

LECTURES ON FOREST POLICY

By C. A. SCHENCK, PH.D.

Director of the Biltmore Forest School, and Forester to the
Biltmore Estate, N. C.

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Second Part:

“FORESTRY CONDITIONS IN THE
UNITED STATES.”

Biltmore Forest School,
Directors' Office.

Biltmore, N. C., January 1, 1904.

Dear Sir—My lectures on Forest Policy appear in print, primarily, for the benefit of the students attending the Biltmore Forest School. Forestal text-books fit for American use not being available, I have been forced, for a number of years, to lengthily dictate the essence of my lectures.

The following pages merely record the dictation. They are not intended for public sale.

I most sincerely request, dear sir, that you may lend me your aid in checking and correcting the data concerning your State, namely,, given on pagef. f., so that this little volume, duly filed and controlled by collaborating friends, may thereafter publicly appear, in a better garment and improved contents, for the benefit of the American student of forestry.

Thanking you for any kindness that you may deem fit to show me in connection with the improvement of my lectures on "Forest Policy," I am, dear sir,

Most truly yours,

LECTURES ON FOREST POLICY

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FORESTRY CONDITIONS OF ALABAMA:

1. Area: 38,300 square miles, or 74% of total area, are wooded.

2. Physiography: The Cumberland Mountains force the Tennessee River into Alabama, where it forms a huge curve. The Appalachian Mountains send a double chain of mountains, in a northeast to southwest direction, from Chattanooga to Birmingham. Tombigby River and Alabama River join just before emptying into Mobile Bay. Chattahoochee River on Georgia line. Southern section of State undulating, swamps alternating with slightly elevated dunes. Mountains near Birmingham bear coal and iron.

3. Distribution: The southern third of the State is occupied by long leaf and Cuban pine; the former on dry, the latter on wet land. Four large isolated tracts of long leaf pine (unaccompanied by Cuban pine) in the northern half of State. *Taeda* occurs all over the State in varying proportion, accompanying here long leaf, there *echinata* or hardwoods. *Echinata* is found, generally, outside the region of Cuban pine and does not proceed to the coast. Best stumpage of *echinata* on upland, with oak undergrowth. Pine stumpage estimated, in 1880, to be 21 billion feet b. m. Enormous cypress swamps along the rivers. Outside the long leaf pine sections, the hardwoods, notably black, Spanish and post oak, prevail in number, but not in importance. In the curve of the Tennessee River, the southernmost sentinels of the fine hardwood and red cedar forests once typical for Tennes-

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see. In the mountain section, the flora of the Cumberland plateau (see under Tennessee), with some little white pine and hemlock.

4. Forest ownership: 525 firms own 1,224,000 acres of forest. The federal government, State railroads and homesteaders are the chief owners.

5. Use of timber: Destructive lumbering only of recent date. Huge deserts are nowhere left by the lumber jack, as is the case in the lake States. No pine resists fire better than long leaf. Cuban pine is protected by its position. The industry threatening ruin to the forests is the turpentine industry, which leaves only taeda intact. The output of the saw mills was in

1880	\$ 2,700,000
1890	8,500,000
1900	12,900,000

The cut in 1900 consisted of:—

Yellow pine	1,012,000,000 feet b. m.
Other conifers	32,000,000 feet b. m.
White oak	61,000,000 feet b. m.
Other hardwoods	44,000,000 feet b. m.

Total 1,149,000,000 feet b. m.

Mill investments average \$5,251 with 1,087 mills. Logs on stump are worth \$1.20, at mill \$4.30 per 1,000 feet b. m. Cooperage stock production, in 1900, is valued at \$200,000; miscellaneous sawn products at \$400,000; shingles, notably cypress shingles, at \$460,000. In 1885, the naval store industry yielded \$851,000.

Leather industry surprisingly large, producing, in 18 tanneries, \$1,098,000 worth of leather and using 18,651 cords of oak bark, worth \$62,628.

Paper and pulp industry: None.

6. Forestry movement: None.

7. Laws: Fire laws of 1852, against wilful or negligent firing. Firing turpentine orchards is under a fine of \$100 to \$1,000, or punishable with hard labor for not more than 12 months.

8. Reservations: None.

9. Irrigation: 89 acres of land were irrigated, in 1899, for truck farming.

No rice fields enjoyed irrigation.

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FORESTRY CONDITIONS OF ALASKA:

1. Area: The total area of Alaska is 590,000 square miles. The area of woodlands can scarcely exceed 60,000 square miles.

2. Physiography: The territory of Alaska forms a square, traversed by the east and west course of the Yukon River and framed by the ocean on three sides, with two appendages, namely:

(a) In the S. W., the Aliaskan Peninsula, with Kadiak and Apognak Islands.

(b) In the S. E., the mountainous coastal belt, 60 miles wide by 500 miles long, with over 1,000 islands (notably Sitka Island) fronting the coast.

Mt. McKinley, in the Alaskan Range, lying somewhat south of the center of the territory, 20,464 feet high, is drained by the Kuskokwim River. The Kuro Shiwo causes abundant (60 inches to 160 inches) rainfall and high atmospheric along the southern coast. Eternal snow, however, lies above the 2,000-foot contour line, even in the coast range and St. Elias Mountains. The mountains are beset with the hugest glaciers on earth, outside the polar region. Short growing season. Geologically, Alaska is one of the latest portions of the continent.

3. Distribution: The south coast, east of Kadiak Island, shows splendid coniferous forests, stocked with Sitka spruce, balsam fir (grandis?) hemlock, red cedar (*Thuja plicata*) and yellow cedar (*Chamaecyparis Nutkaensis*). Amongst the hardwoods, cottonwood alone reaches commercial size. Sitka spruce penetrates, in stunted form, to the Arctic Circle.

The hills of the lower Kuskokwim River have little wood; heavy spruce forests, however, exist on the mountain slopes of its upper course, whilst the valleys exhibit splendid summer prairies.

The northwestern hills are bare. Woodlands are found along the west coast up to Norton Sound.

Arctic tundra—a treeless plain full of ponds and swamps—extends from the Yukon northward to the Arctic Ocean. Dwarfed spruces and willows dot it far to the north.

4. Forest ownership: Practically all woodland belongs to the federal government, though the Russian Greek Church may own comparatively small tracts. Lack of surveys prevents land entries.

5. Use of timber: Most lumber is imported from the

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Pacific States. Coal (sulphurous) is found in many places, restricting the consumption of wood. The population scarcely exceeds, in 1902, 90,000, of which two-fifths are native.

Yellow cedar is used by the natives for huge dugout canoes. The bark of the balsam fir is employed for tanning. The common local timber tree is the knotty Sitka spruce, used for house building, mine props, sledges and firewood.

The large output of the fish canning industry (over 51,000,000 lbs. salmon in 1899) requires packing crates and slack barrels.

The 12th census reports a cut of 6,500,000 feet b. m. lumber, mostly spruce, valued at \$90,000. Much unlawful cutting on vacant timberland.

6. Forestry movement: None.

7. Laws: None.

8. Reservations: The Apognac Forest and Fish Culture Reservation lies north of Kadiak Island and comprises 403,640 acres.

The Alexandria Archipelago Forest Reserve covers 4,506,240 acres.

9. Irrigation: None.

FORESTRY CONDITIONS OF ARIZONA:

1. Area: 16,000,000 acres, or 22% of entire area of Territory, are reported under forest.

2. Physiography: Arizona consists of a high plateau, 5,000 feet elevation, sloping gently towards Gulf of California, intersected in northwest by the Grand Cañon, and diagonally traversed from the northwest to the southeast by a chain of mountain ranges, many tops of which rise to 10,000 feet elevation. This chain drains towards west into the Rio Gila and towards east into the Little Colorado, both of which are tributaries of the Colorado River. The rainfall, especially during the summer months, often evaporates before reaching the ground. Streams are frequently smaller at the mouth than at the head, due to dryness of the atmosphere.

3. Distribution: Below 3,500 feet elevation occur deserts, with cactus, yucca and agave. The river cañons are deeply cut into the plateaus and are fringed with broad-leaved species, i. e.,

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cottonwoods, willows, alders, ashes, hackberries and cherries. The foothills around the deserts show scattered scrub pines; scrub oaks occur notably on the hillsides; Mesas exhibit stunted oaks and pines. Above 5,500 feet elevation, open, park-like forests occur, notably of yellow pine (*ponderosa*), which, in the San Francisco Mountains near Flagstaff, are said to form the largest pure pine forest in the world. Trees are short, branchy and sappy. On the northern slopes, at about 6,500 feet elevation, occurs Douglas fir. The Rocky Mountain white pine (*P. flexilis*) and foxtail pine (*P. balfouriana*) are found at similar elevations in the San Francisco Mountains. Above them, large, often pure forests of Arizona cypress (*Cupressus Arizona*). At the timber line, after Fernow, Engelmann's spruce and Arizona cork fir (*Abies Arizona*) occur.

The plateau north of the Colorado Cañon is almost treeless.

A large number of coniferous species peculiar to Arizona are found in the southern part of the diagonal chain. Here the forest forms narrow stretches of fringe at altitudes exceeding 7,000 feet elevation. The best known mountain ranges are the Bradshaw Mountains, with 25 square miles of forest, the lower slopes dotted with nut pines (*monophylla* and *edulis*).

The Mazatzal Mountains contain about 70 square miles of forest (yellow pine, white pine, Douglas fir, white fir).

The White Mountains contain about 100 square miles of forest. Here, near the natural bridge, a splendid, almost pure forest of Arizona cypress occurs.

The Chirihahua Mountains contain 160 square miles of forest, a strip four miles wide and forty miles long. The Arizona pine (*Pinus Arizona*) and the Chirihahua pine (*Pinus Chirihahua*), further, the Mexican pine (*Pinus cembroides*) and a white pine (*Pinus strobiformis*) are additions to the tree flora in these southeastern mountains, which otherwise consists of yellow pine (*ponderosa*), white pine (*flexilis*), Douglas fir and California white fir (*Abies concolor*). Between the deserts and forests there is invariably found a belt showing pinons and scrub oaks. Timber species are generally wanting on mountains less than 7,000 feet high.

4. Forest ownership: The United States reserves aggregate, in 1902, 6,740,000 acres. Large Indian reservations, notably the Moqui and Navajo, in the northeast and in the White Moun-

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tains. Lumbermen own 409,000,000 feet b. m. yellow pine stumpage on 202,000 acres.

5. Use: Most prominent use of the forest is that for cattle and sheep pasture. Forest fires do little damage, forests being open. Sheep grazing in the reserves from April until December.

Output of lumber industry in 1900 was 36,250,000 feet b. m., worth \$547,000. Log stumpage, \$1.03. Saw logs at mill, \$7.50. Only 14 saw mills, with average capital of \$26,000. No pulp or leather industry. Mining industry, near Prescott, obtains supplies from the Bradshaw Mountains. Saw mills turn out largely yellow pine ties. Percentage of 1's and 2's in the lumber net over 7%.

6. The forestry movement in Arizona is nil.

7. Laws: Forest fire laws punish negligent or wilful firing as a misdemeanor.

8. Reservations: The Grand Cañon forest reserve is not a forest reserve proper. It contains forest only south of the Colorado. It occupies 1,851,520 acres.

The Prescott forest reserve covers 423,680 acres; the Black Mesa forest reserve 4,658,880 acres. The latter extends to the New Mexico line, forming a narrow belt of forest at high elevations.

The San Francisco Mountain forest reserve, with Flagstaff in the center, lies between the Grand Cañon and Black Mesa reserves and contains 1,975,310 acres. This reserve will be important for lumbermen in the near future.

In April, 1902, the Santa Rita forest reserve of 387,300 acres was created. In July, 1902, there were created three new reserves, namely:—

Mt. Graham forest reserve (118,600 acres);

Santa Catalina forest reserve (155,520 acres);

Chirihahua forest reserve (169,600 acres).

All reserves lie on the diagonal mountain range referred to, and are well selected.

9. Irrigation: In 1900, 190,000 acres of farm land were irrigated. Area is small, owing to irregularity of precipitations and lack of steady supply. The necessity and, at the same time, the opportunity for farms irrigated from storage reservoirs is great.

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Some tribes of Aborigines have irrigated their farms long before the advent of the whites.

Irrigation in the Salt River Valley, near Phoenix, shows results similar to those obtained in southern California. Fruits put on the market slightly earlier and freight rates to the east slightly better, give Arizona a certain advantage over California.

The value of the irrigation works constructed is \$4,400,000; the value of the irrigated products \$2,200,000 (anno 1899).

FORESTRY CONDITIONS OF ARKANSAS:

1. Area of woodlands 45,000 square miles, equal to 84% of the State. Probably maximum percentage amongst the States.

2. Physiography: Undulating plains. Ozark Mountains traverse northwest corner of the State in a belt 80 miles wide and from 1,000 to 2,000 feet high. Arkansas River traverses State from west to east, joined by the White River close to its junction with the Mississippi. Red River in the southwestern part of the State.

3. Distribution: Forest everywhere. A small tract of prairie in east central part of State. South of the Arkansas River and west of the Mississippi bottom lands gigantic virgin forests of pine occur (echinata and taeda mixed, the former prevailing on pine ridges, the latter prevailing on pine flats). Both pine species sold under the name of "short leaf pine." Stumpage of both species very heavy, say 6,000 feet b. m. per acre. Sargent estimated, in 1880, the stumpage of short leaf pine at 41,315,000,000 feet b. m. per acre. Bald cypress found in vast swamps in the bottom lands of the rivers. Stumpage about 5,000 feet to the acre.

The hardwoods prevail north of the Arkansas River and all along the Mississippi; further, in the bottoms of the Red River. Here the trees are said to be unsurpassed in size. Black walnut is said to be particularly abundant in the valley of the Red River. The leading hardwoods are white and red oaks, cottonwoods, sweet gum, black gum, yellow poplar, beech, ash, hickories, cow and texan oak. *Pinus echinata* shows some important bodies north of the Arkansas River as well, whilst *taeda* is here lacking.

The composition of the forest at Pine Bluff, after F. E.

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Olmsted, on an average acre, excluding trees of under 12 inches diameter, is as follows:—

On Pine Land.	In Hardwood Bottoms.
Echinata 5.9 trees	Hickory 5.8 trees
Taeda 5.3 trees	Cow oak 4.8 trees
White oak 3.8 trees	White oak 3.5 trees
Post oak 3.3 trees	Holly 2.1 trees
Black Oak 0.7 trees	Ash 1.3 trees
Gum 2.1 trees	Basswood 0.6 trees
Spanish oak 1.2 trees	Post oak 0.2 trees
Hickory 0.8 trees	Pines 1.2 trees
Miscellaneous 0.7 trees	Miscellaneous 1.5 trees

Apparently the pines form little over half of the growing stock on pine lands. Hardwoods not marketable on pine land.

4. Forest ownership: 28% of the hardwood land is reported attached to farms. 517 lumber firms own 1,497,000 acres, of 6,700 feet b. m. average stumpage.

5. Use of timber: Logs on stump are worth \$1.09, and logs at mill \$4.74.

Logging in the pine woods by cattle and high wheel trucks, or by donkey engines. Mill investments, for 738 mills reporting, are \$9,224 on an average. The lumber industry has grown very rapidly of late—more so in Arkansas than in any other State of the Union.

In 1880 the lumber output was valued at. . . . \$ 1,800,000

In 1890 the lumber output was valued at. . . . 8,900,000

and in 1900 the lumber output was valued at. 30,000,000

The cut in 1900 consisted of:—

Cypress	108,000,000 feet b. m.
Yellow pine	1,113,000,000 feet b. m.
Cottonwood	117,000,000 feet b. m.
Red gum	61,000,000 feet b. m.
White oak	226,000,000 feet b. m.
Other hardwoods	40,000,000 feet b. m.

Forests are little used for pasture, other than hog pasture. The railroad freight consists largely of lumber and timber. Three small tanneries. No pulp or paper mills.

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6. Forestry movement: "To get rid of the lumber" is the only demand. Conservative lumbering attempted near Pine Bluff, since cut-over pine land is scarcely salable.

7. Laws: The usual fire laws are unobserved.

8. Reservations: None, excepting a military reserve at Hot Springs.

9. Irrigation: None.

FORESTRY CONDITIONS OF CALIFORNIA:

1. Area: 28,600,000 acres of forest, equal to 22% of area of State.

2. Physiography: The Valley of California, drained by Sacramento from the north and San Joaquin from the south, and embraced by Coast Range and Sierra Range, opens towards bay of San Francisco. Towards the south the Coast Range emits irregular sentinels, notably the Santa Lucia Mountains, San Gabriel Mountains, San Bernardino Mountains, rising up to 10,000 feet elevation. Deserts along the Nevada, Arizona and Oregon line.

3. Distribution: California excels in the number of coniferous species, the variety of forest growth depending on the peculiarities of her climate. Rain winds in southern California are, strange to say, northeast winds. Rainy season begins in September, preceded by three or four months of drought. Coast Range contains no commercial forests south of Santa Cruz. Water courses deep seated, torrents in winter, mere threads in summer, unfloatable.

Immediately along the ocean shore, stunted conifers only grow. Above shore belt, the famous redwood belt of the Coast Range, consisting of *Sequoia sempervirens*. The redwood belt extends from the Oregon line southward to Santa Cruz; it is composed of large, pure redwood forests, exhibiting greatest stumpage of any tree per acre. Accompanying redwood are found, principally, Douglas fir, yellow pine, sugar pine, incense cedar, tideland spruce and three firs (*Abies grandis*, *magnifica* and *nobilis*), which run up to the crest of the range. The coniferous woods are intersected with tracts where chestnut oak and madrona (*Arbutus Menziesii*) dot the brush covered slopes. The east slope of the Coast Range, towards the Sacramento Valley, shows a

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scattering growth of pines and oaks, often imbedded in brush thickets.

The bottom lands of Sacramento and San Joaquin Rivers have a park like growth of huge oaks, which are now rapidly removed by the farmers.

Ascending the Sierras from the west we find the lowest belt, below 2,000 feet elevation, to consist of gray (digger or nut) pine (*Pinus sabiniana*), the favorite nut tree of the Indians, occurring in very open growth, alternating with oaks and the knob cone pine (*Pinus attenuata*), which regenerates only under the influence of fire.

The typical tree of the next higher belt, from 2,000 to 4,000 feet elevation, is the nutmeg tree (*Tumion Californicum*), which is found along the borders of streams. The hillsides show a comparatively poor growth of pine and fir, the Douglas fir being frequently of the "yellow" variety.

Above this zone, from 4,000 to 10,000 feet elevation, extends the famous timber belt of the Sierras. Rainfall is 50 to 60 inches. Typical for the California Sierras is the lack of any woody undergrowth on the ground. The soil is covered with a growth of flowering weeds. Imbedded in this belt are, island-like, ten groves of the big trees (*Sequoia gigantea*). This species, unlike its sister, the redwood, never grows in pure forests. The companions are Douglas fir, sugar pine, yellow pine, incense cedar and firs (*Abies magnifica* and *concolor*).

At elevations ranging between 3,000 and 8,500 feet, incense cedar frequently replaces the big tree. On old burns, lodge pole pine is found in pure stands. Amongst the nut pines, the one-leaf pine is highly thought of by the Indians. In addition, there occur the bull pine (*Pinus Jeffreyi*) and the big cone pine (*Pinus Coulteri*).

The highest belt, reaching up to the timber line at 12,000 feet, is the home of the firs proper. Here the red fir (*Abies magnifica*) and the white fir (*Abies concolor*) prevail. Timber line itself shows the Alpine hemlock, young trees of which are buried in snow all winter. *Pinus monticola*, the white pine, is said to excel in power of resistance to storms. The limber white pine (*Pinus flexilis*) and the white bark pine (*Pinus albicaulis*) are also found. Two typical species for this zone are the foxtail pine (*Pinus Balfouriana*) and the bristle cone pine (*Pinus aristata*).

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In addition, twisted pine (*Pinus contorta*) occurs on high mountain pastures.

Crossing to the east slope of the Sierras, the growth soon gets poorer, for lack of rain. Only pine species are found here, especially lodgepole pine, yellow pine and bull pine. Close to the Nevada line desert growth only occurs, such as mesquit and yucca.

In southern and southwestern California there are scarcely any commercial forests. Along the Arizona and Nevada line the Mohave desert and Colorado desert cover millions of acres. The plains, close to the sea and rivers, have dense groves of willows and sycamores. Majestic oaks occur scatteringly in the river valleys. In addition there are huge cottonwoods. On the edges of the deserts, in slight depressions, two *Prosopis* species are found, i. e., mesquit (*Prosopis juliflora*) and screw bean (*Prosopis odorata*). Piñons or nut pines are also found. The California palm (*Washingtonia filifera*) is found in canyons opening toward the deserts. In the deserts themselves are scattering yuccas. Ascending the mountain ranges the trail winds through endless chaparral thickets, dotted with live oaks and scrub pines (piñon). Forests occur at high altitudes on the Sierra Madre, San Bernardino, San Gabriel, Cuyamaca and San Jacinto Mountains. Here prevail yellow pine, Coulter's big cone pine, big cone fir (*Pseudotsuga macrocarpa*), white fir (concolor), in company with sugar pine, incense cedar, lodgepole pine and limber white pine. In the semi-arid zone reaching up to the 5,000-foot contour line are at home juniper, single leaf pine and gray pine, whilst the moister slopes and canyons, or the water courses, exhibit live oak, sycamore, walnut, alder, willow and cottonwood. The bristle cone fir (*Abies venusta*), a large fir of the canyons, seems unique in the Santa Lucia region.

4. Ownership: Farmers are said to own 1,673,000 acres of forest land. The United States forest reserves cover 8,800,000 acres; the United States parks 1,100,000 acres; both together about one-third of all the forests and 8.6% of the area of the State. According to the last census, 156 lumber firms control 1,177,000 acres of forest land, mostly situated in the Coast Range, and containing one-sixth of the timber of the State.

5. Use: There is scarcely any hardwood fit for cooperage, carriage works and furniture. Firewood is costly in southern California. Large lumber operations are conducted on the Coast

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Range only, supplying South America and the far east. Here a yield of 1,000,000 feet b. m. per acre is amongst the possibilities. Logging is done by railroad and donkey engines. Commercial species, aside from redwood, are sugar pine, Douglas fir, incense cedar and red fir (*Abies magnifica*). Redwood is said to furnish the best tank material and railroad ties, if tie plates are used. From the Sierras, lumber is exported into Nevada and Arizona for the use of the mines.

The Alpine meadows of the Sierras offer good pasture, but are said to suffer severely from sheep pasture. Regeneration in Sierra belt is said to be poor, no undergrowth being at hand. On old clearings, near mines, sugar pines and yellow pines are said to show a good second growth.

The tannin industry of California occupies the tenth rank among the States, using during the last census year 36,123 cords of chestnut oak bark, valued at \$16 per cord. Production is largely sole leather.

The paper and pulp industry is nill, five plants having died during the last decade.

The products of the lumber industry were worth:—

In 1850	0.9 million dollars.
In 1870	5.2 million dollars.
In 1890	8.8 million dollars.
In 1900	13.8 million dollars.

The total cut in the census year was only 864 million feet b. m., drawn from a growing stock of 36 billion feet b. m., owned by private individuals. Log stumpage is worth \$1.16. Logs at mill are worth \$4.63. California leads in the use of traction engines, which are employed on undulating ground. The mill establishments are large, next in size to those of Minnesota and Wisconsin, the investments averaging \$29,300. Eucalyptus plantations are made in the timberless regions of the south to obtain posts and firewood. Species recommended are: *Eucalyptus globulus*, *rostrata*, *viminalis*, *corynocabyx*, *leucoxyton*.

6. Forestry movement: California has been sensible of the dangers threatening from forest destruction and forest fires, since agriculture depends largely on the possibility of irrigation, safeguarded by forests. A State Board of Forestry was established in 1885, drawing a good appropriation, writing some valuable re-

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ports and establishing some experiment stations. In 1891, political decrepitude caused the board to lose its foothold. A prominent member of the board was Abbot Kinney. To him is due the introduction of Eucalyptus.

The tree botany of the State has been advanced by J. G. Lemmon. The California legislature has memorialized the United States government to set aside all forests for reserves. When, in 1897, all western reservations were opened to pasture by Binger Hermann, the California senators opposed the move and secured exemption for their State. At the university of South-California a forestry school was established in 1899. The Sierra Club (John Muir, President) and the California Water and Forest Association (since 1898) are taking up the work of the defunct State board. Sheep owners are the only people in California opposing the forest reserve policy.

7. Laws: The usual fire laws. The State Board of Forestry demanded of Congress, but in vain:—

(a) The temporary repeal of the timber and stone act.

(b) A law providing for sale of stumpage only from forest land, the government retaining the fee simple rights. State law of 1903 appropriates \$15,000 to assist the Bureau of Forestry in a canvass of the forest resources.

8. Reservations: The total area reserved, in 1902, is 8.8 million acres. The reserves are well selected, covering the tops of the Sierra Nevada and the high mountain ranges of the south. No reserves on the Coast Range.

The Sierra forest reserve, aggregating 4,096,000 acres, lies south of the Yosemite National Park, is about 200 miles long by 50 wide and comprises the Sequoia National Park, General Grant National Park and Mount Whitney Military Reservation. North of the Yosemite National Park lies the Stanislaus forest reserve, covering 691,200 acres. The Lake Tahoe forest reserve, of 136,335 acres, is the only reserve drained by the Sacramento. The highest summits of the Sierras are in the reserves. 85% of the reserves are timbered and 15% are covered with snow or glaciers. 70% of the 85% have, however, suffered from fire.

The southern reserves form links in a long chain running, approximately, east and west, and consist of the

Pine Mountain and Zaca Lake forest reserve (1,644,594 acres).

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San Gabriel Timberland reserve (155,520 acres).
Santa Ynez forest reserve (145,000 acres).
San Bernardino forest reserve (737,280 acres).
Trabuco Cañon forest reserve (109,920 acres).
San Jacinto forest reserve (668,160 acres).

The reserves were established solely to protect the water supply. The brush thickets occupy from 50% to 90% of the reserved tracts.

The Yosemite National Park comprises the Yosemite Valley, which was ceded to California by Congress in 1854, and is now in charge of three commissioners said to be lacking in good taste.

9. Irrigation: Value of products from irrigated land exceeds those in any other State. The average size of the irrigated farms is 75 acres. Cost per acre of irrigation system is \$16.80 and average yearly cost is \$1.70. In 1903 the State appropriates \$45,000 to assist federal departments in mapping and surveying reservoirs and in studying methods of water distribution.

The "district law" of 1887 causes great ease in bonding irrigation districts, and hence throws heavy burdens on the irrigationists. Many of the bonds issued are now worthless.

The irrigation systems were constructed at an expense of \$19,200,000.

Irrigation in the north is rather the exception. In the south it forms the rule. Along the Sierra streams, water is lavishly used. In the south, the greatest economy prevails.

Shipments of oranges raised in the south, in 1899, were \$7,000,000 in value.

In 1899, 1,600,000 acres were irrigated. Value of irrigated crops was \$33,000,000.

Irrigation prevails, where the precipitations and the flowage of streams are least; on the other hand, where there is no danger from frost.

FORESTRY CONDITIONS OF COLORADO:

1. Area: 33,500 square miles of woodland, or 32% of the area of the State.
2. Physiography: The 105th meridian separates the eastern

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third from the western two-thirds of the State. The eastern third is a treeless plateau, falling from 6,000 to 4,000 feet, towards the Kansas State line. Little rainfall. The central third of the State is the crest of the continent and is covered with irregular ridges rising up to 14,000 feet elevation. From here the South Platte and Arkansas Rivers run east; the Rio Grande south; the tributaries of the Colorado River (the Green, White, Grand and San Juan Rivers) west; the North Platte river north.

The western third of the State is a high plateau, intersected by high, detached mountain ranges and peaks. Large parks are characteristic of this mountain section. In winter the snow at Durango, in the southwest, is said to be six feet deep. The rainfall west of the crest is much greater than east of the crest.

Forest fires have played more havoc in Colorado than in any other State.

3. Distribution: The central crest is sparingly timbered with yellow pine, lodgepole pine, limber white pine and foxtail pine. Engelmann's spruce, usually associated with balsam (*lasiocarpa*), yields the best logs and must be considered the main timber tree of Colorado. It is found at elevations ranging from 8,000 to 12,000 feet. On moist sites, forests are formed by Colorado blue spruce and the gray modest variety of Douglas fir, followed by quaking aspen after devastation. All over the foothills pinon dots the ground (*edulis*), often replaced by the one-seeded juniper. Along the rivers, a fringe of hardwoods (especially cottonwoods, box elder and ash) is found. The best timber is said to stand in the southwest. It seems that the western third of the State has some timber everywhere, although it is not heavily timbered anywhere. Lodgepole pine is the prevailing species in the parks. The Rocky Mountain oak (*Quercus undulata*) forms brushy thickets on all exposures. Rivers fringed with cottonwood, box elder, elm and ash.

4. Forest ownership: Most forest land belongs to the federal government. Lumbermen own 92,000 acres only. 44,000 acres of forest are said to be attached to farms. One-seventh of the wooded area is reserved.

5. Use: The forest is subservient to irrigation and mines. Majority of cut is yellow pine. Total cut in census year was 135,000,000 feet b. m., worth \$1,627,000. Stumpage of yellow pine on best holdings 8,000 feet.

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Logs on the stump are worth \$1.12 per thousand; at mill, \$4.99. There are 155 saw mills of \$3,883 average investment, 59 of which are said to control 671,000 feet b. m. stumpage. Mineral products of the State are worth \$30,000,000 annually. Stock pasture plays a very important part.

6. Forestry movement: Colorado's constitution is the only constitution emphasizing forestry. State forestry association since 1884. Various attempts to transfer custody of the United States forests, for protective purposes, to the State. Irrigationists strongly in favor of reserve policy.

7. Laws: In 1885 a State forest commissioner and "forest conservators" (justices of the peace and county commissioners) for the protection of forests. Fire law notices to be kept posted by the conservators. Law of 1897 creates a Department of Forestry, Fish and Game; its forest commissioner is charged with forest extension, with water preservation and with the care and records of all woodlands at any time belonging to the State.

The State agricultural college has four experiment stations and offers a course in arboriculture. A law of 1901 practically prohibits lumbering on public domain above irrigation districts. Campers must secure permits. Non-resident hunters must secure "game and forest wardens" for guides. Railroads are required to keep right of way cleared, to supply engines with spark arrestors, to be responsible for damage by fire started by locomotive sparks.

The Denver and Rio Grande has the privilege of obtaining repair material from United States forests.

8. Reservations: The reserves, in 1902, cover 4,849 square miles, which is 5% of area of State and 15% of wooded area. They are well selected and should be increased in the southwest.

The South Platte forest reserve (683,520 acres), Plum Creek timberland reserve (179,200 acres) and Pike's Peak timberland reserve (184,320 acres), north of Colorado Springs, are extremely valuable for mines and irrigation purposes. They contain little merchantable timber, due to cutting and burning.

The Battlement Mesa forest reserve contains 858,240 acres; the White River forest reserve, 1,129,920 acres. These two reserves drain towards the Colorado River. The standing live timber of these two reserves, after Sudworth, consists of the following stumpage, in million feet b. m.:—

FOREST POLICY.

In White River reserve: Spruce, 930; balsam, 310; aspen, 100; lodgepole pine, 50; Douglas fir, 25.

In Battlement Mesa reserve: Spruce, 112; balsam, 37; aspen, 65.

9. Irrigation: The products of irrigation are forage crops and coarse grain staples; further, cantaloupes, peaches, potatoes.

Farming depends entirely on irrigation. On the South Platte and Arkansas Rivers irrigated farming is highly developed, handicapped in its progress by private ownership of water storage at the headwaters.

The irrigated area of Colorado, 1,611,000 acres, exceeds that of all other States. The value of the irrigated products was, in 1899, \$15,100,000. The irrigation system constructed cost \$11,700,000.

FORESTRY CONDITIONS OF CONNECTICUT:

1. Area under forest, 1,900 square miles, or 39% of the State, are classed as woodland.

2. Physiography: The Connecticut River traverses the State centrally, running north to south. Low mountains and hills stretching in the same direction show rugged and stony slopes.

3. Distribution: The primeval woods are extinct. A third or fourth growth of coppiced chestnut, oak, birch, ash, elm, hickory, basswood and cottonwood forms the woodlands, mixed with white pine said to readily reproduce on old fields and wood lots. The usual coppice rotation is 30 years.

4. Forest ownership: 50 mill firms own 9,195 acres of forest. Average stumpage is said to be 9,200 feet b. m. (?) 90% of the woodlands are attached to farms.

5. Use of timber: Stumpage costs \$2.90; logs at mill, \$7.88 per 1,000 feet b. m. 187 saw mills, mostly along the rivers, report an average investment of \$3,567. The output of the lumber industry is rising in value.

In 1860	\$ 572,000
In 1880	1,076,000
In 1900	1,118,000

FOREST POLICY.

The cut in 1900 aggregated 107,600,000 feet b. m., in which white pine participates with 23,800,000 feet b. m.; chestnut with 64,500,000 feet b. m. The coppice woods produce large quantities of fuel.

Leather industry: The output of 7 tanneries is valued at \$891,000. It consumes 495 cords of hemlock bark, worth \$3,810; 133 cords of oak bark, worth \$1,041; 3.516 barrels of bark extract, worth \$37,909; 205 bales of gambier; 494 barrels of quebracho; 111 tons of sumac, and chemicals worth \$1,791.

In 1900, 50,000 hides and 300,000 sheep skins were tanned.

The output of the paper industry is valued at \$3,565,000. No cord wood is used; only rags, waste paper, manilla, imported pulp and imported fiber.

6. Forestry movement: Some interest is manifested in planting waste sand land. The Connecticut forest association is presided over by the State forester.

7. Laws: Fire laws of 1886. Tax exemption on plantations made on abandoned fields, consisting of 1,200 saplings 6 feet high, for 20 years.

In 1901 the office of State forester (Mr. Walter Mulford) was created, charged with the acquisition of waste land at a price not to exceed \$4 per acre. Appropriation, \$2,000. Seed is to be used for planting. The expense of reforestation is not to exceed \$2.50 per acre. The State pays taxes on her own woodland.

8. Reservations: None.

9. Irrigation: 56 farms, situated along brooks, have 471 acres under ditch; expense of system \$34.21 per acre.

FORESTRY CONDITIONS OF DELAWARE:

1. Area: 700 square miles, or 35% of State, are wooded. Very little merchantable timber left after 12th census.

2. Physiography: Delaware occupies the northeastern portion of the peninsula formed by the Chesapeake and Delaware Bays. Soil sandy, slightly undulating.

3. Distribution: In the northern half of the State the broad-leaved species prevail. Here appears, scatteringly attached to farms, a struggling second growth of oaks, maple, poplar and

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gum. In olden times "Delaware white oak," coming from this section, was famous as shipbuilding timber.

In the southern half of the State, woodlands consisting of pines (*mitis*; *rigida*; *virginiana*) and broad-leaved species predominate over the farms.

4. Forest ownership: 10 firms own 2,203 acres.

5. Use of timber: Logs on stump are worth \$3.52; at mill, \$5.55. 76 saw mills report an average investment of \$3,255. The output of the mills rises in value from census to census, in spite of supplies reported as waning. It was in

1850	\$236,000
1880	411,000
1900	471,000

The cut in the census year consisted of:—

Conifers	30,000,000 feet b. m.
Hardwoods	6,000,000 feet b. m.

After Fernow, in 1887, 200,000 cords of firewood were cut, selling at \$3 to \$4 per cord. The Dupont Powder Works use willow charcoal, obtained from their own plantations. Staves and headings locally produced are worth \$37,000. The local production of furniture and carriage stock, etc., is practically nill.

The leather industry is important, its output (from 20 firms) being \$9,500,000 in the 12th census year. The product, however, consists almost entirely of goat skins. These skins are not tanned by the vegetable tanning process, but chemicals (chromium, aluminum and other salts) are used. The price of the chemicals consumed alone is \$244,000. The consumption of hemlock bark amounts to 1,316 cords only; that of oak bark to 300 cords only.

The paper and pulp industry produces \$600,000 worth of goods. It consumes large amounts of fiber and pulp produced elsewhere. There are used, however, 21,320 cords of poplar wood, locally produced and valued at \$131,467 (for soda fiber).

6. Forestry movement: None.

7. Laws: Delaware has excellent laws relative to the main impediments to forestry, which are taxes and fires.

(1) Property is taxed only on its rental value. Hence woodland is almost exempt from taxation, the rents being exceedingly small.

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(2) Firing of woodlands is punishable unconditionally and everywhere. The only fires allowed are those kindled between March 10 and May 1 by land owners intending to burn their clearings previous to plowing.

8. Reservations: None.

9. Irrigation: None.

FORESTRY CONDITIONS OF FLORIDA:

1. Area: 37,700 square miles, or 70% of State's area, under forest, mostly stocked with commercial timber.

2. Physiography: Southern section consists largely of swamps and hummocks, impassable from June to October (Lake Okeechobee). North of the 28th degree of latitude, the country is level, rarely undulating. Here the swamps are found more near the coast.

The western section of the State, near Tallahassee, is higher than the rest (average about 250 feet above sea level), intercepted with low mountain ranges.

Frost is rare; the summer climate is unhealthy in the south. The Everglades show from 1 to 3 feet of water even during the dry season of the year. Drought frequent from February to June.

3. Distribution: Sargent estimates, in 1880, the stand of pine at 6,615,000,000 feet b. m. A line drawn from Charlotte Harbor to Cape Malabar divides the State into a northern three-fifths and a southern two-fifths.

(a) Northern section. It contains long leaf and Cuban pine, with some little Taeda. Long leaf pine, on its way south, loses continually in volume and in quality of timber. Along the shore, evergreen oaks, notably live oak, are found in place of pine; further, palmetto and scrub pines. In the western counties, near Tallahassee, broad-leafed species of northern character prevail besides the pines. Large yellow poplars, ashes and hickories occur here along the water courses.

In the bottoms, cypress and gum swamps are said to scale 10,000 feet b. m. per acre. Evergreen broad-leafed species (magnolias, oaks, bays) fringe such swamps. A species peculiar to this region is the "stinking cedar" (*Tumion taxifolium*) and the

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pencil cedar, the latter of splendid quality on hummocks and bottom land. Palmetto occurs everywhere on moist soil and abandoned fields as a weed. There is practically no echinata.

(b) Southern section. The southern section has only one pine, the Cuban pine, to show, which grows on sand dunes in the Everglades. Cypress swamps prevail everywhere. Along the coast and on the "Keys," the northern sentinels of the West Indian tropical flora occur in small specimens. Their occurrence is commercially unimportant. Amongst them are mahogany and lance wood (*Ocotea catesbyana* Sarg.).

4. Forest ownership: 113 lumber firms own 1,318,000 acres; balance of forests belong to State, federal government, farmers and holders of old Spanish land grants.

5. Use of timber: 368 saw mills of \$16,588 average investment. Logs on stump worth \$1.22, at mill \$6.23. Value of mill output was in

1880.....	\$ 3,100,000
1890.....	5,500,000
1900.....	10,800,000

The cut in 1900 consisted of

Cypress.....	110,000,000 feet b. m.
Yellow pine.....	712,000,000 feet b. m.
Hardwoods.....	2,000,000 feet b. m.

Red cedar (*Virginiana*) output is not given by the 12th census. The largest pencil cedar mills of the world exist at Cedar Keys. Cypress is used for door, sash, shingles, fish and syrup barrels; long leaf pine for railroad ties, car sills, trestle bridge timbers, doors, blinds, flooring and general house building purposes, also for shingles. Value f. o. b. steamer, on an average, now \$14 per 1,000 feet b. m. (in 1895 only \$9).

Conservative lumbering has been practiced along the Gulf coast by lumbermen for dozens of years, unknowingly, since only prime stumpage used to be convertible into lumber. Logging was done in former days by canals (which in many cases were 20 miles long), dug as connections between trees, swamps and water courses.

No leather industry, although the mangrove (*Rhizophora mangle*) forests of the tropical south might yield bark extremely rich in tannin.

FOREST POLICY.

No paper industry.

6. Forestry movement: None.

7. Laws: Wilful firing of woodlands punishable. Fires rare, after Sargent, owing to multitude of swamps.

8. Reservations: None.

9. Irrigation: Florida leads among the humid States—the rice-growing States excepted—in the value of irrigated products and in number of irrigated farms (only 1,485 acres). 180 truck farms (winter farming) report irrigation. Cost of system, \$101.52 per acre (very high).

FORESTRY CONDITIONS OF GEORGIA:

1. Area under forest 42,000 square miles, or 71% of total area, containing, after 12th census, mostly (?) merchantable forests. Sargent, in 1880, estimated stand of pine at 16,800,000,000 feet b. m., a figure found much too low.

2. Physiography: The extreme northwestern eighth of the State is traversed by the Table Mountain and Alleghany Ranges, spurs of which protrude to Rome and Atlanta. Southeast of the mountains the Piedmont plateau occupies two-eighths of the State, separated by a line running through Augusta, Macon and Columbus from the remaining five-eighths of the State formed by the level or slightly undulating coastal plain. The huge Okefenokee Swamp lies in the extreme southeast.

3. Distribution: The mountainous section has the species of the southern Appalachians, namely, white, red, scarlet and chestnut oak; chestnut, walnut and hickory; yellow poplar, cucumber, sweet and yellow birch; cherry, beech, locust, rigid and table mountain pine; also white pine and hemlock. In the Piedmont plateau, oaks and hickories, with or under *Pinus echinata* (usually) or *taeda*. A stray island of long leaf pine is found on the Alabama line in the northwest. The lowlands of the coastal plain show long leaf pine on sandy soil, mixed with *taeda* on moister sites. Huge swamps near coast and rivers are stocked with cypress and gums. White cedar prefers the half-swamps. Evergreen broad-leaved species (*Persea*, *Magnolia*) line the swamps. Cuban pine grows far inland, up to 100 miles from shore, occupying the wet dells in the long leaf pine woods.

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4. Forest ownership: 453 firms own 1,108,000 acres of forest, containing 3,800 feet b. m. average stumpage. The balance of the wood lands belongs to farmers, or to counties and State under tax-forfeitures.

5. Use of timber: Long leaf pine was and is frequently sold as "Georgia pine." The woods are far from being exhausted. The inroads of the turpentine industry seem more injurious to the perpetuity of the forest than those of the lumber industry. 1,202 mills of \$4,274 average investment. Logs on stump are worth \$1.01; at mill, \$4.41. Logging by railroad and by rafting. Value of output in

1860	\$ 2,400,000
1870	4,000,000
1880	4,900,000
1890	6,500,000
1900	13,700,000

The cut of 1900 consisted of:—

Yellow pine	1,295,000,000 feet b.m.
Other conifers	18,000,000 feet b. m.
Hardwoods	39,000,000 feet b. m.

Cooperage and miscellaneous industries are small, their output amounting to only \$135,000 in the census year.

The leather industry produces in 36 establishments \$1,187,000 worth of products and consumes 23,217 cords of oak bark (valued at \$87,000); 85 cords of hemlock bark; 5,107 barrels of oak bark extract (worth \$41,000), and 950 barrels of quebracho extract (worth \$16,800).

Paper and pulp industry: None.

6. Forestry movement: In 1887 a bill asking for a forest commission, etc., seems to have failed.

7. Laws: Firing of woods by the owner must be preceded by notice given the adjoining land owners (excepting the months of March and April).

8. Reservations: None.

9. Irrigation: 7,856 acres of rice fields were irrigated in 1899, constituting 35% of the total rice area and yielding 72% of the total rice product. Cost of system, per acre, is \$31.85.

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FORESTRY CONDITIONS OF IDAHO:

1. Area: 35,000 square miles, or 42% of the State, are wooded.

2. Physiography: Southern third is traversed by the east and west course of the Snake River and consists of barren plains. The northern, wedge-shaped part of the State, contains the mountainous Coeur d'Alene region. The Teton and Yellowstone Ranges form the boundary towards Wyoming; the Bitter Root Mountains the boundary towards Montana. The mountains of central Idaho drain southward towards the Snake River, northward towards the Salmon River.

3. Distribution: Southern lava plains, destitute of timber and vegetation, except sage brush. The Salmon River Mountains are unexplored and contain, after Gannett, little timber. The Rockies show yellow pine, Douglas fir, lodgepole pine and western white pine. In the Bitter Root Mountains, Douglas fir and yellow pine prevail below 6,000 feet elevation, lodgepole pine above 6,000 feet elevation. In the extreme north a dense forest cover, originally found, is now badly burned. Here yellow pine and Douglas fir cease to be prevailing; white pine (*monticola*) and larch (*Larix occidentalis*) preponderate, numerically and in volume. In the Priest River Mountains three zones may be distinguished. In the highest zone, above 4,800 feet, balsam (*Abies lasiocarpa*) and white bark pine preponderate.

The zone between 2,400 feet and 4,800 feet is the largest and contains white pine and larch.

In the lowest zone, Douglas fir is mixed with yellow pine, lowland fir and western red cedar. Lodgepole pine is found all over the northern and eastern part of Idaho, taking advantage of heavy fires. Black hemlock, lowland fir and Engelmann's spruce also occur.

4. Forest ownership: 4,147,200 acres of forest land are reserved. Lumbermen own only 84,000 acres in the lowest zone, with 6,900 feet average stand per acre. Over 200,000 acres lie in the Indian reserves. Over 600,000 acres of forests are attached to farms.

5. Use: Timber is mostly used for mining props. The mill cut in 1900 was worth \$937,000, and consisted largely of yellow pine. The stumpage is worth \$1.09. Logs at mill are worth

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\$3.95. 114 saw mills report an average investment of \$4,759. No paper, pulp or leather industries.

6. Forestry movement: Nill.

7. Laws: Usual fire and camper's laws. Arbor Day law.

8. Reservations: Bitter Root forest reserve, meant to protect irrigation in Washington, contains 4,147,200 acres, of which 690,000 acres lie in Montana.

The Priest River forest reserve, part of which (104,000 acres) lies in Washington, comprises 645,120 acres.

9. Irrigation: Only possible from small feeders in outskirt valleys.

The products of irrigation are forage crops (alfalfa) and small grain at the higher elevations of 4,000 to 5,000 feet; orchard fruit at elevations of 2,000 to 3,000 feet, notably along the lower course of the rivers (Snake River).

The irrigated area, 600,000 acres, has produced, in 1899, \$5,400,000 worth of crops from irrigation systems costing \$5,100,000.

FORESTRY CONDITIONS OF ILLINOIS:

1. Area: 10,200 square miles or 18% of area of State are classed as woodland.

2. Physiography: Gently rolling prairies. Mississippi River on western line. Illinois River traverses State from northeast to southwest.

3. Distribution: The southern third of the State once contained good to splendid hardwood forests stocked with the hardwoods of the Mississippi River Basin, in addition to cypress swamps. The northern two-thirds are prairie, excepting a belt along the lake, on which white pine is sparingly found. The oak openings on the prairie are stocked with burr, scarlet, red, black and post oaks.

4. Forest ownership: All woodland is attached to farms, excepting 162,000 acres of 4,800 feet b. m. average stumpage, owned by 167 lumber firms.

5. Use of timber: Chicago is still the most important lumber distributing center in the United States, fed by the pineries

FOREST POLICY.

of the Lake States and by the hardwood forests of the Mississippi Valley. There are found in the State 825 saw mills, of \$3,815 average investment, and 280 large planing mills, of \$25,000 average investment. The output of the lumber industry is rising, being \$5,000,000 in 1880 and 1890, and \$7,600,000 in 1900. The cut of home grown timber in 1900 consisted of:

Conifers.....	138,000,000 feet b. m.
Cottonwood.....	19,000,000 feet b. m.
White oak.....	170,000,000 feet b. m.
Other hardwoods.....	63,000,000 feet b. m.

Logs are worth on stump \$2.64 and at mill \$8.36 per 1,000 feet b. m.

The leather industry has used in the census year 18,312 cords of hemlock bark (imported) and 22,846 bales of gambier. Products are valued at \$7,800,000.

The pulp and paper industry uses only 864 cords of native wood, and depends on straw, rags, waste paper and pulp of foreign manufacture for its raw material.

6. Forestry movement: None except Arbor Day and bounties for prairie planting.

7. Laws: Firing of woods and prairies permissible only from April 15 to October 15. Railroads liable for fires starting from sparks. Bounty of \$10 per acre for forest plantations.

8. Reservations: None.

9. Irrigation: None.

FORESTRY CONDITIONS OF INDIANA:

1. Area: After 12th census, 10,800 square miles, or 30% of State, are wooded. No large forests exist.

After recent official investigations,

250,089 acres are stocked with heavy timber;

834,506 acres contain second growth, and

3,733,456 acres are described as thin wood pasture.

2. Physiography: Undulating land. Main river is the Wabash. 692,738 acres are classed as waste lands in 1903.

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3. Distribution: Prairie only in some northern counties where the forest is said to be expanding. Entire balance of Indiana, 100 years ago, was heavily wooded with 12 species of oak, 3 of elm, 2 of walnut, 7 of hickory, 3 of maple, 3 of birch, 4 of ash, yellow poplar, linden, buckeye, black and honey locust, dogwood, catalpa, sassafras, hackberry, red mulberry, sycamore, ironwood, chestnut, beech, cottonwood, white pine, gray pine and Virginia pine, bald cypress, tamarack and red cedar. All trees show splendid bole development. The requirements of the farmer and home seeker have caused the forest to be considered a mere encumbrance of the ground. Only small groves now exist.

4. Forest ownership: 162 lumber firms, in 1900, owned 104,000 acres of woodlands. The rest is attached to farms.

5. Use of timber: Indiana leads the United States in the output of wagon stock (raw material), producing 33% of the entire output. In furniture stock, Indiana is second only to Ohio. One-half of Indiana's manufactures rely on the forest for their raw material. Log stumpage worth \$5.39 (maximum amongst Union States); logs at mill worth \$9.39 per 1,000 feet b. m. There are 1,829 saw mills of \$4,500 average investment.

Output of the lumber industry

In 1870 was	\$12,300,000
In 1880 was	14,300,000
In 1890 was	20,800,000
In 1900 was	20,600,000

The cut in 1900 was:—

Conifers	3,000,000 feet b. m.
White oak	646,000,000 feet b. m.
Other hardwoods ...	336,000,000 feet b. m.

Total.....985,000,000 feet b. m.

The leather industry, comparatively small, produces \$1,500,000 of leather and consumes 700 cords of hemlock bark, 7,000 cords of chestnut oak bark and 5,000 barrels of oak bark extract.

The pulp and paper industries are said to use 6,300 cords of domestic (?) spruce, 10,500 cords of Canadian spruce, 20,300 cords of poplar and 4,200 cords of miscellaneous woods, in addition to

FOREST POLICY.

a large quantity of rags and straw (120,000 tons). 39 mills produce \$4,200,000 of paper products.

6. Forestry movement: Recent, but energetic propaganda, influenced by John P. Brown (of Connersville).

State forest association.

7. Laws: Fire laws since 1818. A unique forest reservation law (of 1899) encourages private reserves. Such reserves (which must not exceed in acreage an eighth of a tract individually owned, trees per acre) are assessed at \$1 per acre only, whilst the average assessed value of farm land, in 1898, was \$20. In 1901 there existed 284 private reserves, covering 5,312 acres. Law of 1901 creates a Board of Forestry, consisting of five members, one of them drawing a salary (W. H. Freeman). Its duties are:—

(1) Collection of statistics.

(2) Forestry education.

(3) Formulation of plans for private and State forest reserves. Insufficient appropriations.

8. Reservations: 2,000 acres of State forest reserves are set aside by law of 1903, as a demonstration forest and for nursery purposes.

9. Irrigation: None.

FORESTRY CONDITIONS OF IOWA:

1. Area: Area of woodlands is 7,000 square miles, equal to 13% of area of State. Settlement has reduced the woodland area by 50%. Planted forests said to aggregate 120,000 acres.

2. Physiography: Level or undulating land, extending from the Missouri to the Mississippi.

3. Distribution: Broad bottom lands of the Mississippi bore, and still bear splendid hardwoods, the best in the southeastern section. In the western prairie section the streams are skirted with hardwood groves from one-half to 4 miles wide. Of the northeastern flora there occur in the hardwood bottoms: shag bark and bitternut hickory; burr, red, black and white oaks; green ash, hard and soft maple, box elder, basswood, white

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elm and butternut. From the southeast enter the Kentucky coffee tree, honey locust, swamp white oak, pin oak, laurel oak, red bud, Ohio buckeye, mocker nut, pecan and black walnut. The only conifers found are white pine, scattered in extreme north-east, and red cedar.

4. Forest ownership: Practically all woodland belongs to farmers. 43 lumber firms own 56,160 acres, stocked with 4,900 feet b. m. on the average acre.

5. Use of timber: Woodlands are used for pasture. During seasons of drought, young growth is frequently found dying. The lumber industry, in addition to the cooperage industry, is about to exhaust the fine hardwoods. Logs on stump are worth \$4.95; logs at mill, \$12.16 (maximum of the United States). Still there are now left 264 mills of \$18,885 average investment. The largest of these mills are located on the Mississippi River, and saw pine rafts coming from Minnesota and Wisconsin.

The value of the sawn product in 1870 and 1880 was \$6,000,000; in 1890 it was \$12,000,000; in 1900 it had dropped to \$8,700,000.

The output of the mills in the census year was 303,000,000 feet b. m. of conifers and 40,000,000 feet b. m. of hardwoods. Since there is but little white pine found in Iowa, it seems as if white pine, not home grown, composed the bulk of the output of softwoods. Lumbermen, however, are said to still own, inside the State, 231,000,000 feet b. m. of conifers (?).

Leather industry, none. Paper industry uses straw (12,350 tons of straw in census year).

6. Forestry movement: Arbor Day since 1874. Prairie planting still practiced, the favorite species being soft maple, green ash and box elder. The Agricultural College at Ames has given instruction in tree planting for almost 30 years.

7. Laws: Prairie fire law. A law exempting almost \$6,000,000 worth of property from taxation, in order to encourage tree planting, is now repealed.

8. Reservations: None.

9. Irrigation: No data available.

FORESTRY CONDITIONS OF KANSAS:

1. Area: 5,700 square miles, or 7% of the State's area, are wooded.

FOREST POLICY.

2. Physiography: Undulating prairies. Arkansas River, from Colorado, traverses the western half.

3. Distribution: A few yellow pines occur in the higher ridges of the western section, which is otherwise treeless, except for the fringes of poplar and willow in the river canyons.

The eastern section shows wide belts of hardwood forests along the streams, the best timber being found in the extreme southeast, where the heavy timbered outskirts of the Mississippi River hardwood bottom lands appear.

4. Forest ownership: About 1,000,000 acres of forest are said to be attached to farms. Not quite 8,000 acres are owned by 22 lumber firms, stocked with 3,500 feet b. m. on the average acre.

5. Use of timber: Lumber industry in Kansas has declined since 1880, when 146 establishments were cutting 45,000,000 feet b. m. of lumber.

In 1900 there were in existence 54 mills, showing lowest average investment in the United States, namely, \$1,070. Value of product, \$104,000, against \$683,000 in 1880. Log stumpage worth \$2.17; logs at mill, \$7.84 per 1,000 feet b. m.

Fuel and fencing are badly required by the farmers.

Lumber for building purposes obtained from the east and south.

Paper, pulp and leather industries: None.

6. Forestry movement: Usual Arbor Day enthusiasm.

The State Agricultural Board reports 119,000 acres planted in forest since 1884.

Some of the best catalpa plantations are found on rich prairie soil in Kansas. In 1885 the office of Commissioner of Forestry was created, issuing reports and distributing seedlings. The State Horticultural Society tries to centralize interest in tree planting and issues a Tree Planter's Manual. Kansas City boasts of employing a "Forester."

7. Laws: Bounty Law of 1868 is repealed. Wilful firing is fined \$500. It is the sworn duty of the justices of the peace to bring incendiaries to judgment.

8. Reservations: 94,732 acres of sandy land, south of Arkansas River, are withdrawn from entry to be used for planting trees. No presidential proclamation issued so far.

9. Irrigation: In the census year 24,000 acres of land were irrigated (2,000 acres from wells).

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The irrigated crop was valued at \$226,000. The construction expense of the irrigation system was \$530,000.

FORESTRY CONDITIONS OF KENTUCKY:

1. Area: Area of woodlands 22,000 square miles, or 53%.

2. Physiography: Ohio River on the north. Mississippi River on the west. The Big Sandy, tributary of the Ohio River, on West Virginia line. Cumberland Mountains in the extreme southeast, giving rise to the Kentucky River, which runs north into Ohio, and to the Cumberland River. Undulating plateau well watered.

The Cumberland Mountains, where limestone formation prevails, have coal and iron mines. Middlesborough about the center of the coal industry.

3. Distribution: Kentucky "barrens" in the southwest, very productive of tobacco, hemp and grain. Here the pioneers found big stumps called "stool grubs," the remnants of a splendid forest, probably burned by the Indians. The black oak forest (black jack, black post and Spanish oak) is gradually invading the "barrens."

The bottoms of the Ohio and Mississippi Rivers, subject to inundations, exhibit in the swamps bald cypress, sweet and black gum. On very wet soil, cottonwoods, cow oaks, gums, ashes and hickories of splendid development occur. On somewhat drier soil, beech, red oak, yellow poplar, white oak and burr oak prevail.

In the "Blue Grass Region," gigantic red cedars, walnuts, poplars, hickories, beeches, sycamores, lindens, locusts, coffee trees and white oaks have been cleared away, and only groves or fringes of these species are now left. In the mountain section, walnuts, chestnuts, chestnut oaks, yellow poplars, ashes, hickories, three maples, locusts, white, red and black oaks of splendid development form the bulk of the timber.

The section above the falls of the Cumberland River was practically untouched as late as 1880.

The pines form only a small percentage of the timber. White pine, accompanied by hemlock, occurs at the higher altitudes of the Cumberland Mountains. *Echinata* is scattered over

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the southern two-thirds of the State, especially in the east, never forming pure forests, groves on abandoned fields excepted. *Pinus Virginiana* seems to develop unusually good boles in the eastern half of State and is locally used for custom lumber. *Rigida* is found, like *echinata*, running up higher into the mountains.

4. Forest ownership: 208 mill firms own 382,000 acres of forest, having 4,700 feet b. m. average stumpage. After the 12th census this stumpage includes 125,500,000 feet b. m. black walnut, which figure seems largely overestimated.

5. Use of timber: The value of the sawn product was in

1850	\$ 1,500,000
1860	2,500,000
1870	3,600,000
1880	4,100,000
1890	7,900,000
1900	13,800,000

The cut in 1900 consisted of:—

Conifers	34,600,000 feet b. m.
Ash	4,900,000 feet b. m.
Black walnut	2,100,000 feet b. m.
Poplar	279,000,000 feet b. m.
White oak	392,800,000 feet b. m.
Other hardwoods	63,100,000 feet b. m.

Total776,500,000 feet b. m.

In the census year there were further produced 60,000,000 shingles, worth \$115,000; 63,000,000 (mostly) oak staves, worth \$1,042,000; 3,500,000 sets of heading worth \$234,000. Furniture, wagon and agricultural stock is valued at \$1,358,000. Kentucky ranks 6th in cooperage and 8th in miscellaneous timber industries. The ratio of forestry in wages, investments and products to all other industries, in 1900, was that of 14 to 100. 1,232 mills showed an average investment of \$4,658. Logs are worth on stump \$2.67, and \$6.86 at mill. Logging in mountains by oxen; elsewhere by oxen, horses and mules. Transportation largely by raft, or loose driving. Small portable mills in tracts far from rivers and railroads. Big mills on Cumberland River.

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Leather industry yields, in 1900, a product worth \$3,750,000, and uses 1,080 cords of hemlock bark, worth \$9,440; 29,840 cords of oak bark, worth \$22,400; 13,300 barrels of bark extract, worth \$139,000; besides some quebracho, gambier and sumac.

Paper and pulp industry is insignificant.

6. Forestry movement: Little; recently stirred up by Federation of Women's Clubs. Berea College gives, through Prof. S. C. Mason, excellent training in conservative forestry to farm boys. Agricultural reports allude to forestry and its importance.

7. Laws: In a number of counties the firing of woods is forbidden. Constables are required to extinguish fires at expense of county.

8. Reservations: None.

9. Irrigation: None.

FORESTRY CONDITIONS OF LOUISIANA:

1. Area: 28,300 square miles, or 62% of the total area of the State, are wooded.

2. Physiography: Undulating land, alluvial soil, river bottom lands subject to continuous inundations. Mississippi River forms the eastern line. Red River of the South traverses the State from northwest to southeast. Sabine River is on the Texas line; the Pearl River on the lower Mississippi State line. A multitude of water-courses form a help to the utilization of the forest and to the prevention of fires.

3. Distribution: After the 12th census, the southwest portion is prairie. Long leaf pine in two large bodies, separated by the Red River, aggregating 4,300,000 acres of densest stumpage (4,000 to 6,000 feet and over per acre) often untouched. No Cuban pine. Echinata and Taeda extend from Red River northward to State line. The former species frequently shows an undergrowth of Spanish oak, black jack, post oak and hickories. Cypress grows in enormous swamps, with red gum and black gum. Along rich bottoms, evergreen magnolias, water oaks, red oaks, gums, cottonwoods, burr oak, white ash, pecan, persimmon, sassafras and beech. In drier localities, cow oak and burr oak.

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4. Forest ownership: The State owns large swamp tracts. The farmers own 35% of all the woodlands. 170 lumber firms own 1,500,000 acres of 6,700 feet average stumpage.

5. Use of timber: The use of cypress for cooperage was large as early as 1880, when the pine woods were still untouched. The main center of long leaf pine mills is now at Lake Charles (Calcasieu River). Main center of short leaf pine mills is at Shreveport (Red River).

In 1900, 405 mills existed, of \$25,800 average investment. Logs were worth, in 1900, on stump, \$1.22, and at mill, \$5.59.

New Orleans is not a mill center, but is the largest southern shipping point of the lumber and cooperage industry.

Moss ginning is an industry turning out, in 1880, \$550,000 worth of material. There are no later statistics. Turpentine is only recently introduced, tending to ruin the prospects for conservative lumbering, owing to the danger of fire connected with it. In 1880, Sargent's fire statistics show a loss of \$6,000 worth of timber only, virgin pine being fireproof and the other species protected by swamps. Sargent, in 1880, estimates the stand of pine at 48,200,000,000 feet b. m. The products of the lumber industry are valued, in 1880, at \$1,700,000; in 1890, at \$5,700,000, and, in 1900, at \$17,400,000; a very rapid increase.

The cut in 1900 consisted of 1,200,000,000 feet b. m. (800,000,000 yellow pine, 340,000,000 cypress, 50,000,000 cottonwoods, 5,000,000 white oak). The average stand of white oak is said to be 7,800 feet b. m. per acre (?). Swamps cleared of cypress are doomed to lie barren.

No pulp industry.

Three small leather concerns use a few cords of oak bark, sumac and a few barrels of extract.

6. Forestry movement: None.

7. Laws: Unknown.

8. Reservations: None.

9. Irrigation: Louisiana, leading the States of the Union in rice production, irrigates from water-courses and from wells 202,000 acres of rice fields.

The cost of the irrigation system averages only \$12.54 per acre.

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FORESTRY CONDITIONS OF MAINE:

1. Area: Woodlands comprise, after 12th census, 23,700 square miles, or 79% of State. In 1893 the State assessor reports only 15,000 square miles of forest.

After report of the forest commissioner in 1903 forest lands comprise 21,000 square miles, and 14,800 square miles are taxed as "wholly wild land."

2. Physiography: The north and northwest are said to be mountainous. Mount Katahdin, the highest peak, is 5,385 feet high. The south and southeast is hilly. Lakes, valuable for forest transportation, are found all over the State. The coast line is deeply indented. The most important rivers are the Androscoggin, Kennebec, Penobscot and St. John, the latter on and close to the New Brunswick line. 18,000 square miles are absolute forest land.

3. Distribution: The conifers of the northern pine belt (white pine, red spruce, white spruce, hemlock, balsam, tamarack, white cedar) occur mixed with maple, white and yellow birch, beech, ash, oak, hickory and basswood in varying proportions. Large bodies of hemlock used to exist in the southeast. Valuable bodies of poplar are found, especially on the Kennebec. Only the immediate coast region between the Kennebec and Penobscot lacked the conifers.

The State is largely cleared in the south, and the north is culled of its white pine. Pulp wood has been removed from one-half of the wild lands. Still lumbermen alone in 1900 were reported to be owners of over 1,000,000,000 feet b. m. of white pine. Good second growth of white pine is found all over the southern counties. Regeneration of spruce is frequently met beneath an ushergrowth of gray and white birch, poplar and pine.

The sustainable yield of the spruce woods amounts to 637,000,000 feet b. m. (after Ralph S. Hosmer) per annum.

Forest Commissioner E. E. Ring publishes the following figures as the result of recent explorations:—

Stumpage of coniferous timber (9 inches and over in diameter) in million feet b. m.

Drainage System.	St. John River.	Penobscot River.	Kennebec River.	Androscoggin River.	Ten Minor Rivers.
Spruce	6,942	5,166	3,883	3,248	2,000
Pine	427	153
Cedar	1,830	438

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4. Forest ownership: 204 saw-mill firms own 2,108,000 acres of 2,000 feet (only?) stumpage. Paper firms own several hundred thousand acres of woodland, largely cut over. 22.4% of woodland is attached to farms.

5. Use of timber: The State contains 832 saw mills, of \$11,754 average investment. Stumpage costs \$2.52; logs at mill, \$8.15 per 1,000 feet b. m.

Value of output of saw mills and timber camps was:—

1850	\$ 5,900,000
1860	6,600,000
1870	11,400,000
1880	7,900,000
1890	11,800,000
1900	13,500,000

The cut for saw mills in 1900 consisted of:—

Spruce.....	425,000,000 feet b. m.
White pine.....	220,000,000 feet b. m.
Hemlock.....	89,000,000 feet b. m.
Other conifers.....	87,000,000 feet b. m.
Hardwoods.....	29,000,000 feet b. m.

Total.....850,000,000 feet b. m.

There were produced in the census year \$903,000 worth of shingles, \$408,000 worth of cooperage stock, \$364,000 worth of lath, \$600,000 worth of boxes, \$20,000 worth of baskets and wood-ware, \$294,000 (60% of output of United States) worth of bobbins and spools (white birch) (Ring reports a production of 800,000 spools, worth \$1,000,000, for 1903).

The hardwood industries are increasing with the expansion of the railroads ("Hardwood Novelty Mills"). Modern lumbering is astonishingly conservative and never destroys the chances of a good second growth. Conservative lumbering in pure spruce woods ("black growth") is, however, apt to be followed by sweeping blow-downs. Logging for pulp, consuming about 275,000,000 feet b. m. annually, is less wasteful than logging for lumber. Saw mills, on the other hand, are less interested in permanent supplies than pulp mills. Average age of spruce logs is about 200 years. The use of the cross-cut saw is novel in the Maine woods. Logs are usually peeled (which requires summer cutting), and

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long lengths of logs are held out. Railroading is gradually superseding river driving.

Leather industry: 31 firms produce \$2,451,000 worth of leather and consume 40,600 cords of hemlock bark, worth \$229,000; 4,000 cords of oak bark, worth \$28,000; 1,080 bales of gambier, worth \$7,370; 200 barrels of extract, worth \$2,740; 125 tons of sumac, worth \$7,675; chemicals, worth \$5,615.

Paper and pulp industry: 35 mills produce in the census year \$13,200,000 worth of material and consume: home-grown spruce, 265,000 cords, worth \$1,325,000; Canadian spruce, 20,600 cords, worth \$170,000; home-grown poplar, 49,000 cords, worth \$199,000; Canadian poplar, 500 cords, worth \$1,700; other pulp-wood, 6,500 cords, worth \$21,700.

6. Forestry movement: Public sentiment is aware of the inter-dependence between the State's prosperity and the safety of the forest; hence forest fires are not allowed to roam at random. The memory of famous fires, like the Miramichi fire of 1825, has helped to mould public opinion. The fire warden system, however, is still inadequate.

The public are interested in developing the resort character of the woods. Pine offspring in farming sections is carefully husbanded.

Good reports by Chas. E. Oak and Austin Cary in 1894 and 1896; by E. E. Ring in 1902.

7. Laws: The State Land Agent (now E. E. Ring) acts as Forest Commissioner, since 1891. His duties are:—

- (1) Forestry education, through public schools.
- (2) Preparation of circulars relative to care of woodlands, to be furnished upon application to any citizen of the State.
- (3) Distribution of fire reports (blank forms) amongst fire wardens.
- (4) Posting fire law notices.
- (5) Collecting forest, lumber and fire statistics.
- (6) Prevention, control and extinguishment of forest fires in unorganized townships.

Guides are licensed and charged with protection of the forest.

Fire wardens are

- (a) In unorganized townships appointed by the forest commissioner (since 1903), paid by the State at the rate of \$2 per day. Helpers summoned by the warden are paid 15c. per hour. An

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emergency fund of \$10,000 annually is set aside for this purpose by the legislature.

(b) In organized towns recruited from the selectmen, each selectman serving ex officio as warden for a specified district, at the expense of the town, which also pays for helper's services.

The fire wardens shall submit to the forest commissioner reports on the extent, damage and cause of forest fires; further, on the remedial measures taken to subdue fires within their wardships.

Fire wardens seem, however, not punishable for neglect of duty.

The forest commissioner has, unfortunately, no control over the fire wardens in organized towns.

8. Reservations: None.

9. Irrigation: 11 farms irrigate 17 acres for truck production.

FORESTRY CONDITIONS OF MARYLAND:

1. Area: 4,400 square miles, or 44% of State. After 12th census very little of wooded area contains merchantable timber.

2. Physiography: Three sections.

Western section in Alleghanies and Blue Ridge Mountains, with altitudes of over 3,000 feet. The Potomac, forming the West Virginia and Virginia line, breaks through the Blue Ridge on extreme east corner of West Virginia.

The middle section presents a plateau, falling from the Blue Ridge down to Chesapeake Bay.

The eastern section of lowlands consists of two peninsulas formed by the Chesapeake Bay, Potomac River and Delaware Bay.

3. Distribution: The mountain section was, originally, heavily timbered with white pine, hemlock, maple, birch, beech and spruce—the Adirondack forest at an elevation 1,000 feet higher than it is found in the Adirondacks. Now little virgin forest is said to be left.

The central section was, originally, covered with hardwoods. Now chestnut coppice prevails, or a second growth of white oak, black oak, hickories and gum.

The eastern peninsula shows a second or third growth of pitch and scrub pine, mixed with hardwoods.

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4. Forest ownership: 114 firms own 66,928 acres of 3,700 feet b. m. average stumpage.

5. Use of timber: The lumber manufacture has never been prominent in Maryland. After the census reports, however, it continues growing, in spite of the lack of primeval supplies. The output of the Maryland mills was valued in

1850	\$ 585,000
1860	605,000
1870	1,501,000
1880	1,813,000
1890	1,600,000
1900	2,650,000

The cut in 1900 consisted of:—

Yellow pine	79,000,000 feet b. m.
Hemlock	21,200,000 feet b. m.
White pine	1,600,000 feet b. m.
Spruce	3,500,000 feet b. m.
Miscellaneous conifers	4,300,000 feet b. m.
Oak	66,000,000 feet b. m.
Chestnut	5,000,000 feet b. m.
Poplar	5,000,000 feet b. m.
Miscel. hardwoods ...	2,300,000 feet b. m.

Logs on stump are worth \$2.92; at mill, \$6.75. 366 mills represent an average investment of \$3,643.

The cooperage industry was important in olden times; had greatly declined in 1880, and depends in 1900 almost entirely on the use of imported cooperage stock, turning out \$700,000 worth of products. The home grown staves and headings are worth only \$15,000. No furniture stock and little carriage stock is obtained inland.

The box factories turned out, in 1900, \$1,800,000 worth of boxes, and seem to depend on imported stock for raw material.

Leather industry: There are 21 tanneries of \$1,754,000 annual output. They consume 3,116 cords of hemlock bark, valued at \$21,888; 12,087 cords of oak bark, valued at \$80,603; 309 barrels of oak bark extract; 111 tons of sumac and chemicals; 25 tons of quebracho.

The paper and pulp industry produces, in 21 mills, \$2,600,000 worth of products and uses 23,229 cords of home-grown spruce,

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worth \$147,615; 4,616 cords of poplar, worth \$30,825; 20,623 cords of other woods, worth \$135,825.

6. Forestry movement: None.

7. Laws: A bill, failing in 1902, provided for:—

(a) State Board of Forestry, consisting of three members, one to be a scientific forester, two to be owners of 100 acres of farm land. Commissioners hold office at Annapolis, are supplied with a secretary and receive \$600 each annually. Their duty is to purchase woodland at the headwaters, at a price not to exceed \$8 per acre, or else deforested land in other sections of the State. No price limit is given for the latter purchases. An appropriation of \$30,000 annually is set aside for land purchase, and \$6,000 for salaries and expenses.

(b) Bounties of 10 cents a tree shall be paid for every locust, black walnut, hickory, red and black oak planted according to certain regulations; also a bounty of 5 cents for every chestnut thus planted and for trees of other species fit for fence posts. \$5,000 are annually provided for bounty payments.

Only malicious firing is punishable.

8. Reservations: None, the above cited reserve law having failed to pass.

9. Irrigation: None.

FORESTRY CONDITIONS OF MASSACHUSETTS:

1. Area under forest: After 12th census, 4,200 square miles, or 52% of the State, are wooded. A State canvass of 1885 gives, however, only 1,390,000 acres of woodland classed as follows:—

317,000 acres of timber over 30 years old.

993,000 acres of growth under 30 years old.

6,000 acres of planted forest,

74,000 acres of woodland not classified.

2. Physiography: The western half of the State is mountainous. Here the Taconic and Hoosac Ranges, with the Berkshire Hills, rising in Mount Graylock to 3,535 feet elevation. The eastern half is hilly, or flat in the southeastern peninsula.

3. Distribution: Massachusetts forms part of the northern pine belt, stocked originally with white pine, hemlock and spruce, mixed with hardwoods in varying proportions. The hard-

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wood coppice now existing consists of maple, chestnut, oaks, gray birches, hickories and pitch pine. Scattering red cedar and a few groves of white pine or hemlock are frequently met.

4. Forest ownership: The Boston park system now aggregates 6,784 acres. 162 lumber firms own 41,000 acres of 9,000 feet b. m. stumpage. Cities near South Orleans, after Sargent, have fully 10,000 acres planted in pitch pine. The balance of the woodlands is attached to farms.

5. Use of timber: Stumpage costs \$2.64; logs at mill, \$9.49. 534 saw mills, the larger ones placed along the Connecticut, report an average investment of \$7,518. The value of the sawed output is constantly rising:—

1850	\$1,500,000
1860	2,200,000
1870	3,500,000
1880	3,100,000
1890	5,200,000
1900	6,500,000

The cut of the mills in 1900 consisted of:—

Spruce	29,000,000 feet b. m.
White pine	261,000,000 feet b. m.
Hemlock	12,000,000 feet b. m.
Other conifers	2,000,000 feet b. m.
Chestnut and oak	42,000,000 feet b. m.

Total 346,000,000 feet b. m.

A large proportion of this cut seems, however, to have originated in Vermont and New Hampshire.

Farm lots are said to produce nearly 600,000 cords fire wood and over 400,000 railroad ties.

Woodenware, manufactured from second growth white pine, forms an important industry (notably near Winchendon).

Large production of hoop poles. The miscellaneous industries are otherwise insignificant. The box, casket and barrel industries rely entirely on stock imported from other States for a production valued at \$5,500,000 per annum.

Leather industry: Massachusetts is second only to Pennsylvania in leather production. 119 plants produce \$26,000,000 worth of leather and consume 62,000 cords of hemlock bark, worth

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\$498,000; 1,000 cords of oak bark, worth \$9,000; 15,500 bales of gambier, worth \$106,000; 17,000 barrels of extract, worth \$170,000; 3,600 tons (!) of sumac, worth \$190,000; 500 tons quebracho, worth \$8,000; chemicals worth \$307,000.

Paper and pulp industry: Massachusetts is second only to New York in these industries; still her consumption of wood is small, consisting of home-grown spruce, 21,200 cords, worth \$110,000; Canadian spruce, 13,800 cords, worth \$113,000; home-grown poplar, 3,000 cords, worth \$18,000; other wood, 1,000 cords, worth \$5,000. Enormous amounts of rags, manilla, waste paper; further, imported pulp and fiber form the chief raw material.

6. Forestry movement: The Massachusetts Forestry Association is backed by wealthy and educated tree lovers, and employs a forester (T. F. Borst). The Arnold Arboretum, at Jamaica Plains, offers unrivalled advantages to the student of dendrology. Chair of forestry at Harvard since 1903.

7. Laws: The selectmen of towns appoint annually one or more fire wardens, paid according to the pleasure of the town. Unique and interesting is a law allowing cities and towns to contract loans and to secure State contributions (50% of expense) for forest park purposes. Tax exemptions are granted for ten years on plantations, consisting of 2,000 saplings over 4 feet high (per acre), made on abandoned fields. Sand dunes at Cape Cod are being replanted under State law.

8. Reservations: City reserves are small, but of great local importance. Three State reserves, called the Mount Tom, Graylock and Wachusett State Parks, were established in 1902 and placed in charge of a State forester.

9. Irrigation: 28 farms irrigate 134 acres, for truck production.

FORESTRY CONDITIONS OF MICHIGAN:

1. Area: Area of woodland, inclusive of stump land, is 67% per cent of State area, or 38,000 square miles. Fernow gives 38% only.

2. Physiography: Two peninsulas. Ground level or undulating with sandy or gravelly ridges. Splendid shipping facilities via the lakes. Rivers important in the white pine industry are the Muskegon, Manistee, Shiawassee, Kalamazoo and Saginaw.

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3. Distribution: Prairies only in the extreme south of the lower peninsula. South of the 43d degree of latitude, broad-leaved species prevail on land pre-eminently fit for agriculture. Here are found elm, ash, basswood, maple and white oak of splendid development.

The northern part of the lower peninsula and the entire upper peninsula were occupied by the famous pineries of Michigan, sprinkled with swamps of tamarack, cedar, spruce and balsam, and sand barrens stocked with jack pine, poplar, birch and scrub oak.

In the pineries there are mixed with the white pine, often as an undergrowth, ash, sugar maple, beech, oaks, hemlock, basswood, elm.

In 1880 the standing hemlock was estimated to be seven billion feet b. m., carrying seven million cords of bark.

The maple sugar industry is important, Michigan ranking third in 1880.

4. Forest ownership: The State claims 3,000,000 acres of so-called tax homesteads, which are held for sale to ignorant immigrants.

320 lumber firms own 2,750,000 acres stocked with 5,300 feet b. m., on an average.

In the southern section wood lots are usually owned by farmers.

5. Use of timber: From 1862 to 1887 the State produced \$870,000,000 worth of white pine. In 1880, Sargent reports for white pine a growing stock of 35,000,000 feet b. m., whilst Fernow, in 1896, estimates it at 6,000,000 feet b. m. (underestimate). Another five years will, probably, bring about the end of the white pine in Michigan.

In lumber production Michigan has recently lost its leadership, held since 1870, to Wisconsin. The value of the saw mill products was in

1850	\$ 2,500,000
1860	7,000,000
1870	32,000,000
1880	52,000,000
1890	83,000,000
1900	54,000,000

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The cut of 1900 consisted of:—

White pine	1,300,000,000 feet b. m.
Hemlock	850,000,000 feet b. m.
Cedar	370,000,000 feet b. m.
Other conifers	110,000,000 feet b. m.
Ash	86,000,000 feet b. m.
Basswood	46,000,000 feet b. m.
Elm	110,000,000 feet b. m.
Maple	400,000,000 feet b. m.
White oak	135,000,000 feet b. m.
Other hardwoods...	52,000,000 feet b. m.

Logs are worth on the stump \$3.06; at mill, \$7.60.

1,613 mills of \$20,900 average investment are reported. Michigan still leads the United States in the value of miscellaneous forest products (furniture, wagon, agricultural, cooperage and flooring stock), the output being \$6,700,000.

In the shingle production, worth \$3,200,000, it is second only to Washington. The splendid railroad systems developed in the past now facilitate the logging of hardwoods. A State census of 1884 estimates the cord wood consumption at 5½ million cords annually, worth 8.9 million dollars.

Paper industry uses 12,300 cords of home-grown spruce and 83,000 cords of Canadian spruce. Total value of product is \$4,200,000, for 1900.

Leather industry consumes in census year, in 27 tanneries, 62,000 cords of hemlock bark, valued at \$498,000; 1,000 cords of oak bark, valued at \$8,800; 3,700 barrels of hemlock bark extract, worth \$45,000, and 13,500 barrels of oak bark extract, worth \$124,000.

6. Forestry movement: The impediments to conservative forestry are: Agricultural qualities of white pine soil, excessive taxation, total lack of means to check fires, difficulty of conservative lumbering in scattering holdings of virgin woods subject to wind fall.

In 1875 a forestry commission was created, dying after two years of existence.

In 1887 the State Board of Agriculture was constituted as a "Forestry Commission." Forestal agitation is lead by Senator C. W. Garfield, assisted by the university, the agricultural college, farmers' institutes and women's clubs.

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In 1899 the "Forestry Commission" (appropriation \$2,000 annually) was revived as a commission of inquiry and legislative advice. It consists of three scientific members, but no lumbermen. Allowance \$2,000 a year, to be spent for gathering statistics. A department of forestry was established in 1901 at the State University (now under Dr. F. Roth), and 57,000 acres of land forfeited for non-payment of taxes were turned over to the commission to be worked for two years. In lieu of these 57,000 acres a recent law has turned over to the commission all State holdings in three townships at the head waters of the Muskegon River. By the aid of a continuous appropriation of \$7,500 a year, the commission is gradually acquiring the contiguous lands, so as to make these reserve holdings more solid. The attempt of reserving all land forfeited for non-payment of taxes (and of a protective character) for State reserves failed in 1901.

7. Laws: Fire laws since 1817. Not enforced. Loss from fires reported by Sargent is \$1,000,000 in 1880.

8. Reservations: Now 64,000 acres at the head of the Muskegon River.

9. Irrigation: None.

FORESTRY CONDITIONS OF MINNESOTA:

1. Area: Woodlands, inclusive of stump land, cover 52,000 square miles, an area equal to 66% of the State. Stand of white pine after Sargent, in 1880, eight billion feet b. m.; after Gen. C. C. Andrews, in 1895, seventeen billion feet b. m.; after Horace B. Ayres, in 1900, twelve billion feet b. m.

2. Physiography: Undulating. 10,000 lakes and lakelets, the largest being Red Lake, Leech Lake and Millelac Lake. A multitude of swamps increase in size and number towards the north. Hills are rare. The Rainy River and Rainy Lake form the boundary line towards Ontario; the St. Louis River empties at Duluth; the St. Croix River runs on the Wisconsin line; the Red River on the Dakota line; the Mississippi starts in Lake Itasca and is navigable from Minneapolis southward.

3. Distribution: Two-fifths of the State is prairie, adjoining the Dakota and Iowa lines; another fifth, next to prairie, shows hardwoods prevailing over the softwoods; the remaining two-fifths is pine land and swamp land.

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The northwestern pine belt of the United States reaches its western limit in Minnesota. The species prevailing in the hardwood belt are black oaks, sugar maple, birches and cottonwood. In the pine belt, white pine, Norway and jack pine are found, according to the soil. The poorer the soil, the more jack pine. White pine occurs, usually, with an undergrowth of linden, maple and hazel. In the swamps, black spruce, balsam, white spruce, white cedar and tamarack. On the wind-swept side of lakes, conifers are missing. No hemlock is found, a fact denied by H. B. Ayres. Birches and poplars occupy cut-over white pine land and secure, acting as nurses or ushers, if fire is kept out, a gradual recurrence of white pines. White pine underneath white pine is never found, whilst Norway pine immediately replaces Norway pine, and whilst jack pine invariably follows in jack pine's wake.

4. Forest ownership: 85 lumber firms own 2,025,000 acres of 3,900 feet average stumpage per acre. State owns between 2 and 3 million acres of land forfeited for non-payment of taxes. The United States own enormous tracts still. 30 townships remain unsurveyed north of the continental divide. Large Indian reserves.

5. Use of timber: The value of the products of the lumber industry in Minnesota gives it third rank as a lumber producing State. Minnesota came slowly to the front, having in 1880 an output of \$7,400,000; in 1890, \$25,000,000, and in 1900, \$43,600,000.

The cut in 1900 consisted of:—

White pine	2,250,000,000 feet b. m.
Norway pine	108,000,000 feet b. m.
Other conifers	20,000,000 feet b. m.
Spruce	1,000,000 feet b. m.
Hardwoods	62,000,000 feet b. m.

Total 2,441,000,000 feet b. m.

The miscellaneous industries (furniture, cooperage, wagon stock, flooring, spools, etc.) yielded, in 1900, only \$1,300,000. White pine and hardwoods in Minnesota are, on the average, inferior to white pine and hardwoods in Wisconsin and Michigan.

404 saw mills of \$60,848 average investment (maximum investment, by far, of United States). Logging by rail is taking the place of log driving, on which the mills of Minneapolis used

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to depend. Skidding by horses during the winter months forms the rule. Sleighing over ice roads to the lakes or rivers. Wages of workmen about \$28 (with full board) per month. Large amount of timber consumed by the iron mines of northeastern Minnesota. Logs are worth \$3.40 on stump, and \$8.09 at mill.

The leather industry is small, hemlock lacking. Nine tanneries use 107 cords of bark, 37 barrels of extract and a little gambier and quebracho.

Relative to paper and pulp industry, no data are given by the 12th census. Possibilities are very good, since there is plenty of spruce. Big Weyerhaeuser mill near Duluth.

6. Forestry movement: Since 1876 a forestry association encourages prairie planting. Bounties for prairie planting since 1891. Arbor Day since 1883-1884. The Hinckley fire, of September 1, 1894, through which a large number of lives and many millions of dollars worth of stumpage were lost, caused the creation of a forest fire warden system, effective enough to prevent a second Hinckley conflagration, but insufficient for the absolute safety of forestal investments. The legislators hailing from the prairies antagonize outlays benefitting the wooded portion of the State. The State auditor is "forest commissioner."

Town supervisors and the mayors of cities are constituted fire wardens and are fined for neglect of duty. Remuneration only \$2 per day for not to exceed 15 days annually (two-thirds paid by county and one-third by State). The chief fire warden (\$1,200 salary) is appointed by the State auditor; he maintains and superintends the activity of the fire wardens; has authority to mass them at points of danger; controls an emergency fund of \$5,000 for suppression of fires. Annual forest statistical reports of great value, by General C. C. Andrews.

Forestry lectures by Prof. S. B. Green at the Minnesota State College of Agriculture.

The proposition to establish a national park at the Chippewa Indian reserve ceded to the United States was enthusiastically upheld by the Minnesota Federation of Women's Clubs and by the railroads. The influence of the lumbermen caused partial defeat of the park bill. As the law stands, the agricultural lands of the Chippewa reserve are to be opened to settlers; the pine lands, after the timber is sold at public auction, will form (without the President's proclamation) a national forest reserve. 5%

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of the timber, however, will be left according to the selection of the Bureau of Forestry.

The friends of forestry now endeavor to obtain a national park in the northeast, close to Lake Superior.

7. Laws: "Staples bill" forbids the removal of timber previous to payment of back taxes.

"Cross bill," of 1899, makes State forestry feasible on land either donated by lumbermen or set aside by the State for reserve purposes. Practically no appropriation and practically no donations. Companies are forbidden to own over 5,000 acres of land. Fire warden law, see under "forestry movement."

8. Reservations: The Lake Itasca State forest reserve is insignificant.

The Chippewa or "Minnesota National" forest reserve will be gradually established after timber is sold, and is expected to finally comprise 225,000 acres.

9. Irrigation: None.

FORESTRY CONDITIONS OF MISSISSIPPI:

1. Area: Area of woodlands, 32,300 square miles, or 70%.

2. Physiography: Alluvial and diluvial soil. Huge bottoms between Mississippi and Yazoo Rivers. The Pearl River on the Louisiana line. The Tombigby River drains the north-eastern part.

3. Distribution: Originally the forest was half pine and half hardwood. Long leaf pine prevails in the south, extending northward to the latitude of Vicksburg and Meridian, on sandy soil, especially on former dunes. A belt along the Mississippi, some 30 miles wide, is free from long leaf pine. Cuban pine, with the long leaf, up to 60 miles from the coast, occupies moist soil, on which it regenerates freely. It is not found west of the Pearl River. Echinata is not found close to the coast, beginning where Cuban pine ends. It often appears mixed with long leaf and taeda pine, and prevails on the divide separating the Tombigby from the Yazoo Rivers on 5,000 square miles. Trees are more scattering than in Texas and Arkansas, the hardwoods taking a larger share in the composition of the forest. Taeda occurs everywhere east of the Yazoo, from the coast up to the Tennessee line, under the name of short straw pine, lob-

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lolly, swamp, slash and rosemary pine. It occupies moister and more loamy soil, and is often found in inundation districts. The undergrowth or suite consists of black and sweet gum, red oak and magnolia on wet soil; of hickories, Spanish oak and black jack on drier soil. Spruce pine (*glabra*) occurs in small clumps on rich, terraced soil. Cypress fills huge swamps along the Mississippi and Yazoo Rivers. White cedar occurs, with taeda, in half-swamps.

In the bottom lands are found cottonwood, both gums, white oak, cow oak (prevailing); Texan oak, water oak (*nigra*), magnolia and beech. Further, walnut, shagbark hickory, yellow poplar, sycamore, mulberry, elm and holly. Burr oak and red oak are here wanting. Overcup oak (*lyrata*) occurs under the name "swamp oak."

4. Forest ownership: 349 firms own 1,214,000 acres, stocked with 7,600 feet b. m. per acre. The United States, the State and railroads, notably the Mobile and Ohio, own large tracts. The balance is owned by farmers.

5. Use of timber: In the census year, 820 mills of \$9,400 average investment. In 1900, log value on stump, \$1.30; at mill, \$4.60. The output of the saw mills was valued in

1880 at	\$ 1,900,000
1890 at	5,700,000
1900 at	15,600,000

The cut in the census year consists of

Yellow pine	964,000,000 feet b. m.
Other conifers	37,000,000 feet b. m.
Cottonwood	39,000,000 feet b. m.
Red gum	23,000,000 feet b. m.
White oak	102,000,000 feet b. m.
Other hardwoods ...	42,000,000 feet b. m.

Total.....1,207,000,000 feet b. m.

Hardwood logging is very expensive; yellow pine logging, with four yoke of oxen hitched to a high-wheel cart, is very cheap. The average logging distance, for pine, slightly exceeds one-third of a mile. Expense of logging (cutting and hauling), \$1.25; of railroading, 50 cents per 1,000 feet b. m.

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Railroad grades are fearful. Minimum log diameter of long leaf pine admitted is 10 inches. Average log size about 220 feet b. m.

Turpentine industry is now tapping the pole-woods as well as the tree-woods. Lumbermen box two or three years before cutting. *Echinata* and *heterophylla* as well as *palustris* are boxed.

Leather industry: Insignificant.

Paper and pulp industry: None.

6. Forestry movement: None.

7. Laws: Firing on vacant land is allowed only during the three spring months. On appropriated land, malicious firing only is prohibited.

8. Reservations: None.

9. Irrigation: In 1899, 40 acres were irrigated; 30 acres in rice and 10 in truck.

FORESTRY CONDITIONS OF MISSOURI:

1. Area: 41,000 square miles, equal to 60% of the area of the State, are classed as woodlands.

2. Physiography: The Mississippi River forms the eastern line; the Missouri River traverses the State from west to east. Undulating plains. Highest mountains are the Ozarks, from 800 feet to 1,000 feet high.

3. Distribution: The northwestern portion is prairie, with the usual forest groves along the rivers. The south-southeastern part exhibits short leaf pine (*echinata*) on the hills, notably on the Ozarks, alternating with stretches of post oak barrens. The undergrowth underneath pine is formed by oaks (scarlet, black, post, white), hickories and black gum. Altogether, 3,000,000 acres of pine are said to be found, the average stumpage being only 2,000 feet b. m. (after Mohr, often 3,000 to 4,000 feet b. m.). The lower dells of the east, south of the Missouri, show splendid broad leaf forests, where oak, walnut and ash, of prime quality, are still found away from the railroads. In the deep swamps of the southeast, cypress and tupelo gum prevail. In shallow water, swamp maple, swamp plane tree, swamp white ash and water honey locust occur. In the damp woods, gigantic cottonwoods, burr oaks, gums and cypresses. Here, perhaps, is

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the best remaining supply for white hickory. Gigantic Texan oak, sweet gum, willow, water and scarlet oak are also met.

4. Forest ownership: In south, much forest owned by speculators. 274 lumber firms control 869,545 acres, of 5,500 feet b. m. average stumpage. Farmers own two-thirds of woodlands. State owns 500,000 acres.

5. Use of timber: 1,169 (!) mills, with an average investment of \$5,336, beset the forests. Large cooperage concerns using cottonwood, elm and oak. White oak cut for railroad ties and bridge timber. Stumpage price averages \$1.89. Logs at mill worth \$6.91.

Leather industry uses 774 cords of hemlock bark, 2,936 cords of oak bark and 869 barrels of bark extract. Output of industry, \$816,000.

The cut of the census year was:—

White oak	250,000,000 feet b. m.
Pine	269,000,000 feet b. m.
Cypress	10,000,000 feet b. m.
Cottonwoods	76,000,000 feet b. m.
Elm	28,000,000 feet b. m.
Red gum	51,000,000 feet b. m.
Other hardwoods	35,000,000 feet b. m.

No paper and pulp industry. Value of saw mill products rose from 6.3 million dollars, in 1870, to 11.2 million dollars in 1900.

Hardwood bottoms are invariably thought to be convertible into excellent farm lands.

6. Forestry movement: Arbor Day established in 1886. Forestry lectures at State Agricultural College. Residents seem to vie with one another to steal the timber belonging to non-residents.

7. Laws: Fire fines up to \$500. No inclination of jurors to punish timber theft and incendiarism.

8. Reservations: None.

9. Irrigation: No data available.

FORESTRY CONDITIONS OF MONTANA:

1. Area: 42,000 square miles, or 29% of State, is wooded.

2. Physiography: The 109th meridian divides Montana in half. The eastern half consists of high plains fit for pasture

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only, traversed by the Missouri and Yellowstone Rivers, the courses of which are cut 600 to 900 feet deep into the plateau. This eastern half contains, practically, no forests.

The western half contains barren land only in the extreme north (Maria River Basin). Three main mountain chains may be distinguished in the western half.

(1) The Coeur d'Alene and Bitter Root Mountains on the Idaho line. Water runs towards the Pacific from both slopes via Columbia River.

(2) The main Rockies, lying between the Flat Head Basin and the Missouri River, which drain westward on the west slope and eastward on the east slope.

(3) The northern extension of the Yellowstone Range extending northward to the center of the State. Water runs from both slopes entirely towards the Atlantic, via the Yellowstone and Missouri Rivers.

All these mountains are less rugged and by 3,000 feet lower than those in Colorado and Wyoming.

3. Distribution: The best forests of Montana and of the entire Rockies are found in the chain of the Coeur d'Alene and Bitter Root Mountains. On the mountain chain forming the crest of the continent the forests are equal to the best of those in Wyoming. On the third mountain range, draining solely eastward, the forests are equal to those of the Yellowstone region.

The western cedar (*plicata*) is scarce and small. It is found in best valley soil only at low elevations. Lowland fir and Engelmann's spruce occur in moist bottoms associated with Douglas fir. Lodgepole pine forms very extensive forests at medium altitudes. Limber white pine and balsam (*lasiocarpa*) are found in great bodies, especially on the eastern drainage; larch, white pine (*monticola*) and hemlock prevail on mountains draining towards the west. Along the rivers, cottonwoods and box elders occur. Quaking aspen replaces the conifers after heavy burnings on north slopes.

4. Forest ownership: Lumbermen own very small tracts only, since taxes are high. Indian reservations and railroad grants cover large tracts. (Northern Pacific and Great Northern Railroads.) The forest reserves cover about 7,500,000 acres. Over one-fifth of Montana still belongs to the United States.

5. Use: The mining interests of Montana stand paramount. Montana is second in the production of gold and silver,

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and first, by far, in the production of copper, amongst the States of the Union.

Next in importance are the livestock interests. The stock consists of:—

- 1,000,000 cattle.
- 2,800,000 sheep.
- 200,000 horses.

The forest is meant to subserve the mines, supplying props, fuel and ties; and agriculture, supplying water for irrigation purposes. To the west are the large plains of Washington. To the east those of the Dakotas and Montana, which can be irrigated only, it is claimed, by using water coming from the Montana Mountains. Log stumpage is worth \$1.18 on an average, and logs at mill \$4.11. Mill investments average \$13,475. 38 lumber firms control about 600,000,000 feet stumpage, said to average 6,600 feet per acre.

Mill products were worth in

1870	\$ 430,000
1880	527,000
1890	1,182,000
1900	almost 3,000,000

In 1900 the cut of timber was 257,000,000 feet b. m., three-fifths of which was yellow pine, the balance consisting mainly of red fir and tamarack.

The destruction by fire is said to be beyond belief.

6. Forestry movement: Numerous petitions to Congress led to the establishment of the central reserves. Geo. P. Ahern delivered lectures on forestry at the Montana College of Agriculture, at Bozeman, for a number of years.

7. Laws: Penalty for wilful or careless firing. County commission required to keep fire laws posted. Tax rebate on forestry plantations.

8. Reservations: Only 690,000 acres of the Bitter Root reserve lie in Montana. The Flathead forest reserve, comprising 1,382,400 acres, and the Lewis and Clarke forest reserve, comprising 2,926,080 acres, both lying on the crest of the Rockies, have been recently combined into one reserve under the name of the latter. At the same time, the reserved acreage was increased, making the new "Lewis and Clarke forest reserve" 4,670,270 acres.

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The Gallatin forest reserve of only 40,320 acres, near Bozeman, is unimportant.

The Madison forest reserve (736,000 acres), bordering the Yellowstone Park, and the Little Belt Mountain forest reserve (501,000 acres), both established in 1902, seem important for irrigation at the head of the Missouri and Yellowstone Rivers. On the Lewis and Clarke forest reserve, western larch is by far the prevailing species, having twice the stumpage of Douglas fir and five times the stumpage of yellow pine. In the same reserve there seems to be more spruce than either yellow pine or lodgepole pine. The Canadian larch and spruce are sentinels of the British Columbia forest flora.

The Absaroka forest reserve of 1,311,600 acres, recently established, lies north of the Yellowstone Park. It has been consolidated with the Yellowstone and Teton reserves by Presidential proclamation.

9. Irrigation: Montana is third in irrigation, 950,000 acres being irrigated. Irrigation practicable only near the mountains at the present moment. Irrigation necessary for the cultivation of crops, notably barley.

The canal of the Minnesota and Montana Irrigation Company in Yellowstone County is 40 miles long, with an average width of 35 feet and a depth of 5 feet. Another canal in Chateau County is 75 miles long.

The great eastern plains, with very rich soil, are almost unsettled, owing to the difficulty of irrigation. The best farms are found in the Gallatin Valley, near Bozeman, and along the Yellowstone River.

Winter forage is required for the development of the rapidly increasing livestock interests.

In 1889, 950,000 acres of irrigated farm land produced \$7,300,000 worth of crops from irrigation works constructed at an expense of \$4,700,000.

FORESTRY CONDITIONS OF NEBRASKA:

1. Area: 2,300 square miles, or 3% of the area of the State, are wooded.

2. Physiography: Prairie traversed by the Platte River midway from west to east. The Niobrara flows along the north-

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ern boundary line; the Missouri forms the eastern boundary line towards Iowa.

One quarter of the State north of the Platte River is occupied by the "Sand Hills," which are not sand dunes, but give rise to springs and offer pasture.

3. Distribution: In the broad Missouri Valley of the extreme east were once found splendid groves of hardwoods, notably of burr oak, walnut, ash, box elder, honey locust and Kentucky coffee tree. The canyons of the rivers coming from the west show cottonwoods, willows and red cedar. Further west, some yellow pine, quaking aspen, cottonwoods and birches occur. Yellow pine covers several narrow ridges 5,000 feet high near the Wyoming line. Red cedar is found sparingly everywhere, the original growth being cut away for fence posts.

In the Sand Hills, logs and stumps of yellow pine are found buried in the sand. After Dr. C. E. Bessey, pine groves (ponderosa) were found 50 years ago even in the eastern half of the State. About 300,000 acres (?) of forest plantations are now in existence. Honey locust, cottonwood and green ash are said to do best. The European pines are reported thrifty.

4. Forest ownership: The federal government still owns the Sand Hills. 321,000 acres of forest along the rivers are attached to farms.

5. Use of timber: The hardwoods of the Missouri bottoms are practically used up. In 1880 there were 38 firms producing annually 14,000,000 feet of cottonwood and burr oak lumber. In 1900, 23 mills, of \$1,900 average investment, were in existence. Output in 1900 is not given. Stumpage is worth \$2.29 per thousand, and logs at mill bring \$5.69.

Firewood and fence posts are the leading requisites.

Leather and pulp industry: None.

6. Forestry movement: John Sterling Morton, Cleveland's Secretary of Agriculture, was the soul of a vigorous movement in favor of prairie forest planting. He introduced Arbor Day.

A State agricultural society offers three premia to the largest tree planters.

The "Nebraska Park and Forest Association," founded in 1899, tries to influence the newspapers.

Instruction in forestry at the University of Nebraska by Dr. C. E. Bessey.

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7. Laws: Tax exemption laws of 1869 were found unconstitutional. Towns are required by law to plant trees and authorized to levy taxes for that purpose. There are the usual fire laws.

8. Reservations: The Dismal River forest reserve (85,123 acres) and the Niobrara forest reserve (123,779 acres) are to be planted up, by the federal government, in yellow pine, jack pine and red cedar.

9. Irrigation: 148,000 acres of irrigated farm land have produced, in the census year, \$983,000 worth of crops, helped by irrigation works costing \$1,000,000.

FORESTRY CONDITIONS OF NEVADA:

1. Area: Under forest is 200,000 acres, or 0.3% of the State. Wooded area, after census of 1900, is 3,904,000 acres, or 6% of the State.

2. Physiography: In the western part, the east slope of the Sierras, with Virginia City and Carson City. Scarcely any water leaves the State. In the central part, narrow mountain ranges run north and south, and rise to over 8,000 feet altitude.

3. Distribution: Stunted junipers, and above these mountain mahogany (*Cercocarpus ledifolius*) skirt the barren land. Higher up, slopes dotted with nut pine, and still higher with yellow pine (*Jeffreyi* and *ponderosa*). The limber white pine is said to form extensive forests at elevations from 7,000 to 10,000 feet.

4. Forest ownership: Mines and railroads own little. The United States own practically all of Nevada. The State obtained from Congress a grant of 2,000,000 acres, to be located as the State pleased, in place of the usual school sections 16 and 36. The State sold the 2,000,000 acres rapidly in large tracts along all water courses at \$1.25 per acre to cattle men.

5. Use: Mining timber is paramount. Limber pine, yellow pine and red fir (*magnifica*) are used for props. The timber works of the Comstock mines are said to be of marvelous construction. Since 1870, \$55,000,000 worth of timber is said to have been buried in the mines. Nut pines, mountain mahogany and juniper are used for fuel and charcoal. Lumber is worth \$23 per thousand; mine props, \$10 per cord.

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6. Forestry movement: Nill.

7. Laws: None.

8. Reservations: None.

9. Irrigation: A State irrigation law of 1903 declares all water courses public property and fixes maximum use of water per acre of irrigated land.

The development of the State depends on the possibility of constructing reservoirs (notably on Humboldt River) and on the chances of artesian wells.

The existing irrigation works, costing \$1,500,000, irrigate 500,000 acres of land and produced, in 1899, \$2,800,000 worth of products.

FORESTRY CONDITIONS OF NEW HAMPSHIRE:

1. Area: 5,200 square miles, or 58% of the State, are wooded.

2. Physiography: Northern section of the State is mountainous, containing the headwaters of the Androscoggin, Merrimac and Connecticut Rivers ("the Switzerland of America"). Mount Washington, in the Presidential Range of the White Mountains, is 6,290 feet high. Southern section of the State is hilly, with some peaks over 3,000 feet high. Many summer tourists attracted.

3. Distribution: The growing stock was and is formed of white pine, hemlock, spruce, balsam and cedar, mixed with sugar maple, birch, beech; further, chestnut, ash, basswood and oak. After Fernow, hardwoods with spruce prevail in the northern section; pine and hemlock in the southern section. In 1900 the lumbermen alone owned 3,800,000,000 feet b. m. of stumpage, 2,000,000,000 feet of which are spruce. Large areas stock themselves with white pine after lumbering. Since 1850, 1,750,000 acres of improved farm land have reverted to unimproved land, most of which is coming up in white pine.

4. Forest ownership: 159 lumber firms own 664,000 acres of forest, 43% of the woodlands are attached to farms. Paper companies and speculators own very large tracts.

5. Use of timber: The forest has been culled for decades of years—to begin with, of prime white pine only. Fires used

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to be severe. The stand of virgin spruce often averages 20,000 feet b. m. per acre on large tracts. Logging by water or by rail. Some firms begin to survey the sleigh roads with great care. Stumpage costs \$2.68; logs at mill cost \$6.96 per 1,000 feet b. m. The State contains 535 saw mills, of \$10,200 average investment.

The output of the saw mills was valued in

1850	\$1,100,000
1860	1,200,000
1870	4,300,000
1880	3,800,000
1890	5,600,000
1900	9,200,000

The cut of 1900 consisted of

Spruce	188,000,000 feet b. m.
White pine	310,000,000 feet b. m.
Hemlock	45,000,000 feet b. m.
Other conifers	2,000,000 feet b. m.
Hardwoods	23,000,000 feet b. m.

The miscellaneous mill stock produced in 1900 was worth \$875,000. Hoop poles, excelsior, shoe pegs and maple sugar are produced in large quantities.

Leather industry: 12 tanneries report an annual output of \$2,265,000 of leather and a consumption of 5,700 cords of hemlock bark, worth \$25,400; 712 bales of gambier, worth \$4,600; 40 barrels of bark extract, worth \$480, and of chemicals, worth \$6,400.

Paper and pulp industry: 29 firms produce an output worth \$7,200,000. The raw material consists of domestic spruce, 109,000 cords, worth \$655,000; Canadian spruce, 87,000 cords, worth \$479,000; other wood, 720 cords, worth \$3,430.

6. Forestry movement: A Forest Commission, appointed in 1881, submitted a good report in 1885. Lectures on forestry are offered at the State Agricultural College. The inhabitants are not inclined to check forest fires.

The "White Mountain State Park" movement, in 1892, failed to be successful.

A bill of 1901, intended to limit the cutting of conifers to trees of over 10 inches stump diameter, failed to become a law.

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The "Society for the Protection of the New Hampshire Forests" employs a forester (Philip W. Ayres) and intends to work the park scheme through Congress. Its propaganda, based on merely economic grounds, is most commendable.

7. Laws: A law of 1893 establishes a forestry commission, consisting of the governor and four members appointed by him. The member acting as secretary draws a salary of \$1,000. Duties of commission are:—

- (a) Gathering forest, lumber and fire statistics.
- (b) Forestry propaganda at public meetings.
- (c) Suggesting legislation in annual reports.
- (d) Appointment (since 1895) of special fire wardens upon

application by forest owners, applicant and county equally sharing the expense of the service.

In organized towns, the selectmen are fire wardens ex officio, paid by the town.

Where no town organization exists, the county commissioners are empowered to appoint fire wardens serving at the county's expense.

Fire laws are unenforced.

A law of 1903 provides \$5,000 for the examination, by the National Bureau of Forestry, of the White Mountain forests. A joint resolution of the Legislature authorizes the federal government to establish, by expropriation or otherwise, a national forest reserve in the White Mountains.

8. Reservations: None.
9. Irrigation: None.

FORESTRY CONDITIONS OF NEW JERSEY:

1. Area: The woodlands cover 3,234 square miles, or 43% of State. The forest area is said to be increasing.

2. Physiography: The Delaware River and the Delaware Bay on the west side; Hudson River, Raritan Bay and Ocean on the east side. Shipping facilities and sea climate supply New Jersey with economic and forestal conditions similar to those of England. A belt 12 miles wide, stretching along a line running

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from Wilmington, Del., to Hoboken, is covered by cretaceous clays and marls. North of this belt lies the mountain zone of New Jersey, formed of red sandstone with trap outcrops, replaced further north by gneiss and granite highlands and yielding, in the extreme north, to the limestone and slate formations of the Kittatinney Mountains.

South of the cretaceous belt lie "The Pines," a slightly rolling plain, with gravelly and sandy soil of post-tertiary origin.

3. Distribution: All timber is second or third growth. In the clay and marl belt, chestnut coppice prevails in small wood lots attached to farms; growth thrifty, protected by farmers. *Pinus virginiana* and *echinata* are found, with little *rigida*.

In the highlands and mountains of the north, the farm lots in the valleys are well stocked with hardwoods, especially chestnut. In the Kittatinney Mountains, conifers, especially *Pinus rigida*, are mixed with hardwoods. Slopes and ridges are invariably in woods. In the mountains, tracts are large and hence more frequented by fires and trespassers.

In "The Pines," pure pitch pine forests of a stunted growth prevail on pure sand, the trees formed by stool-shoots after fires. On better soil, black oak and black jack oak are mixed with pitch pine. On wet soil dense stands of white cedar occur, or hardwood swamps, stocked with sweet and black gum, maple and yellow poplar.

The trap rock ridges, breaking through the red sandstone, show a stunted coppice growth of poor oak, chestnut and red cedar.

The woodlands of the northern highlands and those of "The Pines" may be of indirect importance by shielding the water supply for a growing population.

A colony of Russian Jews practice osier culture for basket-making.

4. Forest ownership: 47 mill firms own 7,576 acres of forest, reported to contain 3,600 feet b. m. average stumpage. The balance of woodlands belongs to farmers and to owners of small private reserves.

5. Use of timber: The iron industry in "The Pines," during the 18th century, drew heavily upon the virgin forest for charcoal. In 1850 the whole State was already cut over.

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The output of the saw mills was valued in

1850	\$1,123,000
1860	1,608,000
1870	2,745,000
1880	1,627,000
1890	1,225,000
1900	1,859,000

The cut in 1900 consisted of:—

Yellow pine	27,000,000 feet b. m.
White cedar	10,000,000 feet b. m.
Other conifers	4,000,000 feet b. m.
Chestnut	10,000,000 feet b. m.
Oak	19,000,000 feet b. m.
Other hardwoods ...	3,000,000 feet b. m.
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Total	73,000,000 feet b. m.

Logs on stump are worth \$3.93; at mill, \$7.56. 197 saw mills exist, of \$4,357 average investment. The miscellaneous wood industries furnish only \$157,000 worth of stock. The consumption of forest products, other than lumber, is said to consist of 800,000 cords of wood for fuel, 1,250,000 railroad ties; 14,000 telegraph and trolley poles and \$365,000 worth of fencing. The usual rotation in coppice woods and pineries is from 35 to 50 years.

Leather industry: 77 tanneries produce \$13,700,000 worth of leather and consume 4,016 cords of hemlock bark, worth \$39,600; 15,150 cords of oak bark, worth \$170,830. In addition, large amounts of gambier, quebracho, sumac and chemicals are used for tanning.

The paper and pulp industry works in 34 plants, producing \$3,200,000 worth of paper. No cord wood, however, is used. The raw material consists of rags, straw, pulp and fiber obtained from outside the State.

6. Forestry movement: Public opinion is well aware of the benefits derivable from a sound forest policy. Forestry bills are continuously introduced and continuously fail of passage.

The Geological Survey of New Jersey, since 1885, deals with the forest problem, and, under a law of 1894, has issued, in 1899, a very good report on the forests of the State. No action

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was taken upon it. A State Forestry Association seems to have died. The splendid public road law of New Jersey should greatly facilitate conservative forestry. What New Jersey needs is an enthusiastic and unselfish leader of propaganda for forestry.

7. Laws: Since 1792, county officials act as fire wardens and are privileged to summon help. Railroads are responsible for damages caused by spark fires, and locomotives must be supplied with spark arrestors. The "Minch bill," of 1902, providing salaried fire marshals, seems to have failed. Arbor Day since 1884.

8. Reservations: None, except small private reserves.

9. Irrigation: Only on 73 acres producing hay, vegetables and corn.

FORESTRY CONDITIONS OF NEW MEXICO:

1. Area: 23,700 square miles, equal to 19% of total area of Territory, are wooded.

2. Physiography: Rocky Mountains traverse Territory from north to south. Average elevation of Rockies, north of Santa Fe, 10,500 feet. Drainage chiefly towards the Gulf of Mexico, via the Rio Grande from the west slope of the Rockies, and via Pecos and Canadian River from the east slope of the Rockies. River beds sunken 200 feet into the table lands. Rainfall averages less than one inch per month, except in the higher altitudes. Mean altitude of the whole territory is about 5,600 feet.

3. Distribution: Arid plains east of the Pecos River (Llano Estacado), with some mesquit. In the southwest, narrow mountain ranges separate wide plains on which Madrona, Spanish Bayonet and Palo Verde grow. "Journanda del Morte," along the Mexican frontier, is said to be the worst of all deserts. The mesas show scattering scrub oak with groups of red cedar, western juniper and pinon. In the depressions of the mesas occur fine groves of mesquit. Splendid grazing on the mesas. Along the rivers appear fringes of box elders, willows and cottonwoods. The mountain ranges show, at the highest elevations, a cupressus species forming dense forests (probably *Arizonica*); lower down, on the north slopes, white pine (*flexilis*), Douglas fir and Engelmann's spruce, which are replaced, after heavy cuttings and burnings, by quaking aspen. On south slopes

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yellow pine preponderates in open forests (ponderosa). The foothills show juniper, cedar, pinon, scrub oak. The best forests are in the central north and in the southwest, where the diagonal mountain chain traversing Arizona enters the territory.

4. Forest ownership: Lumbermen own 1,518,000 acres. Attached to farms are 10% of the forests. The railroads and mines are said to control large tracts. Reservations cover 3,258,080 acres, equal to 4% of the territorial area.

5. Use: Forests are mostly used for pasture, especially in the yellow pine region. In the foothills' forests, yellow pine is the most valuable timber. Cedar and juniper are used for fence posts. Scrub oaks and pinion are used for fuel. In the census year the cut was 203,000 feet b. m. of Engelmann's spruce and Douglas spruce, and 31,637,000 feet. b. m. of yellow pine, averaging 1,700 feet b. m. to the acre. Merchantable timber is found only on the higher mountains. Mill investments average \$5,200. Lumbermen control 1,000,000,000 feet b. m. of spruce and 1,300,000,000 feet of yellow pine. No pulp or leather industries. Stock raising stands paramount. Fires are said to do little damage, excepting north of Santa Fe.

6. Forestry movement: None.

7. Laws: Usual fire laws. Liability for all damages. Denver and Rio Grande railroad is the only road privileged to cut timber for repairs from government land.

8. Reservations: The Pecos River reserve, of 431,000 acres, lies northeast of Santa Fe and comprises the sources of the Canadian and Pecos Rivers.

The Gila River forest reserve is large (2,327,040 acres) and compact and drains, through the Rio Grande, westward into the Pacific. In July, 1902, the Lincoln forest reserve of 500,000 acres was created in the central south of the Territory.

9. Irrigation: 88,900 acres. Agriculture possible only in the cañons of the main rivers, depending on irrigation.

The Aborigines have irrigated their farms from time immemorial on. Agricultural chances are best along the southern broad-bottomed course of the Rio Grande. Ditches, roughly constructed, are usually held in common by the Mexican inhabitants. The farms have the form of oblongs, the narrow side joining the river.

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The largest reservoir is on the Pecos River, in the south-east of the State near Carlsbad.

The irrigation works existing in 1889 were constructed at an outlay of \$4,100,000 and irrigate 204,000 acres of farm land, producing \$2,800,000 worth of crops.

FORESTRY CONDITIONS OF NEW YORK:

1. Area: 18,700 square miles, or 39% of the State, are classed as woodlands.

2. Physiography: Whole State slightly mountainous. Western section more level. Catskills on west bank of Hudson; Adirondacks in extreme north, rising in Mount Marcy to an elevation of 5,345 feet (with gneiss and granite for underlying rock). A large number of inland lakes in north and west facilitate transportation.

3. Distribution: The western section is the farming section of the State. Originally the broad-leaved forest of the Mississippi Basin covered the entire State, excepting:—

(a) The Adirondacks, where maple, birch and beech prevail in irregular mixture with spruce, hemlock, white pine and red pine, the spruce forming pure stands on the poorest soil, whilst wet depressions are occupied by balsam, tamarack and white cedar.

(b) The low hills bordering the Hudson and extending westward along the Pennsylvania line, in which the coniferous species of the northern pine belt preponderate.

In 1900, the forests, with the exception of those in parts of the Adirondacks, consist of second growth. Many a so-called "virgin forest" of the Adirondacks has lost its stand of white pine for many a year.

4. Forest ownership: 276 firms own 648,000 acres, stocked with 5,600 feet b. m. per acre. The State reserves comprise 1,325,000 acres in the Adirondacks and 82,000 acres in the Catskills.

5. Use of timber: The stand of conifers in New York was estimated, by Sargent, in 1880, at 8.3 billion feet b. m., and by Fernow, in 1896, at 5.3 billion feet b. m.

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The value of the output of the saw mills, since 1850, shows unexplainable fluctuations. It was in

1850	\$13,100,000
1860	9,700,000
1870	21,200,000
1880	14,300,000
1890	17,100,000
1900	15,800,000

New York stepped down gradually, as a lumber producing State, from first rank in 1850 to 12th rank in 1900.

The cut in 1900 consisted of:—

Hemlock	314,000,000 feet b. m.
Spruce	256,000,000 feet b. m.
White pine	122,000,000 feet b. m.
Other conifers	6,000,000 feet b. m.
Maple	51,000,000 feet b. m.
Oak	43,000,000 feet b. m.
Basswood	30,000,000 feet b. m.
Elm	16,000,000 feet b. m.
Chestnut	14,000,000 feet b. m.
Birch	13,000,000 feet b. m.
Ash	9,000,000 feet b. m.
Hickory	1,000,000 feet b. m.

Stumpage is worth \$3.12, and logs at mill are bought at \$7.75 on an average. 1,742 mills report an average investment of \$6.163. The shingle production is valued at \$342,000; the production of miscellaneous stock at \$1,101,000. In barrel and box manufacture, further, in the manufacture of baskets and woodenware, New York occupies first place amongst the States. 159 box factories turn out \$7,900,000; 413 barrel factories, \$6,500,000; 180 basket and woodenware factories, \$1,000,000.

The expense of logging in the Adirondacks averages \$4.50 per 1,000 feet b. m. Horses only are used in skidding and sleighing. Logs are driven down the rivers, frequently with the help of splash dams.

The average growing stock in primeval parts of the Adirondacks shows, per acre, 31.5 spruces, 4.5 hemlocks, 4 balsams, 0.2 white pines, 0.1 cedar, 14 birches, 10 beeches, 6 hard maples, 2.5 soft maples and a few ash and cherry, making a total stand of 73.4 trees of over 10-inch diameter per acre.

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Leather industry: 147 tanneries yield annually \$23,200,000 worth of products and consume 179,000 cords of hemlock bark, worth \$1,200,000; 4,000 cords oak bark, worth \$33,000; 19,000 bales of gambier, worth \$123,000, 2,100 barrels of hemlock bark extract, worth \$25,000; 526 barrels of oak bark extract, worth \$5,500; 615 barrels of quebracho, worth \$9,500; 2,150 tons of sumac, worth \$104,000; and chemicals, worth \$330,000.

Paper and pulp industry: New York leads the United States, in the 12th census year, by producing \$26,700,000 worth of pulp and paper. 179 firms consume: Home-grown spruce, 363,000 cords, worth \$1,985,000; Canadian Spruce, 141,000 cords, worth \$945,000; domestic poplar 32,000 cords, worth \$181,000; Canadian poplar, 9,600 cords, worth \$57,000; other pulp wood, 9,500 cords, worth \$40,000. After Fernow, more spruce is now consumed for pulp than for lumber.

6. Forestry movement: New York, as late as 1884, was still the owner of some woodlands in the Adirondacks, and Catskills. The Adirondack Park Association stimulated further acquisitions by the State. The New York State college of forestry was expected to demonstrate the feasibility of practical forestry on 30,000 acres of experimental forest and to supply the State with scientific foresters.

7. Laws: Law of 1886 allows the State to pay taxes on her own land.

Law of 1889 provides penalty of \$25 for every tree cut or stolen from the State's land.

In 1897, the Adirondack Park law was enacted.

Since 1893, forest utilization in the Adirondack forest preserve is forbidden by a constitutional clause.

In 1895, the Forest Commission was combined with the Fish and Game Commission (See XXXI.).

In 1900, the office of chief fire warden was created and the Commission authorized to employ three expert foresters to act as deputy fire wardens, attend reforestation, etc.

In 1901, the Forest, Fish and Game Commission was consolidated with the Forest Preserve Board. D. C. Middleton, of Watertown, is the forestry member of the Commission. Col. Wm. F. Fox is Forest Superintendent. The law makes it the duty of the Commission

(a) To take care of the State forest preserves.

(b) To promote "further growth" in the preserves.

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(c) To husband the people's interests in forestry and tree planting, and especially with reference to forest fires. The law authorizes the Commission to employ a superintendent, an assistant superintendent, a land clerk, 12 "foresters and game protectors" and 35 "forest rangers," the latter drawing a salary of \$500 per annum.

Outside the State preserves the town supervisors act *ex officio* as "fire wardens," empowered to summon help (at \$2 per diem) and instructed to annually report to the Commission on the number, extent and cause of forest fires occurring in their respective precincts; further, on the remedial measures taken to fight fires. The town pays half of the fire warden's wages (\$2.50 per diem).

If the fire wardens neglect proper discharge of their duties, then the Justices of the Peace or the Commissioners of Highways shall act as fire wardens in their stead.

Aside of these fire wardens *ex officio*, the Commission may rely, "in forest towns," on the vigilance of fire wardens specially appointed by the Commission. A forest town may be subdivided into two or more fire warden districts.

In 1901, the chief fire warden had a force of 617 fire wardens at his command, with whom he kept in contact by continuous visits. A booklet, "Instructions to Fire Wardens," was issued in 1901.

The negligent or wilful firing of woodlands is punishable by a fine ranging between \$50 and \$500.

8. Reservations: The Adirondack Park exists only on the map and comprises that land which eventually should become the property of the State. It covers 3,226,144 acres, including over 2,000,000 acres of private holdings. The Adirondack forest preserve (the majority of), which lies inside the park, comprises 1,163,414 acres. It is entirely (excepting a few cases of divided rights) owned by the State, and contains 450,000 acres of forest proper, 590,000 acres of woodlands heavily lumbered, 40,000 acres of deforested land, 60,000 acres of water surface, 4,600 acres in farms. The spruce stumpage on the preserve is estimated to be 1.5 billion feet b. m.

The Catskills forest preserve comprises only 82,330 acres.

Both preserves are gradually increased by purchase, the prices ranging from \$1 to \$9 per acre. Tree planting on waste land, within the preserve, was begun in 1902.

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9. Irrigation: 123 acres on 11 farms producing vegetables and tobacco.

FORESTRY CONDITIONS OF NORTH CAROLINA:

1. Area: 35,300 square miles of woodlands, or 73% of the State, are reported as "mostly timbered."

2. Physiography: The western mountain region occupies 6,000 square miles. It is formed by the Blue Ridge on the South Carolina line and the Great Smokies on the Tennessee line. Cross ridges connecting these chains show the highest elevations. Mount Mitchell, of 6,711 feet elevation, is the highest mountain east of the Rockies. Normal precipitation, 57 inches annually. Normal average temperature, 50 degrees F. Rivers running northward, breaking independently through the Great Smokies.

The Piedmont plateau, 400 to 1,500 feet high, occupies 22,000 square miles. Its configuration is rolling, in the west hilly. This fertile plateau is drained by the Catawba and Yadkin Rivers; further, by the headwaters of the Cape Fear, Neuse and Roanoke Rivers. Its elevation averages about 900 feet above sea level; its precipitations, 50 inches; its annual temperature, 59 degrees F.

The coastal plain of North Carolina, an area of 24,000 square miles, falls from 400 feet elevation down to sea level. North of the Neuse River the soil is loamy; south of it more sandy. Normal precipitations, 55 inches. Normal temperature, 61 degrees F. Large swamps along coast.

3. Distribution:

(a) Mountain region:

(1) Lower mountains. There are 6 species of oaks, 4 of hickories, chestnut, dogwood, black gum, sourwood and chinquapin. Post and Spanish oak are said (by W. W. Ashe) to be rather local. *Pinus echinata*, *rigida*, *virginiana*, *strobus* and (after Ashe) *pungens* prevail. White pine is said to cover 200,000 acres, notably in counties close to the Virginia line, reaching its finest development at altitudes ranging between 2,800 and 3,800 feet elevation. The lower mountains are practically deprived of virgin growth.

(2) Higher mountains. (3,000 feet to 5,000 feet elevation.) On the north slopes, hemlock, birches (*lutea* and *lenta*), red oak,

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beech, basswood, cherry, yellow poplar, white ash, cucumber, chestnut and buckeye occur, frequently with a dense undergrowth of rhododendron.

On the south slopes, white, scarlet and chestnut oaks; chestnut, locust and hickory prevail. Table mountain pine on dry ridges. North Carolina hemlock on eastern slopes. Woods virgin

(3) Mountain summits (over 5,000 feet elevation). Black spruce (*Picea rubens*) and balsam (*Abies fraseri*) cover the mountain sides, protected from storms. Buckeye, beech and sweet birch; further, mountain ash are mixed with the soft woods, the two first named often in groups.

The undergrowth is a tangle of laurels standing on a dense matting of mosses. On the wind-swept side of the mountains "balds" occur, fit only for pasture, covered with *Ericaceae*, dotted with stunted red oaks, chestnuts and a locust here and there

(b) Piedmont plateau. Uplands show an irregular mixture of broad-leafed species (notably black oak) with pines (*echinata* and *taeda*). On red sandstone a pure growth of *taeda* and *echinata* is frequently found without admixture of hardwoods. On fertile red clay (tobacco land), hardwoods (black, white and red oak; white, shagbark and small nut hickory; yellow poplar; white ash) occur without pines. The virgin forest is practically removed. Along the large streams, sweet and black gum, overcup and swamp (cow) oak, sycamore and hackberry occur. Along the smaller streams are found red and white oak, yellow poplar, beech, maples and hop hornbeam.

(c) Coastal plain. Maritime forests along seashore are broad-leafed and evergreen, composed of water (*nigra*), laurel (*laurifolia*) and live (*virens*) oak, devilwood (*Osmanthus americana*), mock orange (*Prunus caroliniana*), sweet bay, yaupon (*Ilex vomitoria*) and palmetto. The pine belt uplands, adjoining the maritime forests, show long leaf pine or *taeda* or both, according to fertility of soil. The lowlands in the pine belt exhibit so-called "Oak Flats," with cow, overcup, white, water and Spanish oaks, in company with ash, elm, gum, cottonwood and red maple; or swamps stocked with gum and cypress; or so-called "Bays," where white cedar prevails; or "Pond pine swamps," formed by *Pinus serotina*, mixed with oaks and *taeda* pine.

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4. Forest ownership: 629 lumber firms control 1,714,000 acres. Balance of woodlands is owned by farmers and speculators.

5. Use of timber: There are altogether 1,751 saw mills. The average mill investment is \$3,572. The mill output in North Carolina amounted in the year

1850 to	\$ 900,000
1860 to	1,100,000
1870 to	2,000,000
1880 to	2,700,000
1890 to	5,900,000
1900 to	14,900,000

The cut of 1900 consisted of:—

Yellow pine	1,228,000,000 feet b. m.
Cypress	31,000,000 feet b. m.
Other conifers	11,000,000 feet b. m.
Poplar	51,000,000 feet b. m.
White oak	86,000,000 feet b. m.
Other hardwoods	8,000,000 feet b. m.

The naval store products, in 1885, were \$1,320,000. Then, already, the industry was on the decline, the output having decreased (after Fernow) since 1880 by 30%. The main shipping points for naval stores are Wilmington and Norfolk. After Sargent, the stand of yellow pine, in 1880, was 5,200,000,000 feet b. m. Since 1880, however, at least 15 billion feet of yellow pine have been cut. The stumpage in the mountain section after H. B. Ayres and W. W. Ashe, in 1901, amounts to 10,650,000,000 feet b. m. or 2,640 feet b. m. to the acre. In addition, the stand of firewood in the mountain section is estimated to be 16.83 cords per acre. The various species participate in said stumpage as follows:—

Oaks	41.41%	Chestnut	17.20%
White pine	2.68%	Hemlock	5.30%
Spruce	0.80%	Poplar	1.85%
Ash	1.43%	Buckeye	2.00%
Basswood	2.69%	Black gum	1.64%
Beech	1.06%	Cucumber	0.84%
Maple	2.67%	Birch	3.03%
Pitch pine	1.34%	Hickory	3.16%
Locust	0.67%	Echinata	0.43%
		Miscellaneous	9.80%

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The miscellaneous industries (producing stock for furniture, wagons, agricultural implements, lath, bobbins and spools), in 1900, show an output of \$644,000.

Little cooperage stock (value \$30,000) and boxes (value \$76,000) were produced. Logs on stump are worth \$1.34; at mill, \$4.45.

The leather industry consumes, in the census year, in 75 tanneries, 1,808 cords of hemlock bark, worth \$8,524; 20,467 cords of oak bark, worth \$107,242; 270 barrels of oak bark extract, worth \$3,294. The value of the leather produced is \$1,502,000.

The paper and pulp industry is nil. The spruce forests of the high mountains are still inaccessible; in addition, freight rates are too high for good prospects of paper mill investments.

6. Forestry movement: The "North Carolina Forestry Society" is inactive. A forester, attached to the North Carolina Geological Survey, draws \$1,000 per year salary (W. W. Ashe).

7. Laws: Good fire laws, on the statute book, are a dead letter, since there is no staff charged with their enforcement. A recent law, practically prohibiting the export of logs for manufacture, is, probably, unconstitutional.

8. Reservations: The "Appalachian National Park" (or Reserve?), now planned, is located, largely, in the Great Smokies of Western North Carolina. Congress is asked to appropriate \$10,000,000 for the establishment of such a park covering 4,000,000 acres. North Carolina and the adjoining States have passed laws authorizing the United States to establish and manage such a park. Main difficulty to be met is the problem of local taxation.

9. Irrigation: 101 rice plantations, covering 3,283 acres, or 15% of the total area in rice, were irrigated in 1899, producing 30% of the total rice yield of the State.

Tide water is utilized for irrigation. The cost of the system averages \$34.35 per acre.

FORESTRY CONDITIONS OF NORTH DAKOTA:

1. Area: 600 square miles are wooded, an area equal to 1% of the entire State. No State of the Union has a smaller percentage of wooded area.

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2. Physiography: Plains are unsheltered from the north. There are low hill ranges near the Canadian line, i. e., Turtle Mountains. The Missouri, after taking in the Yellowstone River, runs eastward and then southward through the State. The Red River of the North forms the boundary towards Minnesota.

3. Distribution: All river bottoms show disconnected groups of burr oak (*macrocarpa*), sycamore, cottonwood, box elder and green ash. The low northern mountains contain cottonwoods mainly.

4. Forest ownership: Several thousand acres (40,000?) of artificial forest planted under the timber culture act.

5. Use: Hardwoods used for firewood. Near Canadian line, wood is worth \$1.50 per cord. Building timber obtained from Minnesota. Twelfth census reports 4 saw mills of \$2,000 average capital. Logs worth \$1 on stump and \$5 at mill. No pulp and no leather industry.

6. Forestry movement: An association formed in 1887 seems to have died since. The timber culture act gave rise to enthusiastic but mostly unsuccessful planting. Arbor Day movement since 1884. Much interest in forest planting maintained by the press.

7. Laws: A bounty of \$2 annually to everyone planting one acre or more in trees. A plantation of five acres exempts a quarter section, plus \$1,000 worth of improvements, from taxation for ten years. Usual prairie fire laws. Owner must fire his land in March, April or May, and give 24 hours' notice of his intention to do so to all people living within one mile.

8. Reservations: None.

9. Irrigation: Possibility of reclamation along main Missouri River is limited.

The irrigated area, in 1899, aggregated less than 5,000 acres, yielding crops worth \$28,000.

Only \$18,000 has been spent for irrigation systems up to 1899.

FORESTRY CONDITIONS OF OHIO:

1. Area: Originally entire State was wooded. Forest area statistics are annually derived from data furnished by tax

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assessors. In 1853 forest area was 55%; in 1870, 38%; in 1886, 22%; in 1896, 17.4%. After the 12th census, however, the area of woodlands was 23% of area of State, or 9,300 square miles.

2. Physiography: No mountains, no dry or rocky soil. Undulating, rich table land, every square foot fit for agricultural purposes. Lake Erie in the north and Ohio River in the South facilitate transportation.

3. Distribution: Scattering groves of long boled hardwoods appear everywhere (hickory, sycamore, oaks, chestnut, ash, maple, yellow poplar, walnuts, elm, beech, etc.). Original forest is, probably, left in swamps only. White pine along the Pennsylvania line in a narrow belt.

4. Forest ownership: All woodlands are attached to farms, except 80,700 acres, of 4,100 feet b. m. average stumpage, controlled by lumber mills.

5. Use of timber: Ohio occupies seventh rank as a lumber producing State of the Union, having maintained its position admirably in spite of reports of declining supplies. Ohio leads in the production of furniture stock. Logs are worth at mill \$9.47, and on stump, \$4.92. There are 2,023 mills, of \$4,638 average investment. Value of products of lumber industry averaged, in 1870, 1880, 1890 and 1900 respectively, \$10,000,000, \$14,000,000, \$15,000,000 and \$21,000,000.

The cut in 1900 consisted of:—

White oak	593,000,000 feet b. m.
Other hardwoods	325,000,000 feet b. m.
Conifers	42,000,000 feet b. m.

Leather industry: 58 tanneries use 5,500 cords of hemlock bark, 23,800 cords of oak bark, 10,000 barrels of bark extracts and a little gambier, quebracho and sumac. Total product of tanneries equals \$5,200,000.

Paper and pulp industry has 51 plants using rags, waste paper, straw and manila grass preferably, in addition to 5,000 cords of home-grown (?) spruce, 2,000 cords of Canadian spruce, 10,000 cords of home-grown poplar, 2,000 cords of Canadian poplar and 12,000 cords of miscellaneous woods.

6. Forestry movement: State Forestry Association inactive. Woodland is considered only as farmland bearing the wrong crop. A bill for forestry school defeated in 1897.

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Forestry lectures by Wm. R. Lazenby, at State University. Cincinnati Forestry and Improvement Association formed in 1903.

7. Laws: Fire laws since 1805. State forestry bureau created in 1885. Officers unsalaried and now inactive.

8. Reservations: None.

9. Irrigation: None.

FORESTRY CONDITIONS OF OKLAHOMA AND INDIAN TERRITORY:

1. Area: In Indian Territory, 65% of the total area or 20,000 square miles are wooded.

In Oklahoma, 11% of total area or 4,400 square miles are wooded.

2. Physiography: Undulating plateau, drained by rivers flowing west to east, notably the Canadian River and Cimarron River. The Red River of the south forms the southern boundary.

The highest mountain ranges in the Ozark plateau are the Arbuckle and the Boston Mountains. The Cross timbers enter from Texas.

The Wichita Mountains, in the southwest, are over 2,000 feet high.

3. Distribution: Western section is prairie, with green ash, hackberry and cottonwood along the rivers. Red cedar is said to have been found 20 years ago on the edges of all canyons.

Middle section has woodlands of blackjack oak and post oak, notably in the Cross Timbers. Further, some burr oak, hackberry, white oak, shittim wood and wild china berry tree occur. These species are said to be gradually extending towards the west. After W. L. Hall, black walnut, catalpa and locust can be planted successfully within the original oak forests.

In the eastern section (Indian Territory), south of the Canadian River, *Pinus echinata* and *taeda* are found in large, valuable bodies on the ridges. The lowlands in the east are splendidly timbered with the hardwoods of the Mississippi bottoms. Here the best black walnut of the United States is said to exist. Further, red oak, cow oak, hickories, white ash, gums,

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cottonwood, sycamore, mulberry, maple, osage, orange and pecan.

4. Forest ownership: In Indian Territory, 32,347 acres are owned by lumbermen, with stumpage averaging 3,800 feet per acre.

In Oklahoma, lumbermen own 10,940 acres, of 1,300 feet average stumpage.

5. Use of timber: In Indian Territory, the sawn products of 1900 were valued at \$200,000, consisting of 16,000,000 feet b. m. Logs on stump worth \$1.21 and logs at mill worth \$4.61. There were 48 mills, representing an average investment of \$1,911.

In Oklahoma there were 33 mills, of \$1,423 average investment, which have turned out, in the census year, \$63,000 worth of lumber. Logs on the stump are worth \$2.54 and at mill \$5.82.

Leather, paper and pulp industries: None.

6. Forestry movement: Some forest planting in Oklahoma.

7. Laws: Unknown.

8. Reservations: The Wichita forest reserve, of 57,120 acres, in the Wichita Mountains of Oklahoma.

9. Irrigation: Irrigation is unimportant, being practiced, in 1899, on 2,300 acres only.

The systems of irrigation cost \$22,000.

The irrigated crops are valued at \$16,000.

FORESTRY CONDITIONS OF OREGON:

1. Area: The forests occupy 34,750,000 acres, equal to 57% of total area of State. Fernow gives only 20,000,000 acres and the vice-president of the defunct Oregon Forest Association only 16,000,000 acres of forest. Reason for difference is the difference of definition of forest. The great commercial forests cover about 10,000,000 acres.

2. Physiography: Coast Range separated from the Cascade Range by the Willamette, Umpqua and Rogue Rivers. The heavy rainfall in the Coast Range is due to the Japan current (Kuroshivo). In the northeastern part of the State the Blue Mountains extend into Washington. The southeastern third of the State is without forests, exhibiting deserts close to Nevada.

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3. Distribution: Similar to that in Washington.

(a) Coast Range. Tideland spruce close to the ocean. The bulk of the forests consist of Douglas fir and red cedar. Lawson's cypress forms a forest of great commercial value in the southern third of the Coast Range, where it exhibits splendid silvicultural qualities, i. e., abundant regeneration. In the extreme south of the Coast Range, sugar pine, winter bald white oak and also California chestnut oak are met with.

(b) Cascade Range. On west slope, most important tree is Douglas fir, forming pure forests below 2,000 feet elevation and reproducing splendidly on clearings. Red cedar, hemlock and, higher up, white pine (*monticola*) are next in importance to Douglas fir. The firs (noble, amiable and grand) run high up on the mountains, fringing Crater Lake (10,000 feet elevation). In southern extension of cascades, sugar pine occurs.

On east slope: Below 5,000 feet an open forest of yellow pine is found; above 5,000 feet, Douglas fir, lodgepole pine and lowland fir are mixed with yellow pine. In addition, Engelmann's spruce, western larch and white pine occur. At timber line white bark pine and hemlock are found in open forests.

The river bottoms between Coast Range and Cascade Range exhibit heavy, broad-leaved groves composed of cottonwoods, alders, ashes, willows and white maples; also the ever-green California laurel.

(c) The Blue Mountains (in northeast corner of State) show open stunted forests of yellow pine, Douglas fir and larch, and, above 4,000 feet elevation, a heavy growth of lodgepole pine.

4. Ownership: Farmers own 1.5 million acres.

Lumbermen, mostly Michigan and Wisconsin men, composing 212 firms, control 825,000 acres, of 25,000 feet b. m. per acre average.

United States reserves cover close to 4.5 million acres on the Cascade Range. None exist on the Coast Range.

The Warm Springs and Klamath River Indian reservations cover about 1,000,000 acres each, but are not heavily forested.

5. Use: The hardwoods are largely used for woodenware, cooperage and furniture. The California laurel is the finest wood for cabinet work and ship building on the coast. The center of the hardwood industries is Portland. The cut in the census

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year was 740 million feet b. m. only, which is equal to 0.3% of the growing stock of 225 billion feet b. m. This growing stock is composed as follows:—

Red fir	150 billion feet b. m.
Yellow pine	40 billion feet b. m.
Hemlock, spruce and cedar	35 billion feet b. m.

Mills smaller than in Washington, the average investment being \$12,300. Stumpage prices lower than in any other State, being 66c. per 1,000 feet b. m. Saw logs at the mill cost \$4.40 per 1,000 feet b. m.

The paper and pulp industry used in 1900, 150,000 cords of spruce in 5 establishments. The leather industry had 16 tanneries, worth \$11,000 on an average, reporting to be annually using altogether 936 cords of hemlock bark and 1,247 cords of oak bark (?).

Very important for Oregon is the live stock industry.

The stock consists of

14,000,000 cattle,

24,000,000 sheep,

2,000,000 horses,

500,000 mules.

Sheep are driven to the summer range in the high cascades, so as to leave all pasture in the lowlands to the heavier stock.

Annual value of the wool product is over \$1,500,000. In the reserves, only 60 owners with 188,000 sheep in 86 bands.

6. Forestry movement: In 1888-1889 Legislature petitions Congress to establish reserves. In 1897 outbreak of antagonism against "Reserve Policy," backed by the Wool Growers' Association (John Minto).

In 1898 forest reserves were opened to limited sheep pasture, and the antagonism to reserves has since subsided.

7. Laws: State fire laws of 1893 impose fines on malicious or careless firing of woods, but are ineffective. The public domain is protected under special fire laws. New fire law of 1903 was passed by both houses, but vetoed by governor.

8. Reservations: Reserves cover 13% of wooded area and 7.2% of total area of State.

The Ashland forest reserve (18,560 acres) in the extreme south and the Bull Run timber land reserve (142,080 acres) in the extreme north of the Cascade Range are small and unim-

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portant. The Bull Run reserve includes Mount Hood. Between the two reserves stretches the Cascade Range forest reserve, a reserve of 4,436,120 acres enclosing the Crater Lake National Park of 150,000 acres. The reserves extend, practically, from the Washington line to the California line, are 50 to 100 miles wide, lie largely above 7,500 feet above sea level and include many summits above timber line.

9. Irrigation. The agricultural development of central Oregon depends on the possibility of utilizing for irrigation the scanty and intermittent streams of the region.

The success of a deep well system would allow of an enormous increase of the cattle and sheep industry.

In 1899, 388,000 acres of farm land, producing \$3,100,000 worth of crops, were irrigated from works constructed at an outlay of \$1,800,000.

FORESTRY CONDITIONS OF PENNSYLVANIA:

1. Area: The woodlands comprise 23,000 square miles, or 51% of total area. The forest is said to be, in a great part, depleted of its merchantable timber.

2. Physiography: A belt of mountains 50 miles wide and 240 miles long traverses the State diagonally from southwest to northeast. The mountain ranges are from 1,000 to 2,000 feet high, Negro Mountain forming the highest peak, at an altitude of 2,826 feet.

Northwest of the mountain belt are the broad Allegheny Uplands, rolling high plateaux covering over one-third of the State. Southeast of the mountain belt appears the northern extension of the Coastal Plains at an average elevation of 500 feet. The Susquehanna drains the eastern half of the State, together with the Delaware on the New Jersey line.

3. Distribution: Pennsylvania was originally covered from end to end with heavy forests. White pine and hemlock formed vast forests on both flanks of the Alleghenies. East and west of the mountains the conifers gave way gradually to a heavy growth of broad-leaved species.

In the southeastern section, white oak was and is the most valuable species. The second growth of hardwoods is otherwise

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composed of hickories and birches; further, chestnut, locust, maple, walnut and cherry.

In the Allegheny Uplands the hardwoods of the Mississippi are found, notably, red and white oak, beech and sugar maple. In the southwest of this region occur the Kentucky coffee tree, honey locust, chestnut and yellow poplar. West of the Allegheny River no white pine, but some hemlock occurs. East of this river, hemlock; then white pine increases in proportion on the way toward the mountains.

In the mountain belt prevail, below 1,800 feet, white pine, hemlock, pitch pine, sugar maple, black and yellow birch, beech and cherry. On rocky soil, especially in the southern part, occur chestnut oak, chestnut and locust. Above 1,800 feet the Canadian tree flora sets in, consisting of spruce (*Picea rubens*), balsam and larch, with some white pine, Norway (red) pine and hemlock. White pine stands averaging 25,000 feet b. m. per acre on tracts comprising several hundred acres are no longer found.

In 1880 white pine virgin forests occurred only island-like on their original domain, whilst hemlock was then scarcely touched.

In 1900, on burned white pine slashes, yellow and black birch, bird and black cherry, maple, chestnut and beeches come up in profusion.

Regeneration of hemlock is nill; that of white pine very poor.

In 1896, Dr. Rothrock and Dr. Fernow estimated the stand of conifers as follows:—

White pine	500,000,000 feet b. m.
Spruce	70,000,000 feet b. m.
Hemlock	5,000,000,000 feet b. m.

4. Forest ownership: In 1894, over 1,500,000 acres, i. e., over 5% of State's area, were advertised for sale by the counties for tax forfeiture.

614 lumber firms own 645,000 acres of forest, said to be stocked with 9,300 feet b. m. on an average.

83% of the woodlands are said to be attached to farms.

The State reserves now aggregate several hundred thousand acres.

5. Use of timber: Logs on stump are worth \$2.94; at mill, \$6.71. 2,280 mills report an average investment of \$10,083. Penn-

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sylvania, leading the United States lumber industry in 1860, has dropped to fourth rank in 1900, although she succeeded in vastly increasing the value of her output within these 40 years.

The output was in:—

1860	\$11,000,000
1870	29,000,000
1880	22,000,000
1890	29,000,000
1900	36,000,000

The cut in 1900 consisted of:—

Hemlock	1,608,000,000 feet b. m.
White pine	238,000,000 feet b. m.
Other conifers	19,000,000 feet b. m.
Chestnut	51,000,000 feet b. m.
Oak	342,000,000 feet b. m.
Other hardwoods ..	140,000,000 feet b. m.

Total 2,398,000,000 feet b. m.

The shingle mills turned out, in the census year, \$370,000 worth of shingles, largely using the old remnants of white pine and hemlock, also a little oak and chestnut.

Cooperage stock produced in 1900 was valued at \$762,000 (notably for sugar barrels); the miscellaneous industries furnished \$1,443,000 worth of home-grown stock. Very little wagon and furniture stock.

In forest utilization, the rivers, notably the Susquehanna, are made use of. Skidways and sleds are little used. The logs are moved over so-called "slides," V shaped troughs, consisting of hemlock poles placed on hemlock ties, with an ice crust formed by sprinkling. Six to forty peeled logs form a log train, pulled by horses in a tow path.

At the Williamsport boom, the proportion of hemlock and pine logs was, in 1875, 1 to 10; and in 1893, 5½ to 1.

Leather industry: Pennsylvania excels amongst the States of the Union in the output of the leather industry, which output is valued at \$55,615,000. 254 tanneries consumed, in the census year, 565,062 cords of hemlock bark, worth \$3,460,000; 64,392 cords of oak bark, worth \$437,000; 2,800 bales of gambier, worth \$17,000; 304 barrels of hemlock bark extract worth \$3,368; 5,615 barrels of

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oak bark extract, worth \$56,700; 3,775 barrels of quebracho, worth \$50,700; 206 tons of sumac, worth \$10,000. The chemicals used were worth \$919,600.

The output of Pennsylvania's tanneries is mostly sole leather.

In paper and pulp industry, Pennsylvania has 4th rank, producing \$12,268,000 worth of paper in 73 mills and consuming: Home-grown spruce, 16,697 cords, valued at \$85,504; Canadian spruce, 25,442 cords, valued at \$167,200; other pulp wood, 2,262 cords, valued at \$11,000.

6. Forestry movement: Pennsylvania is more awake to the necessity of forest preservation than any other State, thanks to the energy of Dr. Rothrock. A Forest Association backs his work and publishes "Forest Leaves," since 1885. Forestry lectures are occasionally given at the universities. Arbor Day since 1886.

7. Laws: Since 1887, forest plantations of at least 1,200 seedlings enjoy a tax reduction of 90% to their tenth year; of 80% to their twentieth year, and of 50% to their thirtieth year. From 10th year on, 600 saplings per acre are considered a sufficient growing stock. Similar inducements are granted to owners of second growth, consisting of sound tree seedlings, covering not to exceed 50 acres.

In 1897, the Forest Commissioner was authorized to purchase forfeited land at a price not to exceed back taxes and other "unseated" land at a price of not over \$5 per acre, such lands to become part of a forest reservation system.

The constables of townships are ex officio fire, fish and game wardens, entitled to a premium of \$10 for each offense (fire) reported. They are privileged to summon help, and obliged to report to the court of quarter sessions any case of violation of fire, fish and game laws.

The expense of the fire warden system is equally divided between county and State. The county, however, is not required to incur an outlay exceeding \$500 per annum.

The law of 1897 authorizes the acquisition of three tracts at the head waters of the Delaware, Susquehanna and Ohio Rivers by expropriation for the forest reserve. Each tract is to comprise 40,000 acres in a solid body.

In 1901 the Division of Forestry was raised to the rank of a department.

The revenue from the reserves is to be divided between township and State, to reimburse the former for the inevitable

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loss of taxes. The forest commissioner, as superintendent of the reserves, is empowered to enact rules for management and protection of the reserves; may employ detective service and lawyers in case of forest fires; must publish forest statistics, and may spend \$25 annually per mile for improvement of public roads in the reserves, \$12.50 per mile for improvements outside the reserves.

The reserve policy is handicapped by a constitutional clause forbidding the State to take up loans for such purposes of investment as a forest reserve represents.

8. Reservations: 575,000 acres of State forest reserves have been created within four years, during the administration of Governor Stone. The reserves are scattered over 22 counties. Only two reserves cover an acreage exceeding 100,000 acres.

9. Irrigation: 758 acres are irrigated; 93% of this land yields hay crops valued at \$23.64 per acre.

FORESTRY CONDITIONS OF PHILIPPINE ISLANDS:

1. Area: After Capt. Geo. P. Ahern, 25% to 50% of the islands (or an area of 20,000,000 to 40,000,000 acres) are public forest lands. Mindoro and Paragua contain 5,000,000 acres of virgin forest. Mindanao is almost entirely covered with virgin timber (20,000,000 acres).

2. Physiography: The Philippines, consisting of more than 1,000 islands, separate the Pacific from the Chinese Ocean. The configuration is mountainous, with active volcanos in the south. Mount Apo, on Mindanao, is over 10,000 feet high. The climate is tropical; rainy period from June to November; dry spell from December to May.

3. Distribution: The number of native tree species approximates 700.

4. Forest ownership: The federal government and, to a certain extent, religious orders, own all forest land.

5. Use of timber: Forest utilization suffers from the difficulty of transportation, the lack of efficient labor and the variety of growing stock, containing a large number of commercially untested species.

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Gum, rubber and gutta percha trees, dye woods, ylang-ylang, cocconut palms (in Romblon), etc., have been utilized under Spanish rule.

The occurrence of a pine (*Pinus insularis*) in a tropical climate is geographically interesting.

The price of logs in Manila ranges from 60c. to \$3 (Mexican) per cubic foot. Carabao oxen are used in log transportation. Lumber is hand sawed by the natives. The white ant is the enemy destroying all lumber and timber used and utilized, excepting three or four species.

6. Forestry movement: A Bureau of Forestry, established under G. P. Ahern, succeeded the Spanish forest administration (since 1863) after American occupancy in 1898. The administrative staff is now supplied by American foresters passing the civil service examinations.

The forestry movement centered in the bureau is, naturally, in the direction of forest exploitation only. The botanical and technical characteristics of the timber species are studied and tested. All timber cut on public land is cut by license. Forestry officials, stationed at all important logging centers, inspect, stamp, classify and appraise all shipments of timber cut under license. The cutting of certain species and of certain sizes of trees is prohibited on public land.

The licensee pays from 1c. to 14c. (Mexican) per cubic foot of timber removed from public land.

A forestry school, after the pattern of Dehra Dun, India, should be organized.

7. Laws: The Spanish forestry laws and regulations have been adopted with slight alterations—a course highly commendable.

8. Reservations: None.

9. Irrigation: Not applicable.

FORESTRY CONDITIONS OF PORTO RICO:

1. Area: The island area totals 2,304,000 acres. It is dotted with many trees, park-like; but deforested as a whole, with the exception of eight square miles of inaccessible primeval forest on Mount El Yunque.

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2. Physiography: The climate is tropical. The south is drier than the north. The mountains (volcanic) are continuously bathed in moisture.

3. Distribution: The mountain tree flora is composed of a large number of species, including palms and tree ferns, none of commercial importance.

The coastal forest is said to be often chaparral-like.

Fruit trees (orange, lime, lemon, banana) are common all over the island.

The coffee plantations often appear as dense forest thickets.

4. Forest ownership: No information available. The federal government owns but little land.

5. Use of timber: Fruit trees are most valuable. There is not one saw mill in the island. Natives drag logs cut and roughly squared to the nearest ox-trail. Logs are often whip-sawed into planks or boards. About \$300,000 worth of timber and timber products are annually exported.

6. Forestry movement: None. Avenues of shade trees frame the Spanish highways. Reforestation of denuded slopes seems advisable.

7. Laws: No information available.

8. Reservations: The Luquillo forest reserve, in the eastern part of the island, was established on January 17, 1903.

9. Irrigation: For the cultivation of the staple crops of the south coast, irrigation is practiced with great skill and at considerable expense.

FORESTRY CONDITIONS OF RHODE ISLAND:

1. Area: Area of woodlands, 400 square miles or 40% of the State.

2. Physiography: Flat and sandy. Maritime climate.

3. Distribution: Originally all the island was covered with forest. Now, coppice of chestnut, oak, hickory, ash and birch, with some stray white and pitch pine, are found to form a meager second growth. Trees along the coast are stunted and scarce.

4. Forest ownership: 13 lumber firms own 1,673 acres. Balance of woodland is attached to farms.

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5. Use of timber: Firewood commands a high price, owing to density of population (250 pro square mile). Stumpage costs \$3.02; logs at mill cost \$7.15 per 1,000 feet b. m. 33 saw mills report an average investment of \$3,131. The census gives the value of the output of the lumber mills, since 1870, at about \$250,000 annually.

The cut in 1900 is reported to consist of 18,000,000 feet b. m., including 14,000,000 (?) feet b. m. of white pine.

Leather industry: 5 tanneries, of \$293,000 output, consume 26 cords of hemlock bark, worth \$260, and \$5,000 worth of chemicals.

There is no paper or pulp mill.

6. Forestry movement: None. Some private plantations on sand land.

7. Laws: Fire laws. No case was ever prosecuted.

8. Reservations: None.

9. Irrigation: 2 farms produce on 40 acres \$32,000 worth of vegetables (?).

FORESTRY CONDITIONS OF SOUTH CAROLINA:

1. Area: 20,500 square miles, or 68% of total area, are said to be stocked, generally, with merchantable forest. Sargent's estimate of yellow pine supplies, existing in 1880, was 5.3 billion feet b. m.

2. Physiography: On the North Carolina line, in the extreme northwest, the Blue Ridge Mountains. The Piedmont plateau lies to the east and south of these mountains and extends to a line 150 miles from the coast, where the lowlands of the coastal plain set in.

3. Distribution: In the tier of mountain counties occur the species typical for the southern Appalachians (see Georgia). In the Piedmont section, the hardwoods (especially white, chestnut and red oaks, poplar, hickory, ash, chestnut and cottonwood) occur with *Pinus taeda* and (less) *echinata*. The coastal plain has long leaf pine for the main timber tree. *Cubensis* gives out near Charleston. On moist ground, *Pinus taeda* of splendid growth, often mixed with red oak and white cedar. Huge swamps are occupied by cypress and gums, the hummocks showing elm, hick-

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ory, yellow poplar and red oak. The coast swamps are lined with live oak, magnolia and bays, often with palmetto for an undergrowth.

4. Forest ownership: 251 lumber firms own 454,000 acres of 4,400 feet b. m. average stumpage. Vacant State lands were sold at auction for a song, about 1895.

5. Use of timber: South Carolina seems backward in the lumber industry. The activity was never great. The rivers are not as good for rafting as those in adjoining States, being bordered by broad swamps. Logs are worth \$1.23 on stump and \$4.16 at mill. Mill investments average \$4,097, with 716 firms. The output was valued in

1880	\$2,000,000
1890	2,100,000
1900	5,200,000

The cut of 1900 consisted of:—

Cypress	32,000,000 feet b. m
Yellow pine	433,000,000 feet b. m.
White oak	11,000,000 feet b. m.
Other hardwoods ...	6,500,000 feet b. m.

In 1880, South Carolina lead in the production of tar and turpentine. Since then, the industry was forced westward.

The miscellaneous forest industries (furniture, wagon, cooperage stock, etc.) produced \$168,000 in the 12th census year.

The leather industry is very small, using 305 cords of oak bark and producing \$18,000 worth of goods.

The paper industry is nill.

6. Forestry movement: Nill.

7. Laws: Stock law prevails over entire State. Fire law provides heavy fines for firing turpentine orchards.

8. Reservations: None.

9. Irrigation: 648 planters irrigate, in 1899, 30,000 acres of rice fields. Rice irrigation has been practiced in South Carolina since 1700.

FORESTRY CONDITIONS OF SOUTH DAKOTA:

1. Area: 2,500 square miles, equal to 3% of the area of the State, are wooded.

2. Physiography: Missouri River running from north to

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south to the center of the State and thence towards the southeast corner. Mountains appear only in the southwest, i. e., the Black Hills on the Wyoming line, drained by the Cheyenne River. A strangely large number of rivulets have their sources in South Dakota.

3. Distribution: South Dakota, like all other prairie States, is the meeting ground of the eastern and western tree flora, the former represented by the hardwood groves in the river bottoms (burr oak predominating, in addition, sycamore, cottonwood, willow, box elder, green ash); the latter (western flora) occurring on hillsides and represented by western yellow pine. This species shows in the Black Hills splendid natural regeneration and better trunks than in the Rockies. White spruce (*canadensis*) occurs in the Black Hills near streams, on high northern slopes. Aspen and canoe birch appear on moist slopes in dense thickets after fires.

4. Forest ownership: Farmers own little aside from prairie plantations. Six lumber firms control 6,000 acres. The federal government has reserved 76% of the wooded area in the "Black Hills reserve."

5. Use: Yellow pine only used for timber and for the lead mining interests centering at Deadwood. The cut of timber in census year equals 30,000,000 feet b. m., drawn from a growing stock of 1,500,000,000 feet b. m. Logs are worth, on stump, \$1.80 per thousand; at mill \$5.25. There are 28 saw-mills of \$5,000 average investment. 5,000 head of stock find pasturage in the hills. A plague of bark beetles occurred in 1900. Hardwoods largely used for firewood and fences. Planted forests have perished, usually through fire or neglect, in the majority of cases.

6. Forestry movement: Arbor Day for ornamental planting. South Dakota Agricultural College makes tree planting experiments and issues bulletins bearing on forestry questions.

7. Laws: As in North Dakota.

8. Reservations: The Black Hills forest reserve comprises 1,211,680 acres, one-third of which lies in Wyoming. The opportunity for forest management in this reserve is unrivalled. The financial problem is easy, since stumpage values are high and the demand good. The silvicultural problem is easy, since regeneration is excellent, and since only one species has to be dealt with. There are no "weed trees." Finally, utilization is easy, the moun-

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tains having gentle slopes. Even firewood can be disposed of to a certain extent. Fires and insects, however, handicap the forester's work.

The Wind Cove national park, in the southern Black Hills, created in 1902, is said to be a Yellowstone without geysers.

9. Irrigation: During the census year, 44,000 acres of farmland, irrigated from works (notably deep artesian wells) costing \$285,000, produced crops valued at \$208,000.

FORESTRY CONDITIONS OF TENNESSEE:

1. Area: 27,300 square miles, or 65% of the State, are under forest.

2. Physiography: Vast bottom lands along the Mississippi, subject to inundation. Cumberland River in the north and Tennessee River in the south. Cumberland and Alleghany Mountains in the east, the latter with summits over 6,000 feet high. Low mountain ranges in central part.

3. Distribution: The Mississippi bottom lands show gigantic hardwood forests without undergrowth and a sprinkling of swamps stocked with cypress, red and black gums. Cypress is said to be of poor quality. Amongst the hardwoods are found cottonwoods, gums, red and cow oaks, hickories, elms, beeches and white oaks of huge proportions.

In the middle division of Tennessee (Blue Grass region) agriculture has entirely superceded the forest. Here have grown, originally, the finest red cedar, black walnut and yellow poplar. Now farm wood-lots even are strangely absent. In the original forest there were further found white, red, green and blue ash; white, chestnut, burr, cow, yellow, chinquapin and Texan oak; red, black, sugar and ash-leaved maple; white linden, hackberry, honey locust; winged and American elm. On dry hills, fire has played havoc with the forest. Here white and post oak are rapidly removed for cooperage, whilst black, Spanish and scarlet oak, chestnut and black hickories are badly handicapped by fires. Chestnut is usually dying or dead.

The "Black Jack Lands" (marilandica) are large stretches of strongly calcareous soil, stocked with a stunted growth of black jack, extremely monotonous and much less productive than

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the "Kentucky Barrens." *Pinus echinata* occurs in island-like groups all over middle Tennessee. *Pinus taeda* forms a narrow belt along the Alabama line.

In the Cumberland Mountains the limestone coves show, or used to show, a splendid growth of all valuable hardwoods (white, red and chestnut oak; hickory, notably shag bark; black walnut and black cherry; yellow poplar, cucumber, ash and basswood; red cedar on dry cliffs), whilst the sandstone plateaus overlying them exhibit a poor growth, badly burned, of black, Spanish, post and white oaks; further, sourwood, black gum, chestnut and red maple, with occasional tracts of *Pinus echinata*, *virginiana* and *rigida*. *Pinus pungens* occurs at an altitude of about 3,000 feet and upwards. Good white pine tracts, heavily stocked, are hidden in the backwood coves of the Great Smokies, accompanied on moist and sheltered land by hemlock, or else occur on long, sharp ridges. Spruce and balsams at elevations from 5,000 to 6,000 feet. The hardwoods of the Great Smokies are those of Pisgah forest.

4. Forest ownership: 1,138,000 acres of land are owned by lumber firms. Average stumpage, 3,900 feet b. m. per acre.

5. Use of timber: Logs are worth \$2.18 on stump and \$6.58 at mill. Logs frequently measured in midst of log. Cedar logs bought by the pound. Lumber centers are Memphis and Nashville. The product of the lumber industry in Tennessee was valued in

1870	\$ 3,400,000
1880	3,700,000
1890	9,100,000
1900	18,100,000

The cut consisted of:—

Conifers	82,000,000 feet b. m.
Ash	18,000,000 feet b. m.
Poplar	275,000,000 feet b. m.
Red gum	52,000,000 feet b. m.
White oak	408,000,000 feet b. m.
Other hardwoods	114,000,000 feet b. m.

Total.....949,000,000 feet b. m.

In 1900 Tennessee leads all States in the produced value of staves (181,000,000 staves, worth \$2,500,000) and furnishes 17,-

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000,000 sets of heading, worth \$441,000. Furniture, agricultural and wagon stock are worth \$1,245,000.

Leather industry: Value of output, \$2,800,000. The tanneries consume 846 cords of hemlock bark and 37,050 cords of oak bark, worth \$210,000; further, 58 barrels extract.

Pulp and paper industry: None.

6. Forestry movement: The "Tennessee Forestry Association" was formed two years ago. The Bureau of Forestry has made and published a working plan for a 7,000 acre tract at Sewanee.

7. Laws: Fire laws absolutely ineffective. Arbor Day.

8. Reservations: None.

9. Irrigation: None.

FORESTRY CONDITIONS OF TEXAS:

1. Area: Woodlands cover 64,000 square miles or 24% of the total area of State.

2. Physiography: The Rio Grande River on the Mexican line, the Red River along Indian Territory and the Pecos River traversing the extreme western section are the principal streams.

The western prairies are underlaid with limestone; the east is diluvial and alluvial, traversed by the Ozarks and Cross Timbers.

3. Distribution: Deserts in the extreme west (Staked Plains). Undulating prairies destitute of timber in the middle west. Western red cedar found along the canyons. Western high hill ranges, between Pecos and Rio Grande Rivers, show New Mexican flora. Mesquit extends to the desert borders. East of the 96th degree of longitude, the maritime pine belt exhibits splendid forests of long leaf pine, loblolly pine and short leaf pine (echinata). Stumpage of long leaf pine averages heavier than anywhere else, on 2,900,000 acres.

The low flats between the pine hills show impenetrable thickets of hawthorn, holly and magnolia. Bald cypress forms extensive forests in the river bottoms. Pecan, live oak, holly and Carolina poplar show their finest development along the rivers of the east. Osage orange is a common tree in the east. The Cross Timbers are covered with poor post oak and black

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jack oak woods. These same species extend westward in open groves, ending abruptly where limestone appears. Hackberry said to be found everywhere.

4. Forest ownership: All deserts and outskirts of the Rockies and large forest tracts in the eastern part belong to the State, which, when admitted to the Union in 1845, was allowed to retain its lands and land laws. Federal government owns but a few military reservations.

Lumber companies, in 1900, own 10 billion feet stumpage on 1,671,000 acres. Under the State's general land act of 1895, amended in 1897, the purchase, by individuals, of large tracts belonging to the State is not prohibited.

5. Use of timber: Mesquit and red cedar used for fuel and posts. Cypress said to be of poor quality. Cottonwoods unused so far. The pine belt has been developed rapidly and recently at rising stumpage prices. The output in 1900 was 1,250,000 feet b. m., valued at \$16,300,000.

There are 601 saw mills, of \$14,000 average investment.

Logs are worth \$1.17 on stump and \$4.47 at mill.

The eastern pine forests are most valuable for Texas, since they have to supply the constantly growing population of the treeless three-quarters of the State.

The most important industry of Texas is cotton growing.

Stock raising is a close second.

The naval stores industry gradually adopts dangerous proportions, since it injures the prospects for a second growth.

Paper industry attempts to use pinewood in the soda process.

There are nine tanneries, producing about \$60,000 worth of leather and using about 390 cords of oak and hemlock bark and 137 barrels of bark extract; balance of material used is gambier.

6. Forestry movement: A State "Forestry and Water Supply Association," formed in 1886, seems inactive.

A forestry commissioner cannot be obtained from the legislature. Remarkable is the necessity for the large Kirby Lumber Co. to practice conservative lumbering, owing to stipulations contained in its mortgage bonds.

7. Laws: No information available.

8. Reservations: None.

9. Irrigation: Irrigation on the enormous cattle ranches of central Texas is practically unknown.

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The Mexicans along the Rio Grande and Pecos have irrigated small farms for centuries.

In the east the flooding of rice fields by pumping has recently gained favor.

In 1899, 50,000 acres of farmland were irrigated, yielding crops worth \$539,000 from irrigation systems costing \$1,028,000.

FORESTRY CONDITIONS OF UTAH:

1. Area: 13% of the State, or 10,000 square miles, are wooded.

2. Physiography: The western and eastern thirds of the State are barren. The central third is traversed by the Wahsatch Range, which drains eastward into the Colorado River and westward into Salt Lake, Utah Lake and Sevier Lake.

3. Distribution is little known. In the foothills scrub oaks, nut pine, cedar and juniper occur. Best timber (very poor) obtained from the limber white pine. Higher up in the mountains occur blue spruce (*Picea pungens*), white spruce (Engelmann) and Douglas fir. Yellow pine seems rare, except in the San Pete and San Pitch Ranges. Near Salt Lake the mines have consumed all accessible timber. Cañons are lined with cottonwoods and box elder.

4. Forest ownership: Reserves contain 1,029,760 acres. Large Indian reservation in the northeast called the Uintah Indian reservation. Railroads own alternating sections as usual. Lumber firms own very little.

5. Use: Mine props and fence posts are in chief demand. Coal is cheap. All timber is practically cull; still, log run limber white pine sells at \$40 a thousand. Value of timber output, in 1900, only \$214,000, less than the figures given in the last three census. Stumpage is reported worth \$1.32; logs at mill, \$5.31. Eighty-one mills of \$1,224 average investment. Two very small tanneries, but no pulp industry.

6. Forestry movement: People and legislature are apprehensive of the necessity of forest protection, as shown by petitions to Congress and the Governor's messages. Shade trees planted in cities and on farms, especially box elder, sycamore, cottonwood and lombardy poplar.

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7. Laws: Usual fire laws since 1876. Tax exemption of \$500 worth of property for five years for every acre planted in trees, and of \$50 for every 100 trees planted on streets or streams.

8. Reservations: The Fish Lake forest reserve (67,840 acres) in the San Pete and San Pitch Range of the Wahsatch Mountains. The Uintah forest reserve (875,520 acres) along the Wyoming line at the head waters of the Green River.

The Payson forest reserve of 86,400 acres lies south of Utah Lake.

The Manti forest reserve of 584,640 acres has been established recently in central Utah; the Logan forest reserve of 182,080 acres in northern Utah.

9. Irrigation: The communal organization of the Mormons has admirably subserved the mutualistic cause of irrigation.

Dry farming, for wheat and barley, is possible only on some high bench lands. Generally speaking, however, irrigation is essential for the raising of forage, grain and fruit crops.

The waters of the northeast, emerging from deep canyons, cut into the mountain sides, are diverted into canals, watering the bench land at the foot of the canyons. Large reservoirs are rare.

The value of products raised on 630,000 acres of irrigated land with the help of irrigation works costing \$5,900,000 amounted to \$7,500,000 in the census year.

FORESTRY CONDITIONS OF VERMONT:

1. Area: 3,900 square miles, or 43% of the State, are under forest.

2. Physiography: The Green Mountains, running north and south through the heart of the State, rise to peaks over 4,000 feet high. Lake Champlain and the Connecticut River are the most important water ways.

3. Distribution: Originally, white pine, hemlock and spruce were imbedded in a forest of hardwoods (beech, maple, yellow birch and some little basswood, butternut, ashes, red, white and burr oak and chestnut oak on red sandstone). Spruce, with bal-

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sam, prevails on the ridges. Great bodies of white pine were found on the Connecticut River and in the northwest.

4. Forest ownership: 330 firms own 372,000 acres. 80% of woodlands are attached to farms.

5. Use of timber: White pine is practically exhausted. Quantities of spruce and hemlock are still left. The lumber industry begins to decline slightly. The value of the output of the saw mills was in

1850	\$ 600,000
1860	900,000
1870	3,500,000
1880	3,200,000
1890	6,900,000
1900	6,100,000

The cut in 1900 consists of 376,000,000 feet b. m., comprising 261,000,000 feet b. m. spruce; 43,000,000 feet b. m. hemlock; 21,000,000 feet b. m. white pine; 51,000,000 feet b. m. hardwoods.

657 mills report \$6,304 as the average investment. Stumpage is worth \$2.09; logs at mill cost \$5.80.

The maple sugar industry produced, in 1880, 11,000,000 lbs. of sugar.

The leather industry has consumed, in 1900, 4,990 cords of hemlock bark, worth \$30,000; 163 bales of gambier, worth \$1,200; 100 barrels of extract, worth \$1,200. Eight plants produce \$186,000 worth of leather.

Paper and pulp industry: 27 plants produce, in 1900, \$3,400,000 worth of paper and pulp. There were consumed 31,500 cords of home-grown spruce, worth \$172,000; 25,500 cords of Canadian spruce, worth \$167,000; 2,262 cords of miscellaneous wood, worth \$11,000.

6. Forestry movement: A Forest Commission, appointed in 1882, produced a good report in 1884. No action was taken upon it.

7. Laws: The State pays a premium on forest destruction by exempting the wood lands of saw mill owners for five years from forest taxes. Malicious firing only is punishable.

8. Reservations: None.

9. Irrigation: None.

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FORESTRY CONDITIONS OF VIRGINIA:

1. Area: 23,400 square miles, or 58% of State, are woodland.

2. Physiography:—

(a) Mountain section, a belt 60 miles wide along the West Virginia, Kentucky and Tennessee lines, covering two or three tiers of counties and forming 25% of State.

(b) Piedmont plateau, drained in the main by the James River, lying southeast of "a" and forming 50% of State.

(c) Coastal plains, a belt up to 100 miles wide, extending as far as tidewater in the streams. Swamps near the coast, notably the Dismal Swamp. Soil sandy. The plains cover 25% of the State.

3. Distribution: On Virginia soil the northern tree flora meets the southern. The long leaf and taeda pines do not extend further north than Virginia.

Mountain section: The hardwoods of the southern Appalachians (see under North Carolina) prevail here, with some hemlock and white pine. Spruce at high altitudes. The mountain forests were practically untouched in 1880. It is now claimed that certain species, notably chestnut oak, are exhausted.

Piedmont plateau: In the virgin woods, black oak was the prevailing timber; further, white oak, hickories and black gum. Now no virgin forest is left. Vast areas of fields, exhausted by tobacco growing, come up in Jersey pine (virginiana), rigid pine, echinata pine, sumac and sassafras; further, hardwood brush of chestnut, gum and oaks. Little taeda pine.

Coastal plains: The original growing stock, after Michaux, consisted of belts of taeda pine, alternating with belts of echinata. Now a second growth of taeda forms 75% of the growing stock from the seashore to the meridian of Richmond, whilst echinata appears scatteringly. Long leaf pine is commercially unimportant, reaching its northern limit in stunted specimens near Norfolk. The swamps near the coast show cypress, gums and, after Fernow, red cedar.

4. Forest ownership: 418 lumber firms control 402,000 acres of forest, stocked with 4,300 feet b. m. on an average.

5. Use of timber: Main source of lumber is 2d and 3d growth of loblolly pine, sold under the trade name "Virginia pine," which is said to reproduce exceedingly well. Trees 50

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years old are said to yield three logs. Large quantities of loblolly firewood and kindling are shipped to New York. Sumac leaves are gathered for tanning purposes on such a scale that the railroads reported, in 1885, shipments amounting to 10,300 tons—a good indication of the enormous extent of abandoned fields.

Mill investments average \$3,934, the number of mills being 1,234. Logs on stump are worth \$1.79; at mill, \$8.35. The value of the lumber product was in

1850	\$ 1,000,000
1860	2,200,000
1870	2,100,000
1880	3,400,000
1890	5,600,000
1900	12,100,000

The figures prove a rapidly increasing production, although the virgin woods have gone for many a decade.

The output in 1900 consisted of:—

Hemlock	1,400,000 feet b. m.
Yellow pine	710,000,000 feet b. m.
Yellow poplar	86,000,000 feet b. m.
White oak	143,000,000 feet b. m.
Other hardwoods	13,000,000 feet b. m.

Total.....953,400,000 feet b. m.

The miscellaneous industries report a product worth \$436,000; the cooperage firms, \$587,000; the box concerns, \$900,000.

The leather industry is developed on a large scale. 65 tanneries produce \$4,717,000 worth of leather and consume 73,646 cords of oak bark, worth \$468,000; 420 tons of quebracho, worth \$5,400; 6 tons of sumac, worth \$233. Little extract is locally used, but large amounts are manufactured for exportation.

The paper and pulp industry works in seven plants and consumes 2,917 cords of spruce, worth \$6 per cord; 8,513 cords of poplar, worth \$4.50 per cord, and 3,200 cords of miscellaneous wood, worth \$2.30 per cord.

6. Forestry movement: Nill. The system of forestry actually practiced on abandoned fields may be classed as "intermittent forestry."

FOREST POLICY.

7. Laws: Stock law in many counties. The usual fire laws, existing since 1862, are unobserved.
 8. Reservations: None.
 9. Irrigation: None.
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FORESTRY CONDITIONS OF WASHINGTON:

1. Area: 71% of the State is classed as forests (H. Gannett). Of this area, however, much is burned and cut over. Of the original timber, 55% stands intact, 22% is burned and 23% is cut over.

2. Physiography: The southeastern part of the State is practically destitute of timber, excepting the region south of the bend of the Snake River, owing to insufficient rainfall. The Coast Range extends northward into the Olympic Mountains where there is the heaviest rainfall in the United States. The valleys of the Chehalis and Cowlitz Rivers, separating the Coast Range from the Cascade Range, are not densely wooded. Mt. Tacoma (Rainier) has highest elevation in the Cascade Range. Irregular mountain chains, sparsely timbered, running north and south are found in the northeastern part, mostly covered by Colville Indian Reservation.

3. Distribution: The Cascade and Coast Ranges bear the heaviest continuous forest belt in the United States.

The Coast Range is timbered down to seashore, a strip of dunes excepted. Predominating species are red fir (Douglas fir) and red cedar (*Thuja plicata*). Tideland spruce (Sitka) is said to run only 50 miles inland. Black hemlock forms an almost tropical undergrowth and is the smallest among the giants. Sargent denies fires ever having swept the virgin forest. Pinchot finds cinders below the vegetable litter all over the Olympics.

On the Cascade Range, we must strictly distinguish between west and east slope, owing to great difference in rainfall.

The west slope has at its highest altitudes alpine fir, hemlock, alpine larch (*Lyalli*) and white bark pine. Descending from the crest we meet Engelmann's spruce, white pine (*monticola*), lowland fir, amiable fir and noble fir.

Lower down, Alaska cedar (*Ch. nootkatensis*), western hemlock and western red cedar are met with, and Douglas fir in-

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creases in proportion until it forms the prevailing species at lower altitudes. Near the Gulf, tideland spruce occurs.

On the east slope, below the timber line fringed by white bark pine and alpine hemlock, we strike Engelmann's spruce and Douglas fir. Lower down, we enter upon forests of yellow pine (*Pinus ponderosa*) and groves of lodge pole pine.

The Blue Mountains in the southeast contain yellow pine, Douglas spruce, Engelmann's spruce and lodge pole pine.

The irregular mountain chains in the northeast are said to show timber in the valleys only (?). Yellow pine predominates; in addition, lodge pole pine, Douglas fir and tamarack larch are found; further, Engelmann's spruce, lowland fir, western white pine and red cedar. A tree alder (*Alnus Oregona*) is remarkable for its size.

The Columbia River and its tributaries are fringed by gigantic broad-leaved species, notably cottonwoods, maples, ashes and willows.

4. Forest ownership: The United States reservations aggregate 7.0 million acres; 0.4 million acres are owned by farmers; lumbermen control the Coast Range and own one-tenth of entire stumpage.

5. Use of timber: Lumber industry is modern. Investment in a saw mill averages \$23,500. 24 million staves of cottonwood were manufactured in 1898. In the coniferous forests a yield of 200,000 feet b. m. per acre is not exceptional. 20,000 square miles in one plot are said to average 25,000 feet b. m. per acre. Mining is undeveloped and requires little timber. Clearing of heavy timbered land costs \$100 to \$200 per acre. Timber claims in 1898 were sold at \$10 per acre. The stumpage price after 12th census is 80 cents per 1,000 board feet; logs at the mill are worth \$5.14 making logging expenses \$4.34.

Washington employs three-fourths of all steam power used in logging in the United States (railroads and donkey engines). The waste in logging is from two-thirds to three-quarters of entire tree. Fires destroy enormous amounts of timber and invariably the hemlock left after lumbering.

During the census year (1900) Washington produced 2.3 billion feet b. m., worth \$30,000,000, holding 5th rank among States. There is no paper, pulp and leather industry. (The latter industry consumes only 400 cords of bark, though red fir bark and hemlock bark are rich in tannin.)

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Tideland spruce is used mainly for car linings and interior finish; cedar mainly for shingles; hemlock is only beginning to be used at all. Douglas fir is used for all building purposes, trestle bridges and ship building.

The growing stock of timber in Washington consists of

Red fir	90,000,000,000 feet b. m.
Spruce	8,000,000,000 feet b. m.
Cedar	23,000,000,000 feet b. m.
Hemlock	42,000,000,000 feet b. m.
Yellow pine	13,000,000,000 feet b. m.
Miscellaneous	20,000,000,000 feet b. m.

Total.....196,000,000,000 feet b. m.

As we are cutting 2.3 billion feet b. m., we are cutting 1.17% of the growing stock per annum.

6. Forestry movement: State association in 1898, composed of lumbermen, securing more stringent fire laws.

7. Laws: Fire laws of 1877 comprehensive and stringent, but unenforced. Law of 1903 makes the land commissioner ex officio "forest firewarden," the county commissioners "deputy firewardens," road supervisors and State land cruisers "forest patrolmen." The firewardens may appoint the cruisers and foremen of lumber firms as "patrolmen at large." Fire laws to be posted: firing of slashings forbidden during dry months. Carelessness in camp fires punishable only if it results in damage to private interests.

8. Reservations: Total area reserved 7,036,000 acres, equal to 15.5% of State. In 1898 there were employed one superintendent, three supervisors and twenty-three rangers.

(a) Olympic forest reserve, 1,466,880 acres. Douglas fir prevails, with hemlock and cedar. Very deep humus. No lumbering, owing to difficulty of transportation. Little chance for farming, grazing, mining.

(b) Washington forest reserve, 3,426,400 acres. Two-thirds of the growing stock (20 billion feet) is formed by hemlock. Little grazing. Timber still inaccessible. Mines beginning to be developed. Reserve is said to include 150,000 acres of agricultural land.

(c) Mt. Rainier forest reserve, 2,027,520 acres, embracing

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the Mt. Rainier National Park of 207,360 acres, with its unrivalled combination of ice and woodland scenery.

(d) Part (about 104,000 acres) of the Priest River forest reserve.

(e) Blue Mountain forest reserve.

9. Irrigation: Irrigation is profitable on the east side of the Cascades.

Small farms, along the narrow strips of land left between the river and the foot of the cliffs framing the canyons, are found along the Columbia and Snake Rivers. Here, the irrigation of fruit orchards is particularly remunerative, the water being lifted from the river by bucket wheels.

In the Great Bend country it will be necessary to construct reservoirs, storing away the supply furnished by intermittent and uncertain streams.

Washington hops are famous. The seemingly arid soil of the rolling uplands in the east has been found to produce splendid wheat, without irrigation, owing to its remarkable hygroscopic qualities.

The irrigated farms, covering 135,000 acres, produced anno 1899, from irrigation works costing \$1,700,000, a crop valued at \$2,400,000.

FORESTRY CONDITIONS OF WEST VIRGINIA:

1. Area: 18,400 square miles, or 73% of State, are stocked mostly with merchantable timber.

2. Physiography: West Virginia has the poorest shipping facilities of any State in the east. The main rivers (the Big Sandy, Guyandotte, Kanawha and Cheat)—which are not navigable—rapidly traverse a plateau sloping from the crest of the Alleghanies westward to the Ohio River. The Potomac alone, rising in the extreme northeast, finds its way to the east along the Maryland line.

3. Distribution: The hardwoods prevail by far. Echinata pine is found scatteringly on a narrow belt lying half way between the mountains and the Ohio River. *Pinus virginiana*, *rigida* and *pungens* occur on the east slopes and on the poorer soil of the plateau. A few *Pinus resinosa*, found in the high mountains, are the southernmost representatives of that species.

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In the western and northern section the virgin hardwoods have been removed.

Along the upper course of the rivers the primeval forest is frequently intact. Prime walnut, cherry, yellow poplar and white oak occur here in large quantities. At the headwaters of the Green, Briar and Cheat Rivers a large and commercially important belt of white pine is found, and, adjoining it to the north, a long belt of splendid spruce. (Spruce stumpage said to average 25,000 feet b. m. to the acre.)

4. Forest ownership: 221 lumber firms own 506,000 acres, of 5,200 feet b. m. average stumpage.

5. Use of timber: Logging and log transportation in the primeval woods of the mountains is extremely difficult, owing to the character of the rivers, the lack of snow and the high expense of railroading in a broken country. 929 mills represent an average investment of \$5,700. Logs on stump are worth \$2.36; at mill, \$6.59. The output of the mills was valued in

1870	\$ 1,500,000
1880	2,400,000
1890	5,500,000
1900	10,600,000

The cut in 1900 consisted of:—

Hemlock	91,000,000 feet b. m.
Spruce	94,000,000 feet b. m.
Yellow pine	18,000,000 feet b. m.
White pine	5,000,000 feet b. m.
Walnut	150,000 feet b. m.
Poplar	193,000,000 feet b. m.
White oak	353,000,000 feet b. m.
Ash, birch, chestnut	25,000,000 feet b. m.

The cooorage materials produced were worth \$400,000, and the furniture, wagon, etc., stock, \$580,000.

Leather industry: 46 tanneries produce annually \$3,200,000 worth of leather and consume 8,445 cords of hemlock bark, worth \$50,000; 69,286 cords of chestnut oak bark, worth \$305,000; in addition to 394 barrels of bark extract.

Paper and pulp industry: There are 6 mills yielding an output worth \$527,000. They consume 5,729 cords of home-grown

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spruce, for pulp, valued at \$30,500; 11,286 cords of home-grown spruce, for sulphite and soda fibre, valued at only \$39,100; 1,519 cords of miscellaneous wood, valued at \$4,200.

6. Forestry movement: None. Arbor Day failed to be legalized. The West Virginia Agricultural Experiment Station at Morgantown issues valuable bulletins on insect plagues in the forest, written by A. D. Hopkins, the forest insectologist of the United States.

7. Laws: Laws under which unlawful firing is punished are unenforced, although existing on the statute book.

8. Reservations: None.

9. Irrigation: None.

FORESTRY CONDITIONS OF WISCONSIN:

1. Area under forest, 31,750 square miles, or 58% of the State.

2. Physiography: Undulating land. Splendid shipping facilities on the shore line of Lakes Superior and Michigan, and on the Mississippi River, helped by a multitude of lakes and floatable rivers. The Wisconsin, Menomonee and St. Croix Rivers are famous for the output of white pine.

3. Distribution: The southwestern section is prairie, intruded by the black oaks and paper birch.

The southeastern section shows the hardwoods (maple, basswood, elm, white and red oak) prevailing, the overtowering white pines having been removed.

The northeast is characterized by hemlock and birch, whilst white and red oak are scarce.

The north shows pineries stocked with white, jack and Norway pines. A large number of swamps produce spruce, balsam, white cedar, tamarack or nothing.

4. Forest ownership: The northern half of the State—the coniferous region proper—is owned in the following proportion:—

United States	5%
State and counties	2%
Railroads	5%
Resident settlers	24%
Lumbermen	50%
Outsiders	14%

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The last census credits the lumbermen with a total forest property of 1,020,000 acres.

5. Use of timber: The growing stock of white pine was estimated in 1880 (by Sargent) at 41 billion feet b. m., and in 1897 (by Roth) at 17 billion feet. Both estimates were found too small. 4.7 billion feet white pine are still owned by lumbermen alone, whilst the annual cut has been from 2 to 3 billion feet since the estimates were made.

The cut of the census year was:—

Hemlock	402,000,000 feet b. m.
Norway pine	94,000,000 feet b. m.
White pine	2,479,000,000 feet b. m.
Other conifers	66,000,000 feet b. m.
White oak	127,000,000 feet b. m.
Other hardwoods	392,000,000 feet b. m.

The cutting of pines is very close, logs of 4 inches diameter at small end being used. Log drives are said to average frequently only 100 feet b. m. per log. The average investment, in 1,033 saw mills, is \$35,959, a figure exceeded only by the Minnesota mills.

Value of products of lumber industry was:—

In 1860	\$ 4,400,000
In 1870	15,100,000
In 1880	17,900,000
In 1890	61,000,000
In 1900	57,600,000

which latter figure places Wisconsin in the lead of all States.

The leather industry is important, the value of its products being \$20,000,000 per annum. 35 plants use, in the census year, 177,628 cords of hemlock bark, worth \$1,070,000; 770 cords of oak bark, worth \$8,000; 56 barrels of hemlock bark extract and 1,692 barrels of quebracho extract; 41,726 bales of gambier and 247 tons of sumac.

The paper and pulp industry produces in 47 mills products worth \$10,895,000 and consumes 66,300 cords of native spruce for pulp, worth \$398,000; 58,659 cords of native spruce for fibre, worth \$350,000; 24,754 cords of Canadian spruce, worth \$164,000; 1,400 cords of native poplar, worth \$12,000, and 60,000 cords of miscellaneous wood (the majority of which is hemlock), worth \$210,000.

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6. Forestry movement: Forestry commission reports to legislature in 1898. Ernest Bruncken, secretary. (See also XXXI.)

7. Laws: Forest fire warden law of 1898, creating certain county officials ex officio fire wardens.

A law of June 2, 1903, provides for an unpaid "board of forest commissioners" or a "department of forestry." Paid superintendent of State forests acts as secretary of board for records, publications, maps, etc.; acts as "trespass agent" on State forest reserve; acts as chief fire warden of the State; appoints fire wardens in certain counties. Fire wardens and helpers are paid by the towns; but the annual fire expense per township must not exceed \$100. Fire notices. Fire reports. Duty of district attorneys to prosecute incendiarism, upon complaint of fire wardens.

All State lands are withdrawn from sale (excepting swamps, farm wood lots, agricultural land and small tracts) and constitute a "State forest reserve." Here possibility of forestry is to be studied by the superintendent; dead and down timber to be disposed of; experiment stations to be formed.

The State may accept unencumbered forest land donated by private persons for reserve purposes. Insufficient appropriation.

Any 40 acres planted with 1,000 pine trees obtain a tax release for fifteen years.

8. Reservations: No federal forest reserves.

The State forest reserves created in 1903 consist of holdings so scattering that protection from fire will be difficult.

9. Irrigation: None.

FORESTRY CONDITIONS OF WYOMING:

1. Area: 13% of area of State or 12,500 square miles are said to be wooded. (Underestimate??).

2. Physiography: A broad, high, bare plateau, stretching from the northeast to the southwest into the Uintah Range, occupies one-half the State. Deserts in the southwest (Colorado and Red Deserts). The Yellowstone Rockies occupy the northwestern quarter; the Big Horn Mountains, drained by the Yellowstone River, the central north; the Uintah Mountains come from Utah; the Laramie and Medicine Bow Mountains from Colorado; the Black Hills from South Dakota. The northern moun-