—proved itself most satisfactory in seasoning.

All the ties looked so sound that another 12 year duration may be predicted. The red heart—which does not absorb the fluid—has remained perfectly sound.

The ties treated with zinc chloride and 12 lbs. tar oil also remained perfectly sound, but the difficulty of securing a satisfactory liquor of these two materials for the use in large operations rules out the process.

The treatment with tar old after Rütgers and Rüping leaves 33 lbs. of tar oil in the tie.

Failure is always to be credited to improper handling and lack of care in using only sound wood.

Versuche über die Verwendbarkeit des Rotbuchenholzes zu Eisenbahnschwellen. Zeitschrift für Forst- u. Jagdwesen. July, 1910. Pp. 427-432.

Use of Preservatives. During 1906, of all ties used in the United States, 11.5 per cent were treated with preservatives; in 1907 it amounted to 12.9 per cent; in 1908 it was as high as 21.1 per cent. During 1908 there was used in the United States 57,548,268 gallons of creosote and 18,843,864 pounds of zinc chloride besides small quantities of other preservatives. Nearly three-fourths of the creosote used came from Europe, Great Britain and Nova Scotia. The average life of the untreated tie is said to be seven years while the treated tie is conservatively estimated to last seventeen years. In 1900 there were 13 timber treating plants while in 1910 there were 83 and several more contemplated or being constructed.

Conservation and Preservation of Forest Products, West Coast Lumberman. August, 1910.

Quality and Growth Conditions. Schwappach refers to the finding that compression strength of pine and weight are related, yet with modifications due to growth conditions, the favorable sites producing strength with less weight. He now combines his own and Janka's investigations on spruce to prove the same relation, tabulating the results of both investigations on 141 trees from 14 growth regions.

Janka, assuming a normal air dry moisture content of 15 per cent, calls the compression strength with that moisture per cent divided by the weight with the same per cent the relative quality quotient; and on this basis Schwappach makes his comparison.

He comes to the most interesting result, that in general the quality of spruce wood, as far as expressed by weight, compression strength and their relation, improves from south to north.

Grouping somewhat the regions from which the material was drawn he finds that the quality quotient in the most southern range, Vienna Forest, Southern Tirol, Central Alps, lies at 83-84 in the Bohemian Forest, Eastern Carpathians, Northern Tirol lies at 88-90, in the Thuringian Forest, Sudetes and East Prussia between 91 and 95, while the Silesian plain and Harz mountains have the quotient 96 and 98; the lowest quotient was found exceptionally with 76 in the Erz mountains, a southern location, a high plateau in exposed location, severe climate with high moors and raw humus. (The necessity of adding site quality to geographical location—climate—seems evident!)

The relation between ring width and compression strength is brought out by a comparison of some of the material. East Prussian material below 50 years old with an average ring width of 3.7 mm showed a strength of 371 *Kg* per *q cm*, that from 70 to 84 year-old wood with a ring width of 2.2 *mm* a strength of 412 *Kg*. While Hartig had come to the conclusion that ring width alone is not the essential but the summer wood per cent, Janka points out that the width of the ring after all determines quality since a greater specific weight is never connected with wide rings, and since the weight of narrow ringed wood never sinks below a certain limit. The reason is that in spruce the relation of summer wood to total ring width under normal conditions remains the same with narrower or wider rings. Narrow ringed wood shows a relatively large percentage of summer wood and hence is stronger. With the pine on the other hand, a larger per cent of summer wood goes with considerable ring width.

The importance of this finding is pointed out, since ring width is the only factor which the silviculturist can influence.

The Austrian and Prussian data side by side show the relation:

Average Ring Width. *mm*	Compression. Strength. *Kg per q. cm* *Austria.*	Compression Strength. *Kg per q. cm* *Prussia.*
1	400	470
1.5	395	457
2	378	447
2.5	351	398
3	336	380
3.5	328	367
4	320	353

The greater strength of the Prussian wood for same ring width suggests that other factors are at work influencing weight and strength, and Schwappach suggests difference of growth conditions making a difference in anatomical structure.

Both authors come to the conclusion that for best quality production the average ring width should not exceed much 2 to 2.2 *mm* in the average, which in 100 years would represent 16 to 18 inch trees. The question arises whether quality is paid for to pay for the loss in quantity.

The author then takes issue with Janka's propostions for growing spruce; natural regeneration or dense sowing or possibly closely spaced planting, growing in dense crown cover, only in later life more open positions to secure dimension, etc. Schwappach then takes the same position as Schiffel and Bohdannecky (see p. of this volume), opposing the close position in plantations and advocating early thinnings to secure crown lengths of 30 to 40 per cent of stem height.

Einfluss der Herkunft und Erziehungsweise auf die Beschaffenheit des Fichtenholzes. Zeitschrift fur Forst- u. Jagdwesen. August, 1910. Pp. 455-473.

Specifications of Structural Timber.

In the Year Book for 1910 of the American Society for Testing Materials, page 121, Structural Timber is defined as "all such products of wood in which the strength of the timber is the controlling element in their selection and use." Structural timbers are divided into Trestle Timbers, Car Timbers, Framing for Building, Ship Timbers, and Cross Arms for Poles. On pages 123-4 an attempt is made to standardize the names of structural timbers. The term "Douglas Fir" is to cover the timber likewise known as Yellow Fir, Red Fir, Western Fir, Washington Fir, Oregon or Puget Sound Fir or Pine, Northwest and West Coast Fir. The term Southern Yellow Pine includes both Longleaf and Shortleaf Pine—these two terms being descriptive of quality rather than of botanical species. Western White Pine includes the timbers sold as White Pine coming from Arizona, California, New Mexico, Colorado, Oregon, and Washington. It is also known as "Western Yellow Pine," or "Ponderosa Pine," or "California White Pine," or "Western White Pine." The term Idaho White Pine includes shipments from northern Idaho, Western Montana and Eastern Washington. East of Minnesota the terms Hemlock, Spruce and Tamarack have their usual meaning, but on the Pacific Coast the related species are known as

Western Hemlock, Western Spruce and Western Larch, respectively.

On pages 122-3 are definitions of such standard defects of timber as sound, knotty, loose, pith, encased, rotten, pin, standard, large, round and spike knots; small, standard and large pitch pockets; pitch streak; wane, ring shake and through shakes; and rot, dote and red heart. There are good photographs of the various kinds of knots and pitch streaks, which lend interest to the definitions.

These specifications are to serve as standard classification. *Year Book American Society for Testing Materials, 1910.*

Felling Trees by Electricity.

Austrian foresters seem to have little faith in the possibility of felling trees by electricity. A glowing fixed wire is condemned as too easily broken and apt to burn the wood unevenly. While a coarse glowing wire moved back and forth rapidly would meet these objections, it also is pronounced impracticable on account of the difficulty in maintaining a constant current in the wire.

Das Fällen der Bäume mittels Electricität. Centralblatt. f. d. g. Forstwesen. August, September, 1910. P. 422.

Cahücit Dangerless Explosives.

Trials with the new safe explosive, to which brief reference was made in F. Q. vol. VII, p. 475, in roadbuilding have furnished satisfactory results in every respect, in blowing out stumps and roots and even whole trees without spoiling their values, as well as in rock blasting.

The explosive is so safe that the State railways transport it without restriction. Besides being absolutely safe the handling is less time consuming as there is no need of tamping the cartridge which comes into the market in paper cover, 4 inches high and a little less than 1½ inch thick at 4 cents apiece. A hole is made in the ground, *not* in the root-stock, with an iron rod to a depth of say 5 feet, slanting toward the center of the stock. After the stronger side roots have been kerfed or partially cut through, several cartridges are introduced and with them a copper blast capsule with fuse. It is this copper capsule alone which is to be handled with ordinary care, the cahücit cartridges are perfectly harmless. The hole is then filled up with dry earth, lightly pressed in, and after the cartridges are covered 12 to 15 inches the additional earth cover is stamped down with the foot so as to make a close fit, when the fuse is lighted.

In rock the boreholes are made, at most, $1\frac{1}{4}$ inch wide.

Die Anwendung des neuen Sicherheits Sprengstoffes Cahücit im Forstbetriebe. Forstwissenschaftliches Centralblatt. June, 1910. Pp. 324-330.

Scaling in British Columbia.

Up to 1902 the Doyle rule was the official rule of British Columbia and each mill had its own scaler. The Government appointed several scalers without salary who could be called on in case of dispute. In 1901 a committee of three was appointed to devise new scale methods which resulted in the British Columbia rule which was made compulsory west of the Coast Range. Since July 1, 1909, this rule has been legal for the entire province and since July 1, 1906, the Government has had an official supervisor and scalers west of the Coast Range. These scalers are paid monthly Government salaries and the Government in turn charges five cents per thousand for all scaling, or if called for, grading. The mill pays all scaling fees but charges the logger one-half.

In August, 1906, the loggers and millmen adopted log scale rules for all species except cedar and these rules are recognized by the Government but not legalized.

1. Flooring logs are reasonably straight, not less than 30 inches in diameter nor less than 20 feet long; clean and free from defects that would impair value for clear lumber.

2. Merchantable logs are not less than 14 inches in diameter; sound; free from rotten knots or bunch knots; reasonably straight; and the grain straight enough to insure strength.

3. Rough logs have visible defects such as crooks, bad knots or other defects impairing their value and lowering their grade below merchantable.

4. Cull logs will not produce 50 per cent of their contents in salable lumber.

Log Scaling in British Columbia. Mississippi Valley Lumberman. September 2, 1910.

Log Rafts. Log rafting on the Pacific ocean is thought to have originated with Capt. H. R. Robertson of Astoria, Oregon, and to have become a success largely through the efforts of the Benson Logging and Lumber Company. Ocean going rafts are 600 to 700 feet long, about 50 feet broad by 30 feet deep at the center, and taper about 100 feet at each end. They are built in a cradle or frame having one detachable side. The sides of the cradle are vertical posts 22 feet long, connected underneath by pairs of sills, each sill being attached to one post and arranged to telescope when unlatched. Binding timbers extend the whole length of the cradle. After being built up 20 feet the main tow chain is laid from stern to stern with about 50 feet projecting from each end. "Herringbone" chains are fastened to the center tow chain and drawn diagonally to the circle chains to which they are attached. The safety of the raft depends upon the tow chain.

"Pacific Ocean Log Rafting," American Lumberman. June 11, 1910.

Lost Logs. The idea of gathering lost logs by an association has prevailed for a considerable period in New England and the Lake States. At Ashland, Wisconsin, such an asssociation has been active since 1888 and originated because it was found too expensive for each owner to operate independently in such work. The log owners incorporated and appointed a committee who one year sold the logs on the beaches at a fixed price per thousand board feet and another year gave a contract for picking up the logs and delivering them at a specified place. Still another year, the logs were delivered at a specified mill, sawed into lumber, and the lumber sold to the highest bidder.

The writer maintains that such an association is necessary along the Columbia river where it is held that a large number of rivermen are making a living by catching logs lost from booms.

"Organization of a Log-Owners Pick-Up Association"—The Timberman. June, 1910.

Kiln Drying.

Some interesting facts well-known to kiln driers are summarized as follows:

1. White pine, poplar and several Pacific coast woods, after being water-soaked for a considerable period. dry much more quickly and satisfactorily than when not floated or held in a log pond.

2. Green cypress piled on sticks enclosed in a steam box and subjected to several hours of exhaust or live steam will lessen weight from 1,000 to 1,500 pounds to the thousand board feet.

3. Lumber placed either in a steam box before entering the kilns or subjected to exhaust steam, after being placed in the kilns, materially lessens the time for kiln drying. The lumber is less likely to case-harden, check, or split.

4. Steaming mahogany, oak and black walnut under a moderate pressure for a limited time does not injure the wood fibre but breaks up the cellular structure of the wood.*

5. Lumber piled on sticks in a steam cylinder with a moderate pressure and limited time allows kiln drying in from 12 to 36 hours and air drying will be reduced 30 to 60 days. If steam treated further staining is eliminated, borers do not work, the color of the wood is distributed; warping, twisting and bucking are practically eliminated, splitting and checking are minimized and future swelling and shrinking are slight.

The author is sweeping in some of his general statements and cannot be entirely substantiated.

"Common Sense Applied to the Seasoning of Lumber." Hardwood Record. Aug. 10, 1910.

Grades.

An interesting experiment at one of the hardwood mills during December, 1909, shows some indication as to the grades of lumber secured from oak logs.

	Quartered White Oak Logs	*Quartered Red Oak Logs*	*Plain White Oak Logs*	*Plain Red Oak Logs*
Fas	45%	39%	29%	31%
No. 1 Common	37%	42%	21%	30%
No. 2 Common	9%	11%	7%	10%
No. 3 Common	2%	5%	2%	2%
Dimensions	7%	3%	12%	16%
Ties	...	...	29%	11%

* Mr. Tiemann, of the U. S. Forest Service states that this is a mistake; that the cells do not break but that microscopic slits occur which also occur in air drying.

The general run of averages for the month gave quartered oak amounting to 33 per cent distributed as 14 per cent Fas, 15 per cent No. 1 common, 3 per cent No. 2 common, and 1 per cent No. 3 common, while plain oak amounted to 67 per cent distributed as 19 per cent Fas, 17 per cent No. 1 common, 4 per cent No. 2 common, 1 per cent No. 3 common, 22 per cent ties and scantling, and 4 per cent dimension stuff.

Manufacturing Cost of Lumber. Hardwood Record. Feb. 10, 1910.

Grades. A compilation by R. S. Kellogg shows the following grades for species in Northern Wisconsin:

	Firsts & Seconds	No. 1	No. 2	No. 3
Hemlock		45%	30%	25%
Basswood	25%	25%	23%	27%
Birch	23%	25%	23%	29%
Elm	19%	24%	24%	33%
Maple	16%	25%	25%	34%

"Hardwood Grade Percentages." American Lumberman. August 6, 1910.

Wood Waste. In manufacturing sawn lumber and its use in the industries, 67 per cent of the wood is lost; in cordwood the loss may be as low as 5 per cent; in posts and rails 20 per cent; in hewed ties 70 per cent and in cooperage stock approximately 78 per cent. It is suggested that sawmill waste should be more largely used by the cooperage industry and by the manufacturers of small products such as clothes-pins, meat skewers, handles, brushes and toys.

"Necessity for Reducing Waste." Barrel and Box. June, 1910.

Sulphite Waste. Professor P. Klason of Sweden has shown that the organic substances in the waste from sulphite mills consume much of the oxygen dissolved in the water. In small streams this can go so far that the oxygen is reduced to less than 2 cubic centimeters per litre which is the minimum for the life of fish. It has also been noted that fish living in such contaminated water get a disagreeable oil taste when boiled.

Added contamination is noted in the disagreeable smell and taste of the water, the deposition of pulp fibres on the grass along shore, the killing of young fish by obstructing their gills, and destroying the mating places of fish. The writer states that collecting the waste in large reserve ponds which held all or most of it during low stream flow had proved an efficacious remedy and cites the pond at Fredriksberg, Sweden, as a good example.

A striking piece of work has been done in this country on the refuse from sugar beet factories which is very similar to pulp waste. The remedy proposed by Mr. Robinson in the Report of the Michigan State Medical Board for 1909 is to construct dams and thus increase the oxygen content of the water. The use of the dam in small streams is much more feasible than the reserve pond.

"Purification of Waste Water from Sulphite Mills." Pulp and Paper. August, 1910.

Blue Stain.

Dr. von Schrenk states that blue stain fungus grows only in the medullary rays and not in the wood fibres as is sometimes claimed. This seems to be due to the starches, sugars and oils found in the rays and not acids as has been popularly supposed. During the past two years it has been found that the relative quantities of moisture and air in the wood have a strong controlling influence. Dr. Ernst Münch found that the maximum growth obtained when there was 15 per cent or less moisture and this will probably be a basis for preventive measures. The blue stain is not a color of the wood but is due to the presence of the brown mycelium of the fungus which probably gives a blue color by reason of its division. Bicarbonate of soda, borax and mercuric chloride have been found to be effective preventives but borax is unreliable and mercuric chloride too strong a poison for the average manufacturer.

Many of the poor results of the treatment are due to careless methods and a lack of exact knowledge. It is necessary that the exact strength of the alkali be known and that the supplies be controlled by different vats of concentrated solution and water which are properly mixed in the dipping tank. It is advisable to have the dipping solution hot in order to obtain a perfect coating and to pile the lumber as soon as possible, being sure to use chemically treated cross strips. The author believes that good results can be secured if technical men are in charge even if our present information is imperfect.

"Prevention of Blue Stain in Lumber." The St. Louis Lumberman. July 1, 1910.

Counteracting Teredo.

Fossil remains of the teredo have been found in petrified woods but the work of the mollusc first attracted attention about 300 years ago when its work on wooden ships was especially destructive. It is found in all ocean waters except those of polar regions and is represented by many species. The worst infested waters are the Gulf of Mexico and Caribbean Sea.

Pine, oak, cedar, mahogany, ebony, teak and lignum vitae are only a few of the species affected while such a soft wood as the palm may be immune. The greatest development of the teredo occurs in areas where fresh water and salt water meet.

Mahogany and cedar logs have been destroyed in four months. Such work could be prevented by turning the logs while piling may be protected by sheathing with copper. Many experiments with paints, pitch, coal tar and chemicals have failed, but recently napthaline oils forced into the wood under heavy pressure has given good results. This process is so expensive, however, that its use is limited.

"Destructive Work of the Teredo." American Lumberman. July 23, 1910.

Wood Paving.

Probably the earliest method of wood paving was the corduroy road which was a crude method used on extremely bad areas. The planked road followed and was in turn followed by many kinds of wood blocks. This paving was first laid in London about 70 years ago, fir blocks being used which were 6 to 8 inches across and 6 inches deep. The first use of wood paving in the United States is unknown but there is one street in Philadelphia which seems to have been paved with wood in 1843. Within a few years a large amount of wood paving was used, Chicago and Detroit using round cedar blocks 6 inches long set on end in sand or mixed sand and gravel. This paving was cheap and soon became decayed and roughened.

Comparatively recently the chemically treated block has come into use. The three principal methods of creosoting are known as kreodone-creosote, creo-resinate and carbolineum, which are similar processes with a variation in the chemical used. In the first process the seasoned blocks are sterilized in dry heat at 240 degrees Fah., and the preservative forced in at 70 pound pressure until 12 pounds to the cubic foot are absorbed. This usually takes 2 to 3 hours. The second process is like the first except fifty per cent of melted rosin is used with the creosote with the idea of closing the pores. In the last named method carbolineum is used. This is an insoluble chemical compound of high specific gravity, which remains liquid summer or winter and is non-volatile.

The principal cities mentioned as users of creosote blocks are Minneapolis, Chicago, New York and New Orleans. It is claimed that the heaviest traveled streets in the world such as the Rue de Rivoli, Paris; Avenue de L'Opera, Paris; King William street, London, and Oxford street, London, are paved with wood blocks.

It is claimed by the author that the ten qualities of good paving are more nearly fulfilled by wood than any other material. These qualities are:

1. Reasonableness of initial cost.
2. Cost of maintenance in condition.
3. Facility of making repairs as needed.
4. Durability under necessary traffic.
5. Freedom from unnecessary noise.
6. Sanitary quality or freedom from dust.
7. Freedom from decay or disintegration.
8. Freedom from absorption.
9. Foothold for horses.
10. Low resistance to traction.

"Merits of Wood Pavements." Mississippi Valley Lumberman. September 2, 1910.

Coffins. Single factories use as much as 2,500,000 board feet annually and it is estimated that the whole industry uses 30,000,000 board feet annually of hardwood lumber. The manufacturers do not limit their choice of species and nearly every hardwood is used in some connection. The principal requirements are dryness and proof against moisture. Plain oak, quarter-sawed oak, mahogany, poplar, basswood and teak are most largely used and the last mentioned wood is particularly desirable because of its indestructible nature.

"Utilization of Hardwoods." Hardwood Record. September 10, 1910.

Butter Dishes. Butter dishes have been made principally from maple but are made from any wood that will stand steaming, cuts well and does not have a sap that will leave a taste. Black Gum, Tupelo Gum and Red Gum are used in the south with Black Gum a favorite. On the Pacific coast spruce and fir are largely used.

"The Butter Dish Trade." St. Louis Lumberman. August 15, 1910.

Oak Flooring. Oak flooring is manufactured principally by flooring concerns but is also being manufactured more and more by sawmills which make a specialty of oak lumber. The low grade problem is a serious one in oak and the manufacturers are finding that the narrow strips of flooring cut into all lengths offer one solution. There is also developing a good market for common stock in oak flooring for use in the floor center that is to be covered by a rug or for use in kitchens.

At present there is a tendency toward narrow widths and two thicknesses. The favorite widths are 1½, 2 and 2¼ inches face while formerly it was made as wide as 3¼ inches and very little was narrower than 2¼ inches. It is held that the narrower strips look better, stay placed better, and do not shrink enough to leave an unsightly crack, while they are an advantage to the lumbermen since a more than proportionately greater amount of flooring can be sawed from common lumber if small widths are used. The two standard thicknesses are 13/16 inch made from one inch stock and 3/8 inch made from one inch stock which has been resawed or split.

"Oak Flooring." The Wood Worker. June, 1910.

Gum Barrels. The scarcity of oak timber for cooperage purposes has led to the introduction of the steel barrel for high class uses and the substitution of gum for barrels used for syrup and glucose. This species has been used for some time in slack cooperage. The Standard Oil Company tried gum for oil barrels but found it unsatisfactory because the glue used was disintegrated by the oil and the stave was not heavy enough. It is said, however, that the gum barrel is used abroad for heavy oils and lubricants. The principal centers of use for the gum barrel are New Orleans, where it is used for molasses, and New York City, where it is used for glucose. The gum stave has an advantage over oak in being fully 25 per cent lighter but the manufacture is more complex since the log must be flitched at the mill, then cut into 36 inch blocks which are in turn sawed with the grain. The gum barrel can be sold at $1.25 to $1.40.

"The Gum Barrel," Barrel and Box. September, 1910.

Gum Staves. Gum staves eight years ago were only an experiment and for a time were not considered of much value because of a poorer joint than elm and not so good holding power. The timber is brittle and demands a sharper knife than elm or many other hardwoods while the problem of turning out bright staves is difficult because of climate. By good management as high as 60 to 80 per cent of bright staves may be secured. Many manufacturers shut down during the rainy season while others manufacture barrels for lower grade use during this period.

Most of the high grade gum staves are produced in Missouri Arkansas, and Mississippi but mill run stock is also produced in Virginia and West Virginia where the timber is not so good. Higher grade material is used for gum staves than in elm, red oak or other species where the best cuts are often used for higher class use. Gum staves are used almost exclusively in the South for sugar barrels and have given good service for miscellaneous purposes such as for chemicals, high grade salt, etc. This species has also largely taken the place of elm for fruit barrels in New York and Michigan while it is used exclusively in the South. Prejudice against the gum stave is held in New York city and vicinity by sugar barrel manufacturers and in Michigan and some of the central states by flour manufacturers.

"The March of the Gum Stave." The Southern Lumberman. July 16, 1910.

Teak.

Teak exports from Siam for the year ending March 31, 1909, amounted to 7,693,037 tons worth $4,259,907 which is a decrease of $546,338 as compared with the previous year. Teak ranks second in the list of exports and is principally used for shipbuilding, furniture, rolling stock and the better class of wooden houses. It contains an oil which prevents the rusting of iron or steel imbedded in it and is not attacked by the white ant. The survey of Siam's forests started in 1907 and is not yet completed. Only trees 76.5 inches in girth can be girdled for cutting. Bankok is the principal market.

"Teak Forests of Siam." American Lumberman. July 9, 1910.

Price of Gleditsia Wood.

It is of interest to establish values even for the wood of rarer trees. Some Honey Locust trees were cut in the park at Sans Souci (near Berlin). They had been planted about 70 years ago and showed only one inch or so of the light colored sapwood with a fine red to brown heart. There were six logs of 20 to 24 feet and a middle diameter of 12 inches, altogether 125 cubic feet which sold at 19 cents a cubic foot, a very good price considering that the wood was entirely unknown. Two wagonmakers and a broker divided the lot.

Allgemeine Forst- und Jagdzeitung. July, 1910. P. 266.

STATISTICS AND HISTORY

Prussian and German Statistics.

A most extensive and complete record of matters connected with the forest administration of Prussia and cognate subjects is contained in an article by Semper.

As regards felling budgets, it shows that in the years 1906, 1907, 1908, the cut was increased 18, 19, and 26 per cent above the proposed budget and that the actual cut in 1908 was nearly double that of 1870. Taking only timberwood (over 3 in.) the per acre cut increased from 29.7 cubic feet to 56 cubic feet (total cut 65 cubic feet). The workwood per cent improved from 30 to 63. The price for all wood rose from 3.9 cents to 6.6 cents, and for workwood alone is now 9.4 cents per cubic foot, prices in 1907 having been somewhat higher. The net result per acre has more than doubled, namely the gross yield from $1.66 to $4.28; the net yield from $.87 to $2.13 per acre of forest land—the latter figure showing a loss of 29 cents over 1907, similar to a drop in 1901, which is explained by an increase in the cost of administration, especially woodchopper's wages. These have grown from 1.2 cents in 1906 to 1.55 cents in 1910.

The great significance for the forest administration of the increasing mine timber requirement is illustrated by the growth of coal production which in 1908 had grown to 594 per cent (nearly 148 million tons) of the output of 1870, and which consumes at the rate of 1.6 cubic foot per ton. This consumption alone requires a third of the total cut, or one half the workwood, and this accounts largely for the increase of the workwood per cent. The import of this class of wood, from Russia and Austria, in 1907 was 161,000 tons, in 1908, 362,000 tons.

A slump in price against 1907 is explained mainly by the unusual high prices (up to 16 cents per cubic foot) and the unusual coal output of 1907.

A similar slump was experienced in wooden railroad ties, namely for pine from 71 cents to 69 cents; this, owing to increasing importations from Russia. Interesting figures are quoted from official sources as to the iron tie and wooden tie consumption on Prussian railways. About 30.5 per cent of the mileage (an increase of a half per cent since 1905) is laid with iron. In rebuilding in 1908 nearly 44 per cent was laid with iron, showing no decrease in the appreciation of this superior track. In new construction, while in the last three years the consumption of wooden ties had grown by 10 per cent, that of iron had grown by 27 per cent.

Reference is then made to the article on beech ties briefed elsewhere in this issue. Unsatisfactory experience with some of the impregnated ties, and the cost of treatment with creosote, the author assigns for the doubt in its superiority.

In the wood industries, while 1907 was a banner year, 1908 proved a year of recession. The total cut in the empire—some 700 million cubic feet—remained nearly the same, the increased cut of Bavaria, representing about 3 per cent of the whole, made little, if any, impression on the market. But importations, which in general represent 70 per cent of the home production of workwood were curtailed by more than 1,300,000 tons under the previous year. The import statistics of Germany, being the second largest importer of wood in the world, are of interest. They have grown from 2,320,000 tons of forest grown material in the quinquennium of 1866-71 to 10,990,000 tons in the average of 1902-7; and in this last period they rose from 7,643,000 in 1902 to 13,031,000 tons in 1908, a year of depression. These 13 million tons represent the excess of import (6,899,000 tons) over export (400,000 tons) of shaped materials expressed in round log material. The import comes in the following shapes:

	1,000 Tons.
Logs and Bolts,	3,455
Sawn,	1,683
Hewn,	397
Railroad ties,	405
Cooperage stock,	42
Pulpwood,	833
Exotics,	84
	6,899

The pulpwood importation is more than four times what it was in 1901. Cellulose and paper are export articles. Russia and Finland furnish over half of this material with Austria-Hungary a close second, Sweden and the United States with 448 and 385 thousand tons being small contributors.

A table of occupations shows that of the 11,256,254 workers in all industries 11 per cent are occupied in wood working industries, a loss of one per cent from the number in 1895.

The whole movement of wood on railroads was 19 million tons, to which inland water transportation adds over 30 million tons, to get a picture of the whole trade.

A curious difficulty in handling the freight tariff on wood is interesting to Americans. All exotic species which have been grown and are cut in Germany pay a different freight rate than the imported, the latter being favored. So far, only Robinia, Cottonwood, White Pine, Walnut and Chestnut are charged this rate. But as there are a number of imported species like the poplars which can hardly be distinguished from native ones, the latter sail under false colors. Soon, the writer declares, the list of exotics which are grown and regularly cut at home will have to be enlarged.

An interesting discussion on the formation of rings among wood handlers and of strikes in woodworking industries shows that these troubles have become common. In 1908 some 40,000 men in 1,600 factories being on strike, of the 430 strikes more than half had partial or full success.

The improvement in the salaries of all forest officials, which went into effect in 1909, has placed the latter into satisfactory conditions. Colonization of wood choppers and building of dwellings for wood laborers, for which annually $25,000 are appropriated, has not produced the desired results, the colonized men on account of the size of the farms, 12.5 acres, soon becoming independent, and the renters of dwellings leaving soon. Now the size of the colonist's parcels of land, single locations in the neighborhood of settlements rather than large colonies, are to be kept within 2.5 acres, but no obligation to work is to attach to them,only some advantages in the way of pasture and wood are to be given.

The various methods employed are discussed.

In 1892 one man for every 40 acres or nearly two working days for every acre were employed. In 1908, one laborer for every 37 acres, and only 1.6 days for every acre of woodland were required, while the total number of laborers has increased. They are simply not working as many days, the number of season workers having increased. At the same time the labor requirement has increased on account of more intensive management.

Wages have considerably increased in a short time. In 1904 in given localities daily wages varied for men in summer 36 cents to 62 cents, in 1908 from 44 to 77 cents; in winter, nearly the summer rates of 1904. (Yet woodchoppers if skilful, being paid by the piece can make $2 and more!)

Forstwirtschaftliche Rückblicke auf das Jahr 1908. Zeitschrift für Forst- u. Jagdwesen. May, 1910. Pp. 293-316.

Prussia Forest Department Budget.

Of the total area of 7.4 million acres, 87 per cent is devoted to wood production. For the administration of this area a force of 6,129 men is employed. Their salaries, except those in the six highest positions, vary from $275-$1,800 per annum exclusive of the perquisites like house rental, etc.

The total receipts for the year 1910 are figured at $33,950 divided as follows:

Wood,	88 %
By-products	4 %
Chase,	0.4 %
Peat,	0.1 %
Forest schools,	0.09%
Sale of land,	6.4 %
Miscellaneous,	1 %

The expenditures, estimated at $17,339,000 will be distributed among the following items:

Current administration,	76 %
Educational purposes,	0.6%
Buying out servitudes, road, cabin and telephone construction,	14.4%
Miscellaneous,	9 %

The balance of profit, $16,611.25, will be larger than during the last fiscal year on account of the heavy cutting necessary to remove the timber killed by the nun moth in eastern Prussia.

Der Etat der Domänen-forst- und landwirtschaftlichen Verwaltung für das Etatsjahr 1910. Centralblatt f. d. g. Forstwesen. August, September, 1910. Pp. 411-413.

Bavarian Statistics.

From the official report, which the Bavarian Forest Department issues periodically that for the year 1905 is reviewed, from which a few items are of interest.

Yield of workwood per acre varies from district to district as much as from 12 to 128 cubic feet!

The highest net money yield for wood is secured in Suabia with $7.20 (here also the highest workwood per cent, 59 occurs) the lowest with $2.67 in Upper Bavaria, the average for the Kingdom being $4.14.

Forest by-products yield around $14,000 or 15 cents per acre. This almost pays for the planting which consumes a little over 16 cents per acre of the total forest area; or else for the road building which consumes over 18 cents.

If we read that in the year 79 forest fires occurred but burned over only 240 acres we may conclude that carelessness—almost the only cause—is not yet out of the world, but effective service is keeping its results in check.

In 1906, 58 fires ran over 220 acres.

The planting was done on 11,000 acres with 86 million conifers at a cost of $240,000, besides insignificant planting of broadleaf species (on 1,200 acres) and repair planting on about 6,000 acres In private forests during the four years from 1902-1906 around 60,000 acres were cleared, but the planted area is reported as 85,000 acres, or an increase of forest area of round 15,000 acres.

Mitteilungen aus der Staatsforstverwaltung Bayerns. Allgemeine Forst- und Jagdzeitung. July, 1910. Pp. 241-251.

Baden Statistics.

In an official volume prepared for the meeting of the German Foresters Association conditions of Baden's forest administration are described on 139 pages, with 13 graphic charts, showing the changes during the period of 1850-1904. It appears that the rotations have gradually been increased not only in the State forests, but also in the communal forests. While in 1862 50 per cent of the former and 18 per cent of the latter were managed in 120 year rotation, in 1902 the percentage was over 59 and 30 respectively.

Naturally the stock capital has also increased, from 3,200 to 4,000 cubic feet, and from 2,830 to 3,930 cubic feet in the two classes of forest.

In the 55 years the gross receipts of the State forests have risen from $550,000 to nearly $2,000,000; the expenditures from $250,000 to $850,000; the net receipts from $300,000 to over $1,000,000.

The value of this domain which is stated as $35,000,000, was therefore quadrupled in the 55 years.

Forstwissenschaftliches Centralblatt. July, 1910. Pp. 411-413.

Lumber Exports.

Official records of United States lumber exports for the year ending June 30, 1910, show a large increase. In shipments to the principal importing nations of Europe there is an increase amounting to 7,487,000 feet or 4 per cent for the United Kingdom; 11,124,000 or 21 per cent to Belgium; 4,223,000 feet or 18 per cent to France; 6,414,000 or 10 per cent to Germany; 12,986,000 or 44 per cent to Italy, and 15,390,000 or 23 per cent to Netherlands. In shipments to minor importing countries, not named, there was a decrease of 1,826,000 feet or about 6 per cent.

Notable increases occur in this hemisphere. Argentine Republic had an increase of 64,837,000 feet or 36 per cent; British North America 62,094,000 feet or 49 per cent; Cuba 60,289,000 feet or about 75 per cent; Central American States and British Honduras 21,560,000 or 57 per cent; Mexico 25,297,000 or 30 per cent, and Chile 4,155,000 or 25 per cent. Brazil is the only exception with a decrease of 992,000 feet or about 3 per cent.

Some Orient shipments were even more remarkable. China had an increase of 36,537,000 feet or 117 per cent; Japan 4,409,000 feet or 56 per cent; Philippine Island 5,887,000 feet or 36 per cent; other Asiatic and Oceanic countries 45,615,000 feet or 58 per cent; British Africa 8,886,000 feet or 90 per cent and the rest of Africa 1,253,000 feet or 7 per cent. British Australasia showed a falling off of 23,116,000 feet or 17 per cent and Hong Kong 1,956,000 feet or 56 per cent.

Miscellaneous countries, not enumerated, imported 72,000 feet of which 2,000 feet was increase.

Boards, deals and plank show an increase of 336,667,000 feet or about 25 per cent and most of this is due to the demand for line, joists and scantling in which the increase is 4,150,000 feet or 19 per cent; hewn lumber has an increase of 294,668 cubic feet or 10 per cent; sawn lumber 68,410,000 feet or 18 per cent; logs and round timber 21 per cent; shingles 3,188 M or about 24 per cent, box shooks about 17 per cent, and other shooks 5 per cent.

The five principal Gulf ports of New Orleans, Galveston, Gulfport, Mobile and Pensacola show an increase in boards, deal and plank except Gulfport. Comparing figures with the rest of the country it is found that the timber shipped from Mobile approximates 16 per cent, Pensacola 15 per cent, Gulfport 11 per cent, and New Orleans 10 per cent or more than one half of all shipments abroad.

"Lumber Exports," The Lumber Trade Journal, Sept. 1, 1910.

Cut of Southern Pine.

The cut of southern yellow pines as reported July 15, 1910, for the past six months, is considerably greater than in the years of 1906 and 1907 when the cut was especially heavy. The net increase in cut above 1907 being 213,347,386 feet or 151 per cent for 147 mills which reported both years. The net increase in shipments is 10.6 per cent over 1907 and the total excess of shipments over cut is 7.14 per cent for 218 mills in 1910 as against 1.27 per cent for the same mills in 1909. The net increase in cut in 1910 over 1909 for 218 mills is 23.65 per cent and the net increase in shipments is 20.40 per cent. These statistics include reports from Missouri, Oklahoma, Arkansas, Texas, Louisiana, Mississippi, Alabama, Georgia, and Florida.

"Yellow Pine Statistics," The Southern Lumberman, July 23.

Canada's Trade.

A comprehensive study of Canada's exports and imports for the fiscal year ending March 31, 1910, is compiled by the Department of Customs. The total export amounts to $53,522,142 of which $12,393,903 went to the United Kingdom and $36,061,920 went to the United States. The total import amounted to $11,462,522 of which $251,422 came from the United Kingdom and $10,912,619 came from the United States. A list of all goods exported during 1910 is contrasted with 1909 and for March, 1909, with March, 1910. This is scheduled under 45 headings of lumber, dimension material, logs, etc., and and 10 headings of manufactured wood. The imports of dutiable goods are classed under 10 headings and of free goods under 28 headings.

"Canadian Lumber in Foreign Markets," Canada Lumberman and Woodworker, June 15, 1910.

Pulp Wood Consumption and Prices.

A preliminary report of the Census Bureau on the wood pulp industry brings out the fact, that in the years from 1907 to 1909, practically the quantity of pulpwood used remained the same, namely, 4 million cords (worth nearly $35,000,000) producing about 2,500,000 tons of woodpulp. But the price has somewhat increased, namely, from $8.16 per cord to $8.60. The year 1908 shows a depression in consumption, but not in price, which was $8.37 per cord. The most striking change, however, is the steady falling off of spruce consumption, which in 1907 represented 68.1 per cent; in 1907, 64.5 per cent; in 1908, 60.5 per cent of the total product, and the increase of price for this product was at the rate of 4.8 per cent in 1908, and another 6.7 per cent in 1909, the price in the latter year being $9.96 or $1.36 above the average price for pulpwood. A slight falling off in importations of spruce is also noticeable, the price having risen from $9.60 to $11.35 for such. Balsam is largely substituted for the expensive spruce, in 1907 double that used in 1908 being reported, the price in the latter years being $8.31. Birch, beech, maple, gum and basswood also figure in greater amounts.

Paper Making in Wisconsin.

Wisconsin outranks all middle western states in paper making and is the third state in the Union. It has 75 mills owned by 45 different concerns which yearly manufacture 459,000 tons of paper, 264,900 tons of ground wood pulp, and 216,000 tons of sulphite pulp. This amount of pulp requires 300,000 cords or 645,000 tons of spruce and 540,000 cords or 1,350,000 tons of hemlock. A cord of spruce averaging 4,300 pounds yields 39.53 per cent or 1,700 pounds of ground wood pulp while a cord of hemlock yields 800 pounds in sulphite which shrinks to 727 pounds or 14.54 per cent of the cord when made into paper.

It is only 30 years since the real manufacture of paper in Wisconsin began along the Fox River and the price of spruce wood for a considerable period was only five dollars per cord while now a comparatively inferior quality commands ten to eleven dollars per cord. Hemlock which had no value at that time has a higher value now than spruce did then. The direct investment in Wisconsin represents about $30,000,000 with over 7,000 employes and an annual product valued at $23,000,000. This does not include the woodsmen or carriers.

"Address by B. R. Goggins," Mississippi Valley Lumberman, June 10, 1910.

Forest Nurseries.

The Forest Commission of New York was established in 1885 but the first recommendation for reforestation was contained in the report for 1898 and the first tree planting was done in 1901 in the Catskills. The first nursery was provided for in the laws of 1898 when Cornell University was authorized to plant, raise, cut and sell timber. The first nurseries were established at Axton and Wawbeek in 1899 on a 30,000 acre tract in Franklin county set aside for teaching and demonstrating practical forest management.

In 1901 a four acre hardwood nursery was located in Ulster county south of Brown's station and a coniferous nursery of two and a half acres at Saranac Inn. The first of these nurseries failed because it was located on a side hill which had a gravelly soil. The Saranac Inn nursery is located on sandy soil and has a water tank and pipe system supplied by water from a hydraulic ram. Many experiments have been tried with resulting discoveries of great value to the profession.

In 1906 a cooperative experimental nursery of two acres maintained by the U. S. Forest Service and the New York Forest, Fish and Game Commission was established just east of the Saranac Inn nursery. The area was increased in 1907 to 4.2 acres and the work is being devoted to seedlings and transplants of a large number of species.

The Axton nursery was abandoned in 1908 and the Wawbeek nursery in 1909 while a site of ten and a quarter acres was selected at Lake Clear which is close to Saranac Inn and has a favorable soil. In 1908 the Commission was authorized to distribute trees at cost to citizens of the State, which amounted to 28,000 trees in 1908; 1,200,000 trees in 1909, and 2,400,000 trees in 1910. During 1908 a nursery of 5.1 acres was established at Salamanca and subsequently increased to 11.1 acres. The soil here is a sandy loam with a gravel sub-soil.

These four state nurseries aggregate about 30 acres and produce an annual product worth $10,000 at market prices. The seed beds are 4 x 12 feet and will produce about 10,000 seedlings to the bed.

"Tree Nurseries in New York State," The Southern Lumberman, Aug. 13, 1910.

POLITICS AND LEGISLATION

Forest Policy in Prussia.

In view of the movement in the United States of bringing private forest property under some kind of government control, it is of interest to note the position taken by the Minister of Agriculture, Domains and Forests in the Prussian legislature when an extension of government control over private deforestation was asked for.

The Prussian law of 1875, which can be called into requisition against a mismanagement of private forests requires that the adjoiner who fears damage from such management bring an action, but he must not only bear the costs but also pay to the owner whose management would be interfered with whatever difference in financial results would be caused by a change of management.

Naturally nobody, except occasionally the government, utilizes this law. The Minister, however, did not think that any other law of a more stringent interference would be justifiable or have practical effect.

In Bavaria where a more strict superveillance of private forest property exists, it was by no means in better condition.

He recommended, however, an extension of the method, in vogue for several years in various provincial agricultural councils, of providing experts to give advice to forest owners (see F. Q. vol. V, p. 438). Under this provision in the province of Brandenburg some 300,000 acres were now under such advice, and other provinces were following the good example.

Allgemeine Forst- und Jagdzeitung. August, 1910. Pp. 304-305.

Louisiana Forest Law.

The new law provides for a Department of Forestry with a register of the state land office as ex-officio forester who shall receive $500 salary and $300 traveling and incidental expenses. A state forester is provided for who shall have direction of all forest interests and matters pertaining to forestry within the jurisdiction of the state. The forester shall receive a salary of $1,800 per year and $600 office and traveling expenses.

Areas reserved for forestry purposes cannot aggregate more than 10 per cent of the area of any parish. Forest fires caused by negligence are punishable by a fine of not less than $20 nor more than $300 and by imprisonment of not less than 10 days nor more than six months or by both fine and imprisonment. Anyone maliciously causing forest fires may be fined not less than $25 nor more than $1,000 and imprisoned not less than three months nor more than five years or by both fine and imprisonment.

Anyone causing forest fires is liable for damages and in case of reproduction this damage is to be calculated as the expense of artificial planting and cultivating such growth to the point of development at the time when the fire occurred. Cost of fire fighting may also be charged to anyone negligently or wilfully causing forest fires.

Parish game wardens are to be fire wardens without extra pay and the state forester has the power to appoint volunteer fire wardens upon the recommendation of five or more reputable persons. These wardens have the power of arrest, the power to call out men between the ages of 18 and 55 to fight fires and the granting of permits to burn brush, etc., during seasons of minimum danger.

Provision is also made for a reduction of taxes when private owners shall enter into an agreement with the state forester for reforesting lands not assessed at more than five dollars per acre.

"Louisiana's Forest Law," The Lumber Trade Journal, July 1, 1910.

Hunting in Prussia.

In the debates of the legislature regarding the proposition not to administer the chase in the government forests but to rent them to the highest bidders, in order to secure a larger income, the Minister of Agriculture showed unsatisfactory results from this method in other states.

Baden had rented the chase on 235,000 acres at 6 cents per acre but had abandoned the method as undesirable, the hunting being entirely spoiled at the end of the contracts.

In Alsace-Lorraine, on account of French competitors the hunting on half the State forests, 195,000 acres, was leased at 11 cents per acre. Bavaria renting the hunting on about one million acres gets a little over 6 cents an acre. Prussia's 7.5 million acres brings now $150,000 and in future when the lower chase is also administered will bring an income of $200,000 or about 3 cents per acre; a few parcels in the West being rented for eight cents an acre. But the larger possible income would lead to inconveniences, friction, take away pleasure of the foresters, and in the end leave the hunting in poor condition, after first having increased the damage by game.

Allgemeine Forst- und Jagdzeitung. July, 1910. P. 258.

MISCELLANEOUS

Reforestation in France.

The "Touring Club of France," an organization of now 16,000 members with 364 branches, is one of the main agents in promoting the reforestation of denuded land. Some 4,000 acres have been planted up, 920 nurseries with 50 acres, furnishing plant material. Improvements of meadows were made on 1,200 acres and altogether $50,000 expended.

Recently the society has sent a memorial to the officials of the sections of mountain country in which the floods which inundated Paris rose calling their attention to the advantages of communal forests. The few municipalities which have them are realizing good returns from the money invested, ranging from 90 cents to $1.40 per acre annually. But in addition to the income such forests would exert a beneficial influence whose effects would be felt far beyond the community to which the forest belonged. In view of the fact that 40 per cent of the cultivated area of France is now artifically drained and that the run off from these areas is very rapid, many floods could be prevented if the run off on other parts of stream basins could be retarded. This can be accomplished most effectively by the reforestation of the denuded mountain slopes by communal forests so that in addition to helping themselves by establishing such plantations, the mountain communities would be aiding the lowlands by preventing the rapid accumulation of flood waters in the lower reaches of the streams.

Der französische Touring Club, etc. August, September, 1910. Pp. 414-416.

Photography in U. S. Forest Service.

An interesting account of the work of the photographic division in the Forest Service comes to us through German sources. Harrer describes in detail the organization and methods of procedure in the making of maps, and in the collecting and printing of photographs. We learn that about 100 million acres of forest reservation have been mapped and that some 80,000 pictures have been collected. He uses the information as an incentive for his own government (Bavaria) to use similar means.

Die photographische Abteilung der amerikanischen Forstverwaltung. Forstwissenschaftliches Centralblatt. June, 1910. Pp. 348-352.

OTHER PERIODICAL LITERATURE.

American Forestry, 1910,—

State Regulation of Timber Cutting. Pp. 280-290.
A discussion of the opinion of the Supreme Court of Maine as to power of state regulation.

The History of Resin Canals in White Fir. Pp. 351-356.

The New Forest Products Laboratory. Pp. 387-403.
An outline of the class of work to be carried on at the new Forest Service laboratory opened in June at Madison, Wisconsin.

Agencies for the Restoration and Conservation of Forests. Pp. 481-489.

The Protection of Forests from Fire. Pp. 509-518; 589-595.
Publication of bulletin 82, U. S. Forest Service, in six instalments.

The Reforestation of Denmark. Pp. 525-529.
Deals with the reclamation of the Jutland heaths.

The Philippine Bureau of Forestry and its Work. Pp. 539-544.
Official statement of conditions.

The Forest and the Nation. Pp. 607-610.
An address delivered before the second National Conservation Congress, St. Paul, Minn., September 8, by Mr. H. S. Graves.

The Indian Forester, 1910,—

Notes on the Forests of Heppenheim in Hesse-Darmstadt. Pp. 191-202.

Details of the system of management.

Some Factors Which Influence the Yield of Resin from Pinus longifolia. Pp. 278-283.

The season of year, year of successive tapping, time between freshening of cut, and vigor of tree.

Bagasse for Paper. Pp. 428-431.

This, the refuse crushed sugar canes, cannot be seriously considered as a substitute for wood pulp.

Report on the Paper-Pulp Industry in Sweden. Pp. 438-450.

A consular report on methods of manufacture.

Production of Synthetic Rubber. Pp. 489-490.

German Turpentine Substitutes. Pp. 491-492.

Root Infection of Trametes Pini. Pp. 559-562.

Dry Rot in Timber. Pp. 620-622.

Canadian Forestry Journal, VI,—

The Brown-Tail Moth in Canada. Pp. 43-44.

British Columbia Timber Problems. Pp. 47-51.

The Rocky Mountain Forest Reserve. Pp. 55-57.

Forest Fires and Railways. Pp. 69-74.

The Spruce Budworm. Pp. 93.

Quarterly Journal of Forestry, IV,—

Observations on the Large Larch Sawfly with Suggestions for Remedial and Preventive Treatment. Pp. 203-221.

Lays stress on the value of mixed stands, underplanting, etc., to provide soil conditions least favorable to safety of cocoons and pupal stage of the insects.

A Disease of the Alder. Pp. 221-224.
Valsa oxystoma.

Statistics of Danish Forests. Pp. 300-305.

Rhizina undulata. P. 308.
A fungus attacking conifers.

Witches' Broom on Spruce and Larch. P. 309.
Declared by Tubeuf to be a mutation and not due to parasitic causes.

Coombe Plantation, Keswick. Pp. 348-359.

The Minnesota Forester, III,—

The Brush Burning Law. Pp. 62-64.
Discusses criticisms of the law.

The Journal of the Board of Agriculture, XVII,—

Financial Aspect of the Growth of Scots Pine. Pp. 189-194.

Forestry in Hesse and some other German States. Pp. 199-205.
Deals with development during last ten years, with comparative statistics.

Reclamation of Moorland on the Continent. Pp. 205-211.
The steps taken to promote this work in Germany, Austria, Denmark and Sweden.

Coombe Plantation, Keswick. A Successful Plantation at a High Altitude. Pp. 265-283; 353-370.
Financial and other data of a sixty-year plantation, mainly larch and spruce.

Transactions of the Royal Scottish Arboricultural Society, XXIII,—

Belgian System of Planting on Turfs. Pp. 153-157.
Results of experiments begun in 1907.

Notes on Creosoting. Pp. 172-179.

The Cultivation of Willows. Pp. 191-196.

Teredo navalis and other Sea-Worms. Pp. 196-204.

The Protection of Timber Against White Ants. Pp. 227-228.

The Pulp and Paper Magazine of Canada, 1910,—

How I made Sulphite Pulp with 8 per cent Sulphur. Pp. 153-158; 179-183; 207-212.

Determination of Lignine in Sulphite Pulp. Pp. 172-173.

The Botanical Gazette, L,—

The Origin of Ray Tracheids in the Coniferae. Pp. 101-115.

Oxidizing Enzymes and their Relation to Sap Stain in Lumber. Pp. 142-147.
Suggests treating sap lumber in long tanks of boiling water as a practical method of preventing stain due to chemical discoloration.

Forest Leaves, XII,—

The Improvement of Farm Woodlots. Pp. 133-135.
A practical article.

Some Notes on Wood Preservation. Pp. 154-158.
Deals with the production and character of creosote oil, methods of preservative treatment, figures of cost, etc.

Rod and Gun, XII,—

Ontario Game and Fisheries Commission 1909-1910: Interim Report. Pp. 313-376.

NEWS AND NOTES.

By inadvertence a news item in the last issue on page 400 refers to the summer term for forestry students of the *University of Michigan.* This should have read *Michigan Agricultural College.* We understand that the University of Michigan does not carry on a systematic summer term work. The Public Domain Commission referred to in the item is not the old Forest Commission which it has supplanted.

Another piece of partial misinformation, we regret to say, slipped into the previous issue on p. 273, where Mr. C. H. Sellers, formerly assistant to the State Forester of California, is said to have followed Mr. Lull into the employ of the North American Hardwood Timber Company. As a matter of fact, Mr. Sellers had left the State Service before Mr. Lull, and owns the nursery at Fruit Ridge Road himself.

We may add that the news service of the *Quarterly* cannot pretend to be perfect; indeed, it intends to record personalia only as far as they show advance in the professional employment of foresters, and as far as possible, to confine itself to notes of general interest to the profession.

The past summer has been one of the worst for a long time in the matter of forest fires in the Western States. A guess rather than a well-based estimate places the amount of commercial timber destroyed at two years' cut or around 80 billion feet (six billion in National Forests), and the value in the neighborhood of $200,000,000.

These estimates put forward by 'American Forestry' are challenged by lumbermen as greatly excessive, and especially the statement that private owners suffered more—over ten times—loss than the national government, the argument being that the private forest owners (lumbermen) are always prepared to send fire-fighting crews into the woods, and the government is not. They believe, moreover, that the salvage will be much greater than is anticipated and that the market will not be affected by overproduction from the burned timber.

In the United States Circuit Court, at Deadwood, S. D., the government, this summer, won a signal victory in the case against the receiver of the Missouri River and Northwestern Railroad Company, in which damages were claimed for the destruction of timber by sparks from the defendant's locomotives. The jury brought in a verdict for the plaintiff, allowing practically the full amount asked. The total sum demanded was $3,728.85 and the verdict was for $3,659.45, a difference of but $69.45. This item was the alleged value of the cord wood destroyed, amounting to 231½ cords at $.30 per cord. The government claimed that the wood before the fire was worth $.60 per cord and as it was subsequently sold for $.30 they claimed the difference, which was not allowed.

The important feature of the case was the allowing of $12.00 per acre for reproduction and the suit was unique in that this establishes a precedent of the greatest value to the Forest Service. It is the first time that a court in the United States has decided that trees of such immature growth have a value that may be determined and for which damages may be estimated and allowed.

The item of reproduction in this case was $1,094.40 or $12.00 per acre for 91.2 acres and it was allowed by the jury in full. The other item allowed was for the partial destruction of 675,000 feet of mature timber, originally valued at $6.00 per thousand, but a credit of $2.20 per thousand was allowed the defendant as the fire killed timber was subsequently sold at that price. This added $2,565.00 to the reproduction allowance.

The basis for the valuation of the reproduction were the figures derived from the actual operations of this kind in the Black Hills National Forest during the past season, when 1,500 acres were reforested by seeding. Thus the Forest Officers, in their testimony, were able to give exact figures for the work already performed and thereby put a definite value on young trees, which to practical lumbermen would be worthless. This may be a very important feature in connection with the many forest fires along the railroads, which the Forest Officers have been obliged to fight during the summer just ending.

Nearly at the same time the settlement recently made with the Burlington Railroad Company, for the destruction by fire of timber on the Forest Reserve in the Galena district of the Black Hills, was accepted by the government. The terms of settlement were arrived at during a conference several weeks before.

By this settlement, the government will be paid the entire amount of the actual damages sustained, which has been estimated at $6,750. As the matter was settled out of court, the question of double damages did not enter into the negotiations. The fire which swept 1,000 acres of the National Forest below Galena, was started by sparks from a Burlington locomotive in September, 1908, and was fought by soldiers from Fort Meade and by employes of the Homestake Mining Company, whose timber lands in that section were threatened by the conflagration. The soldiers were called in when the fire appeared to be endangering the army wood reserve, which is located below the Galena district.

The items included in the amount of the settlement are 500,000 feet of timber, $6.00 per thousand, $3,000; 300 acres of reproduction at $6.66 per acre, $2,000; expenses of fire fighting, $1,500; damage to soldiers' clothing, $140; total, $6,750. In addition to this sum which the Burlington will pay in settlement, the railroad company is said to have been put to an expense of about $5,000 in conducting a survey of the fire swept district and securing estimates of the extent of the damage.

It has been suggested that the Burlington Company was probably urged to the settlement by reason of the recent action of Judge Garland of the United States Court, who overruled a motion of the company to strike out of the government's declaration the clause relating to the recovery of double damages. This was taken as an indication that the court would probably hold the double damage law valid, if the case came to trial. Another incident, which is believed to have induced the Burlington to seek a settlement out of court is the victory of George Bennere in the Lawrence County Circuit Court last term in the case in which he recovered a judgment of $3,300 from the railroad company for timber destroyed on patented land owned by him in the same district and burned in the same fire which damaged the government forest.

In Forest Service District No. 2 encouraging results of seed sowing three and four years ago led to sowing nearly 3,000 pounds of seed of Western Yellow Pine, Austrian Pine, and Lodgepole Pine as well as 1,000 pounds of Douglas Fir seed. This seed covered about 1,400 acres and was planted in various ways; in hills 3 x 3 feet apart by using a corn planter; in newly plowed furrows; in holes dug by grub hoes, and in broadcasting after burning low brush. On the Pike National Forest in Colorado 500 pounds of Douglas Fir seed were sown on a burned area in the West creek district from which Denver obtains a portion of its water. Here the seed was put into hills by corn planters; into seed spots one foot or more in diameter and six feet apart, prepared by heavy rakes, and into lines five feet apart made by grub hoes along contour lines of the hill, spaced 5 feet apart, and after dropping the seed rakes were used to cover it. Some seed was broadcasted on snow that fell May 16 and 22 and some was broadcasted on bare ground and raked in.

In the Nebraska sandhills about 200,000 trees were planted of Jack Pine, Scotch Pine, and Western Yellow Pine, and in Kansas sandhills 150,000 conifers and hardwoods. About 35,000 western yellow pine were also planted in Bear Creek Canyon of the Pike Forest.

It is understood that plans are made for gathering immense quantities of seed for next year's sowing. At this stage of seed sowing and tree planting in National Forests the greatest need is for well planned experiments under diversified conditions and a careful elimination of the mere scattering of seed. It is well known that the Secretary of Agriculture believes that remarkable results may be secured from seed sowing but before such results can be secured a large amount of experimentation will be necessary.

On July 21, 22 and 23 there was held in Portland, the Second Pacific Logging Congress. There are many lumber associations which handle the finished product, but if we are not mistaken, the Pacific Loggers Association is the only organization of loggers in this country,—an organization of men whose brains and muscle make possible the harvesting of the forest crops. There is hardly another association whose meetings could be of greater interest to the forester than the ones held during the session of the Logging Congress. The papers touched upon practically all phases of logging operations. "The scaling of logs," "Handling of explosives," "The value of topographical surveys and maps in connection with logging operations," "Handling logs on steep grades," "The gasoline locomotive," "Electricity in connection with logging," "Taxation," "Growth of timber" are only a few of the subjects which were discussed at the Congress.

The purpose of the loggers' association is to create a feeling of solidarity among the loggers of the Northwest and raise the loggers occupation to the dignity of a profession—logging engineer. The modern methods of logging, especially in the mountainous regions, tax the ingenuity of the ablest engineers and the modern logger is an engineer in the truest sense of the word. Every forester has a deep interest in such a movement and should wish it fullest success.

In attempting to develop a high type of logging engineer, however, it must not be forgotten that logging is only one phase —the final phase—in the management of timber lands. With the area of timber land rapidly decreasing, and the increase in stumpage prices, there is rapidly growing a tendency toward holding for future crops timber land by private owners in the Northwest. Under such conditions, the timber land will form the largest part of the timber owner's investment and its handling in such a way as to perpetuate it will be as much the concern of the manager of a timber tract as the logging-off of the mature timber. Logging when properly carried on is the most effective means for improving the forest. In order to properly handle a timber tract, the logger, therefore, will have to adapt his logging in such manner as to leave the logged-over areas in a condition capable of continued productiveness. The logger, therefore, will have to be also a forester and the forester a logger. Only when the forester fully understands the details of logging operations, or the logger can foresee the effect which logging operations will have on the future of the forest, can there be any forest management. The type then of man who will in a few years be needed to handle the large timber lands to the best advantage to the timber owners and to the country is a *forest* engineer,—a man who will combine the knowledge of logging with the knowledge of forestry

An attempt to develop merely a logging engineer means stopping half way. What is really needed is men who, with a thorough, theoretical and practical knowledge of logging, would combine no less a thorough understanding of the life of the forest and the methods of its handling so as to secure continuous yield. Such type of a forest engineer exists in British India, in France and other countries, why then not in this country?

The various papers presented before the Pacific Logging Congress are published in full in the August number of "The Timberman." Nearly every paper contains items of interest to the forestry profession and the entire set makes this issue one of the best ever published by any trade journal in this country. A few of the most important articles are as follows: Handling of Logs on Steep Ground; Building Logging Railroad with a Piledriver; Cableway Yarding System; Necessity for the Logging Engineer in Modern Logging; Map Showing Logging Operations, Costs of Grades and Outputs by Landings of English and Tyee Lumber Companies; Housing and Feeding Logging Camp Outfit on Wheels; Use of Fuel Oil with Proper Burners; Topographic Survey and its Economic Value in Logging Operations.

The sixth Congress of the International Union of Forest Experiment Stations met at Brussels from September 10 to 20 in connection with the Exposition. The Belgian government had voted $1,800 towards the entertainment of the guests who came from all parts of Europe, as well as from Japan and America. The United States were represented by Prof. Roth, and Canada by Dr. Fernow.

A number of excursions to various points of interest was arranged. A method of planting a moor was shown, which is done in a peculiarly Belgian manner of mound planting with spruce, which has been found the only satisfactory species for these peaty soils.

A stand of 48-year old *Picea rubra* showed its inferiority in amount of production to the Norway Spruce.

A plantation on ground similar to the Landes, sand and sand dunes underlaid with impermeable hardpan, with Scotch Pine proved a profitable investment in 40-45 years, the material selling for mine props and bringing $270 per acre; cost of planting varying from $5 to $40 according to conditions and method. One-year seedlings are used; or 2-year transplants on the dunes. A series of thinning experiments in spruce grown on peat, was exhibited in the forest of St. Michael, another in beech in the forest de Soigne.

Much interesting discussion was aroused, to be briefed later.

In view of the frequent and alluring offers of Mexican and Central American railroad ties which are made to railroad companies in the Eastern United States, a recent news note is interesting for its statement that the largest cargo of railroad cross-ties ever brought to Vera Cruz, Mexico, was unloaded in October from a British steamer, the source of the ties being Port Huron, New Zealand. These ties were consigned to the Vera Cruz Terminal Company and the Mexican (Vera Cruz) Railroad, being divided about equally between the two companies. They are sawed blue gum ties, and are said to be free from knots and other defects, and of more lasting quality than any that can be obtained in Mexico, and, it is claimed, they can be laid down in Vera Cruz about as cheap as Mexican ties can be bought. The plantation promoters and others who offer Mexican ties in the United States make great claims for their durability and hardness, and intimate that they are available in large quantities. It is apparent that if the Vera Cruz Railroad brings ties from New Zealand, either they are not aware of the possibilities of home supply or the offers of Mexican ties for delivery in the United States are not well-founded. Another interesting feature in connection with this importation is that the Vera Cruz Railroad has experimented extensively with steel ties, but they having proved unsatisfactory, all renewals will be made with wooden ties.

As an aftermath of the forest fires in Montana and Idaho this summer, it is reported that the Forest Service is advertising the sale of two billion feet of fire-damaged timber. White and Yellow Pine, spruce, fir, and tamarack are offered at 40 to 50 cents on the dollar, and if the timber is removed within the next three months it will be as good as green timber, while it will not entirely lose its value for at least three years. The prices for burned timber range from $2.00 for White Pine to 50 and 75 cents for other timber. In connection with the actual fire damage, it is estimated that the high winds that preceded and accompanied the fires caused a loss from breakage equal to that caused by the fire. In the case of White Pine, reports from certain districts indicate that while the loss of logs from burning is approximately 10 per cent, the loss on the same kind of logs from breakage is often more than 40 per cent.

The government of Ontario is slowly beginning to work towards a more conservative forest policy.

This fall it has bought out for $290,000 the right of a lumber company to the balance of the timber not heretofore cut in Algonquin Park, over an area of 350 square miles. This park of 1,733 square miles was set aside 17 years ago, but under timber license to various companies, including, as in this case, hardwoods which at the time were valueless but now have become commercially available. It is mainly a game preserve, but eventually may become a real forest reserve.

At the beginning of the academic sessions of the Faculty of Forestry at Toronto University, Mr. J. E. Lapham, of the U. S. Bureau of Soils gave a practicum on soil survey, with excursions to the Don Valley, one of the best examples of glacial and lacustrine deposits, and to Lewiston, N. Y., studying the various soil types established in the survey of that section of the State of New York. The need of soil knowledge, the methods of procedure in classifying soils is especially important in setting aside forest reservations, and in excluding the farm soils.

Another forest school, attempting a high grade education, was started in the province of Quebec this summer, under the auspices of the Crownlands Department of the Province, and affiliated to Laval University, with G. C. Piché as director. Admission is based on a competitive examination. Ten scholarships are provided to make entrance attractive, as well as the promise of employment by the government. To secure the scholarships, a year's work for the government at $25 a month and traveling expenses is required before entrance.

The possession of both English and French is required. A nursery is at the disposal of the school for practice work.

Mr. G. B. MacDonald has been elected to the professorship in forestry at the State College, Ames, Iowa. Mr. MacDonald graduated from the forestry course at the University of Nebraska in 1907 and has had considerable field experience in California, Idaho, Montana, Colorado and Nebraska as well as minor assignments in other states. His work has largely been in forest planting and he is well qualified for his work in Iowa.

An interesting report from the Faber Pencil Company has been received by the U. S. Forest Service as a result of specimens sent in from Arizona and New Mexico. Alligator juniper was noted as being somewhat hard; one-seeded juniper as being spongy and suited for only cheap grades of pencils, and western red juniper as a very close grained, fine quality wood with red color, aromatic odor, and fine qualities for pencil making. Since there are large quantities of this juniper in the southwest it seems probable that it will be used for pencil material.

In May representatives of the International Paper Company and American Realty Company set out near Bangor, Maine, 150,000 three year old spruce trees, imported from Norway. These trees were set out with a spacing of 6 feet each way and the large planting is due to the success of 10,000 trees set out in 1909 by the same interests.

What is believed to be a world's record for wood sawing was made when two men sawed ten cords of 18-inch elm wood in eight hours and 15 minutes.

COMMENT

With this issue, at the end of another year, the Editor desires for himself and his board of collaborators to explain their attitude as regards the character and contents of their publication to those of their readers who might be inclined to criticize and to those who are inclined to help along.

The QUARTERLY is still, as it has been for the last eight years, a labor of love, the subscription list having never been sufficient to pay for its publication, since the number of professional readers is still insufficient. The danger of a financial surplus has every time been met by increasing the amount of material or printed pages.

Naturally, neither any of the collaborators nor of the contributors are paid for their services, nor is it possible to launch out on more liberal use of illustrations, on account of insufficiency of funds. Moveover, the work of briefing and editing, proof-reading, distributing, etc., is done by men crowded with other work, hence, in the nature of the case, the work must be done hastily, errors may creep in or matters that should be taken care of are overlooked. But the Editor will always be glad to have such errors and oversights pointed out and corrected if possible.

As regards the contents of the journal, the Editors can also see possibilities of expansion and improvement. Expansion is, to be sure, limited by finances and the time which is at the disposal of the Editors.

As regards the character and quality of original contributions, the Editors have been careful not to be too critical. The QUARTERLY was to furnish the opportunity of literary expression for the budding profession, a profession manned almost entirely by young men, the first graduate issuing from an American forest school only a decade ago; it was to stimulate and encourage literary effort among a class of busy men engaged as a rule in strenuous field work. Hence, it has been the policy to accept and print almost any contribution offered, and even to exercise as little as possible editorial revision. The Editors have rarely solicited articles but have relied mainly on voluntary contributions.

The contents of the Quarterly, then, represent, not the best but the average of the literary accomplishments of the professional men at the present time. There are to be found in it contributions of the highest professional value and such of merely ephemeral interest; there is a range of subjects from mere descriptive matter to highly philosophical dissertations, and every phase of a forester's interest is represented, without an attempt on the part of the Editors to accentuate one phase more than another.

It was thought desirable to acquaint our subscribers with the state of affairs and explain the attitude of the management, and to invite those who are interested in a raising of their profession to higher standard and are capable of doing so, not to "sit back," but come forward with assistance, especially by contributions to the original literature of the journal.

Mr. Mell's article printed in this issue, in which he tries to establish the possibility of utilizing the length of wood fiber to determine site quality, should not be allowed to go out without comment and a word of caution.

We were glad to print it as a contribution to a new line of thought on a subject on which we are unfortunately still too ignorant, namely, the influence of site conditions on the quality of our crop. If Mr. Mell had reversed the position of his question in this way, namely, making fiber length a function instead of a criterion of site quality, we would have been more ready to accept his conclusions and to acknowledge their practical value.

For such investigation the microscope has its indispensible use; but we doubt very much whether a forester will ever turn these findings to practical account for ranging his forest into site classes. Life is too short for such method! For such purposes the misroscope is too fine. The outward result of long fibers as expressed in vigorous height growth is all sufficient for such gross determination as is needful in the forester's practice. Moreover, wood is such a variable material, there are such radical variations to be found in the same tree, due to variation of light conditions and seasons on the same site, that the sampling would even for a microscopist be an almost hopeless task.

There are some minor points in the introductory remarks of the article which are open to question. The causes of differentiation in spring and summer wood, for instance, as far as we know, are as yet entirely in the realm of theory. Evidently ring-porous and diffuse-porous woods cannot, as the author seems to do, be treated as alike. Generalization from the behavior of one species or genus to species and genera of a different class of wood is, to say the least, dangerous.

We would, however, encourage the author to proceed with his investigations with the suggested change of problem to be solved, when we predict fruitful results.

In this connection the briefed article on another page of this issue regarding relation of quality to site may be of interest.

Since the possible profits from long-time management of forest lands depend to a considerable extent upon the capitalized value of the land, the present agricultural boom in the South will have the effect of discouraging lumbermen in the use of their lands for permanent forest production. Throughout Florida and in parts of Georgia and South Carolina, the demand for cut-over forest land for agricultural purposes is very active, and the real estate people are reaping a veritable harvest from the thousands of home-seekers in this widely-advertised region where conditions are described as ideal. Real estate men have been making fortunes by buying cut-over land at a low price and selling it to the settlers for two or three times the original cost; and the lumberman who might have considered holding his cut-over land for such second growth as nature would provide, either with or without his help, is now looking towards the disposal of this land at the attractive prices offered. There is bound to be a reaction, for the most optimistic must admit that a large percentage of the cut-over land is not suitable for agriculture, and no doubt many of the settlers who are now going into the South will have cause to regret the activities of the real estate man who persuaded them that ten acres of sterile sand or clayey swamp would provide a home and fortune. In the meantime, however, many of the large holdings which should have been kept intact and devoted to forest production will have been broken up, and the opportunity for the practice of forestry on them lost. It is to be hoped that when the reaction does come, the timberland owners will better appreciate the possibilities of timber production, and not be so easily persuaded to dispose of their holdings.

American Foresters, and particularly those in Federal employ, will do well to regularly read the Indian Forester. On account of the similarity of administrative problems many of the articles are particularly apropos. In the September number, under the title "Forest Divisions," by Mr. F. A. Leete, a number of problems in regard to permanent improvements, including "rest houses," roads and firelines are briefly discussed. "There was a definite scheme of buildings, that all arrangements were made well ahead, while the artizans moved from place to place and wasted no time." Is it not equally essential that the Forest Service should go further than the annual improvement plan, but instead plan for work over a period of 5 or 10 years so far as varying local conditions will allow? Mr. Hodgson's notes on cleared firelines will be particularly applicable on some of the National Forests. Under "correspondence" a communication from Mr. E. M. Hodgson brings up "Fire Conservancy in Indian Forests." It is the old problem of absolute fire protection in Burma as opposed to systematic burning. Since this seems to be a mooted question, would not Indian Foresters profit by arranging for very comprehensive experiments to determine systematically, which methods give the best teak reproduction?

Instructive reviews have been contributed on the progress reports of Forest administration in (1) The Central Provinces and Berar, 1908-09, (2) The Mysore State for 1908-09, (3) States Under the Bhopawar Agency, C. I., for 1908-09.

A digest of these reviews shows (1) that in the haste to prepare working plans "ill-considered and unworkable schemes" have arisen. In speaking of the ideal working plan the reviewer states, the result should be a practical compromise between the wants of the people and the silvicultural requirements of the forest. Personal discussion, presumably on the spot, should dispose promptly and finally of difficulties which would otherwise have to be thrashed out later on at the expense of reams of paper and pints of ink." During the year Central Provinces spent for roads, 3.8 rupees ($1.21) and for buildings 4.8 rupees ($1.54) per square mile. On the other hand in the United Provinces the expenditure was 16.5 and 20.9 rupees respectively. Eighty per cent of the total area of forests remained open to grazing and on the grazed area averaged one animal to every 2.6 acres. Mention is made of damage from overgrazing and of the meager data on cultural operations. The net revenue was twenty-one per cent of the gross revenue and presumably included the cost of the satisfactory local forest school which was recently started.

From the State of Mysore we learn that forty per cent of the net revenue was from the sale of standing trees. There seems to be a lack of suitable personnel in this administration, but efforts are being made to secure trained men from Dehra Dun.

The work accomplished in the States under the Bhopawar Agency does not seem to be considered satisfactory to the reviewer. No new working plans were sanctioned or prepared; little progress was made in the construction of roads; forest offences increased, and "No less than thirty-six per cent of specially protected areas was burnt over and fifty-seven and one-half per cent of generally protected areas." Little artificial reproduction has been attempted. On the other hand the receipts amounted to 194,338 rupees ($621.88), expenditures 72,196 ($231.23), surplus around $40,000.00. The surplus is almost double the average for the period 1903 to 1907. From a financial standpoint the Federal Forest Administration in India seems to be immeasurably superior to that of the United States.

A note entitled "Turpentine Substitutes" speaks of manufacturing a pseudoturpentine from petroleum.

T. S. W., Jr.

The heated discussion of forest influence on stream flow continues with considerable acrimony but with little real addition of fact to substantiate or controvert the claims that have been made. This discussion will probably continue for a long time to come and the great need is for a thorough investigation extending over a period of years. One writer says, it would be well worth the expenditure to carry on measurements over several typical watersheds, then completely deforest one or more of them, partially cut over others and leave still others undisturbed. Such an investigation would definitely settle most if not all of the disputed questions here and abroad. It is quite questionable whether such a drastic experiment would be practicable or even definitely settle anything. Meanwhile European investigators are busy gathering definite data as they naturally present themselves.

Once more we beg to protest against the confusing of forestry with arboricultural operations with street trees. We refer to a recent article in a leading forestry periodical dealing with a city "forester's" work. No doubt a man with a training in the subjects basic to the science of forestry is well equipped to care for trees in city parks and streets. But the education of the public as to what forestry really is seems to progress slowly enough without the circulation of articles which spread false conceptions of the art.