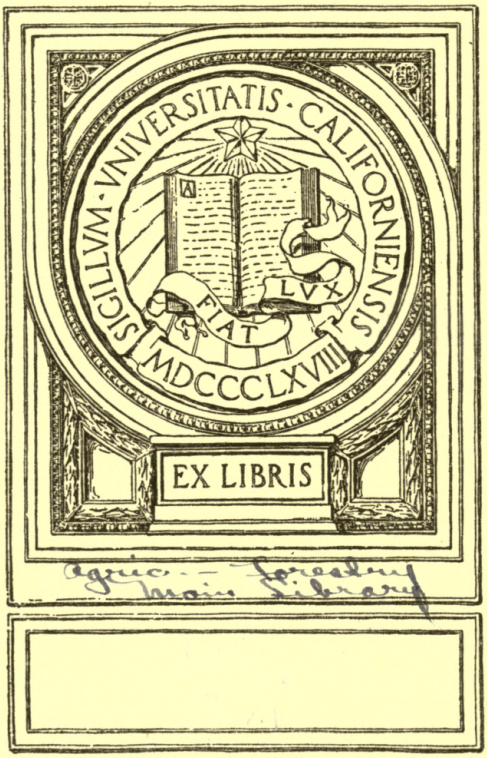

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FORESTRY PAMPHLETS

Pamphlets on forestry in GEORGIA

VOL. 1

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Farm Forestry--Lesson 1, The Tree.
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Georgia State College of Agriculture

ANDREW M. SOULE, PRESIDENT

Extension Division

J. PHIL CAMPBELL, DIRECTOR

Correspondence Courses in Agriculture

Farm Forestry

Lesson I—The Tree

J. B. Berry, Professor of Forestry

Co-operative Extension Work in Agriculture and Home Economics, Georgia State College of Agriculture and United States Department of Agriculture co-operating.

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University of Georgia, Athens, Georgia

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Correspondence Courses in Agriculture

Farm Forestry

Agriculture treats of the production of vegetable matter and includes the various steps of sowing or planting, cultivation, harvesting, transportation, marketing and manufacture. Forestry is but a part of this great subject and deals more specifically with the production of wood material. Similarly with agriculture, forestry treats of the steps of formation (sowing or planting), care (cultivation, pruning, thinning) mensuration (determining the volume of production), logging (harvesting the crop), milling (manufacturing the logs into useable product), and marketing. Forestry differs from agriculture mainly in that the yearly growth may not be harvested annually but must be allowed to accumulate until the product is of usable size.

Farm forestry is that portion of the general subject which considers more particularly the production of farm timbers, fence posts and fuel. It deals specifically with the management of the woodlot.

It is not the object of this course to teach one to recognize the different kinds of trees found in the woodlot. Such a knowledge is presupposed. Those desiring knowledge in the identification of trees should consult the following publications:

Manual: Trees of North America, by Sargent.
Our Native Trees, by Keeler.
Trees and Shrubs of North America, by Newhall.
Key to Trees, by Collins and Preston.
Studies of Trees, by Levison.

Lesson I—The Tree

To be able to grow and care for forest trees successfully it is necessary to have a knowledge of the structure and life processes of the individual tree, and to understand the factors that influence its growth and development.

Trees are living organisms. They are the highest type of vegetation found on the earth. They differ from herbs in having a woody structure and a permanent life, and from shrubs in developing single stems that elevate the branches above other forms of vegetation.

The Parts of a Tree and Their Uses

The tree is made up of three parts: roots, stem and crown.

The Roots. The roots of a tree serve several purposes. In a mechanical way the larger roots hold the stem in an upright position so that the crown receives a maximum amount of sunlight, very small roots (root hairs) near the ends of all roots, serve to absorb the soil moisture, and all roots serve in the transportation of food materials to and from the crown. As the roots grow and force their way into the soil the root hairs die and are replaced by new ones nearer the tips.

The form of root system varies with the different species of trees

and with the character of soil. Certain trees, as hickory, walnut and white pine, develop a stout tap root which extends perpendicularly into the soil. With others, as maple, red gum and cottonwood, the roots tend to spread laterally in the upper layers of soil, producing a shallow root system. With others again, as beech, red oak and chestnut, several strong roots penetrate obliquely into the soil. A few trees will adapt themselves to soil conditions, in a shallow soil developing surface roots, and in a deep soil developing deep lateral roots. A shallow soil may be due to hard-pan, bed rock or soil water. In the latter case it is susceptible of improvement through drainage. In general it may be said, however, that unless the soil is deep enough for a tree to develop its characteristic form of root system, the growth of the tree will be slow and the form irregular and stunted. The characteristic form of the root system of many trees may be studied on those upturned by the wind.

The Stem. The stem or trunk (occasionally termed "bole"), supports and elevates the crown. It conveys the soil moisture (sap) from the roots where it has been absorbed, to the crown where it is used. The stem also serves as a storehouse for surplus food material. From an economic standpoint, the stem is the most valuable portion of the tree. Upon its size and shape depends the amount of lumber, cordwood, ties, or other product that may be obtained. Each species has its characteristic form of stem, some trees producing a long cylindrical bole free of branches, others developing a short tapering bole more or less branched and crooked. Often the same species develops two very different forms, depending upon whether it is growing in the open field or in the forest. One may be short with a long crown and rapidly tapering stem, the other tall and straight with a short crown and a cylindrical stem.

The bark is characteristic of the species and varies in thickness, color, roughness and markings. It serves as protection against heat, cold, mechanical injury and the entrance of disease (rot). Occasionally it forms a valuable commercial product, as in the case of hemlock (spruce) and chestnut bark in the production of tannic acid.

Crown. The crown is composed of branches, twigs and leaves, together with buds, flowers, fruit, etc. As it has to do with many vital processes it is the most important part in the life of the tree. As a result of almost endless division the branches enable the tree to present the greatest possible extent of leaf surface to the action of the sunlight and air. Unlike the roots the branches have a more or less definite arrangement.

The leaves of the tree function in much the same way as do the lungs and stomach of an animal. In them are carried on the processes of respiration (breathing—the breaking down of tissue through oxidation), transpiration (the loss of surplus moisture through evaporation), and photosynthesis (the combination of carbon dioxide from the air with the mineral matter of the sap to form sugar). Protosynthesis is carried on by the green matter of the leaf (chlorophyl) under the influence of sunlight. In darkness (often in subdued light) this process is interrupted.

The shape, size and texture of leaves vary greatly in different species, often in the same tree, as a result of the struggle for existence—for light and air. All gradations of size and shape occur, from the broad, soft leaves of cottonwood (Paulonia) to the needle-like leaves of pine and the sharp, scale-like leaves of red cedar.

The form of crown, as well as of leaf characterizes the different species, such as the inverted vase form of elm, the conical form of hemlock, the rough, irregular form of oak.

An intimate relation exists between the size of the crown and the extent of the root-system. If for any reason the one is not allowed its full development, the other will be correspondingly affected. Since the amount of food manufactured, and consequently the amount of growth, depend upon the extent of leaf surface in the crown, it follows that any operation which will result in more light and a greater growing space for the crown will influence the rate of growth favorably. This fact is of great importance in the practice of forestry and for this reason, the crown becomes of special interest in the management of the woodlot.

Structure of Wood. The stem, branches and roots of trees are composed of woody tissue. This is not a simple substance like iron or gold, but as is true of all organic material, is composed of minute cells. These are somewhat similar in appearance to the cells of honeycomb, though many times smaller. In a cross-section of oak the centers of these cells may be seen as tiny holes. The walls of the cells are built up of cellulose and lignin, the main constituent of which is carbon. In the living state these cells are more or less filled with a living substance (protoplasm), which is common to all life. The cells are not all alike but differ in form, size and thickness of wall, and in their use. Some conduct food material to and from the crown, some store reserve food material until it is needed, others serve simply to strengthen the woody tissue.

Parts of the Stem of the Tree. If the top of a stump of a recently cut oak is examined, it will be found to be made up of several parts. Around the outside is observed the bark, which is composed of two parts, the outer, protective, corky layer and the inner, light-colored, softer layer. Inside the bark is found the wood proper, which is likewise differentiated into two parts, the outer, lighter-colored, moist "sap wood" and the inner, dark-colored, firmer "heart-wood." At the center is found the pith, very inconspicuous in most trees. From the bark to the pith are found broken, wide or narrow lines of woody tissue, known as medullary rays. To the medullary rays is given the credit for the beautiful silver-grain of quarter-sawn oak. They carry food from the bark to the inner portions of the tree, serve as a storehouse for surplus food material, and form a means of communication with the air. Occurring in all species of wood, often so small as to be invisible to the naked eye, thousands may be counted to the square inch. In a few species, as birch and cherry, their termination in the bark is marked by conspicuously roughened spots known as "lenticles."

Between the bark and the "sap-wood" is found a layer of wet,

often slippery, light-colored, living-wood-tissue (cambium) in which the cells are capable of division. The division of the cambium cells results in diameter growth. All other wood tissue is dead or nearly dead material. When first formed from the cambium all cells contain protoplasm, but they soon lose their living contents.

The outer layers thus form a coating or shell of living tissue over the dead inner portion of the roots, stem and branches. Often the entire heart-wood at the base of the tree may be destroyed and yet the tree be growing vigorously, indicating that the life processes are carried on in the sapwood and bark only.

Annual Rings. If the bark, sap-wood and heart-wood are carefully examined, each will be found to be made up of layers which in cross-section appear as concentric rings of tissue, one of which is produced each year. These concentric layers are known as annual rings, and it is possible to determine the age of the tree by counting them. As a result of the division of the cambium cells a layer of new cork tissue is produced on the inside of the bark and a layer of new wood tissue is laid on the outside of the sap-wood, the cambium layer always remaining between the layers of new tissue. The amount of bark produced each year is much less than the amount of woody tissue. The entire tree, roots, trunk and branches, is covered each year with a new coat of wood and bark.

Spring and Summer Wood. If an annual ring of oak wood is examined it will be found to be made up of two layers, a soft, open, light layer (spring wood), and a dense, hard, darker-colored layer (summer wood). In the spring a large amount of water is required by most trees to produce the new leaves and to supply the growing parts, with the result that the cells produced during the early part of the growing season are large and thin-walled. In oak wood the openings of the cells in the spring wood are visible to the naked eye. As soon as the leaves have developed, much less water is required and the cells produced later in the season are small and thick-walled. This difference in growth gives rise to the marked contrast between spring and summer wood in many trees, results in the "grain" of sawn wood, and separates one year's growth from another. The rate of growth of the various species is not the same, nor is it the same from year to year in any one species. A favorable, moist season will produce a wide annual ring; an unfavorable, drouthy season, a narrow ring. In general trees grow slowly during the first few years of life, the rate then increases until middle life, then falls off gradually. In an old tree the annual rings may be so narrow as not to be distinguishable with the naked eye.

Height Growth of Trees. Height growth and growth of branches in length are produced by the development of the terminal buds. In this growing tissue the division of cells takes place transversely (in contrast to the longitudinal division of the cambium cells), resulting in an elongation. Along with this there is a stretching process as the cells become filled with water. New shoots do not grow in length after the first season. They grow in thickness only, and other new shoots are produced from new terminal buds to increase

the length of the branch and the height of the tree. The growth of the roots in length and thickness is somewhat similar to that of the branches.

Life Processes of the Tree. A tree, being a living organism, must carry on certain life processes, much as with an animal. It must breathe, absorb and digest food and transport the nourishment to the parts requiring building up.

Breathing, or Respiration. Breathing is carried on through minute openings (stomata) in the leaves. The tree breathes in oxygen and breathes out carbolic acid gas, the same as an animal. This oxygen is used in carrying on the life processes of the tree. To some extent breathing takes place through small openings in the bark of the stem (lenticles), the oxygen being conducted to the inner portions of the stem through the medullary (pith) rays.

Absorption. Raw materials (for the manufacture of food) are absorbed by the root-hairs and through the leaves. In the former case the raw materials consist of mineral (or soil) salts in solution; in the latter, of carbolic acid gas. The mineral salts in solution are carried from the roots, through the stem and branches to the leaves where they are combined with the carbolic acid gas of the air to form food (sugar). When wood is burned, the mineral salts remain as ash; the portion of the material from the air (carbon) goes off as gas (carbolic acid gas) and disappears. The mineral salts occur (usually) in very weak solution. That enough may be brought up to supply the requirements of the tree, a far greater amount of water must be absorbed than is actually needed. The excess of water passes out through the stomata of the leaves as water vapor (transpiration). This action serves to cool the leaves and the tree, as does perspiration in animals. Transpiration takes place in winter as well as summer and is often the cause of "winter killing" when excessive.

Digestion. The raw material (carbolic acid gas) absorbed through the stomata of the leaves, forms the bulk of the food manufactured. By the action of sunlight on the chlorophyl (green matter of the leaf), the carbolic acid is decomposed into carbon and oxygen (photosynthesis); the carbon being retained, the oxygen returned to the air. The carbon is combined with hydrogen and oxygen of the water and the mineral salts to form sugar, a good material capable of utilization by the tree. In other words, the raw materials absorbed in the root-hairs and the leaves must be digested in the leaves before they become available as food.

Circulation. After the food material is thus prepared in the leaves, it is carried down through the inner-bark of the branches, stem and roots and through the medullary rays to the tissues requiring nutrition and building up. Some of the food material is used at once in forming the annual ring, flowers, fruit and other new parts of the tree. Other portions are changed from sugar to starch and stored away as a reserve supply with which to begin the next year's growth. Before being available for use it is again transformed into sugar.

Georgia State College of Agriculture
Correspondence Courses in Agriculture

Farm Forestry

Question Paper

Lesson I

The student will discuss freely the following topics, not confining himself to the lessons but using information gained from all sources. Write freely on the questions as topics for discussion rather than as questions to be answered briefly. All answers to be written without the direct aid of book or lesson.

Answers to be plainly written in ink.

Send answers to the president Georgia State College of Agriculture, Athens, as soon as completed and a new lesson will be forwarded. In no case will a succeeding lesson be sent until the questions of the previous lesson have been satisfactorily answered.

Always give name, address, and certificate number.

1. Name the parts of a tree and give uses of each part.
2. What constitutes the raw food materials of a tree, how obtained and how manufactured?
3. What is the structure of wood? How does the stem of a tree grow in diameter?
4. How and why does a tree carry on respiration and transpiration?
5. What are the medullary rays in wood? What use do they serve? What is quarter-sawn wood?

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Georgia State College of Agriculture

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Extension Division

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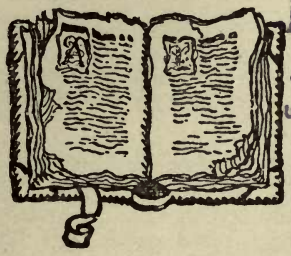

Correspondence Courses in Agriculture

Farm Forestry

Lesson II

Factors Influencing the Development of Trees

J. B. Berry, Professor of Forestry

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Correspondence Courses in Agriculture

Farm Forestry
LESSON II

Factors Influencing the Development of Trees

Tree growth, like all plant development, is dependent upon certain factors of habitat; namely, temperature, light, moisture, soil salts. A certain degree of each factor, varying for each species, is necessary for best growth. In fact, the character of tree growth in any situation is determined largely by the degree to which each of these factors is present.

Temperature. For each species of tree there is a minimum, optimum and maximum degree of heat. Below fifty and above 115 degrees Fahrenheit, growth practically ceases and trees take on a dwarfed and shrubby form. Towards the equator the vegetation becomes more luxuriant, yet the development of trees is not so vigorous as in the temperate regions. Temperature is affected similarly by altitude and latitude. Consequently, tree growth is stunted whether it occurs at the summits of high mountains or in the arctic zone.

A temperature favorable to the development of any one species may vary between wide limits. The range of White Pine, for instance, extends from southeastern Canada to northern Georgia, and Quaking Aspen occurs in practically all parts of North America. However, if a study be made of a species throughout its natural range, one portion of the range will show a maximum development and the temperature of this situation may be said to be the optimum for the species. In a higher or lower temperature than this the development of the species is not so vigorous. In any one section, however, the differences in temperature are so slight as to be negligible, and temperature as a factor of plant growth possess little importance.

Light. So important is sunlight in the growth of trees that it is said to be the purpose of trees to convert sunlight into wood. Practically all trees thrive in full sunlight, but there are a few which have adapted themselves to conditions of less light. Trees which require full sunlight for development are designated as "light demanding" (intolerant), while those which thrive with less than full sunlight are classed as "shade enduring" (tolerant). Most trees are more tolerant when young than in later life. This property enables seedlings to become established in the shade of mother trees.

Of the more tolerant trees, Hemlock and Dogwood are good examples, while Yellow Poplar and "Old Field" Pine represent

the intolerant class. As a rule representatives of the tolerant class are to be found on northern slopes, in coves of the mountains and in the shade of other trees. Intolerant trees, on the other hand, occupy southern and western slopes, the tops of hills and ridges, and old fields. They quickly die if they become over-topped. Between the extremes of tolerance is a class known as "moderately" tolerant. Thus chestnut often occurs in the shade of poplar and oak, but never in the shade of hemlock.

Table of Tolerance.

Tolerant	Moderately tolerant	Intolerant
Dogwood	Loblolly Pine	Cypress
Hemlock	White Pine	Shortleaf Pine
Maple	Chestnut	Yellow Poplar
White Cedar	Red Oak (shade when young only)	Sassafras
Black Gum	Black Walnut	Hickory
Beech	Sycamore	Black Locust
Basswood (Linden)		Longleaf Pine

Trees which grow naturally in the shade of the forest usually die when transplanted to the open, while trees grown in the open never survive transplanting to the dense forest. If planting is to be done in the forest, part of the old trees must be removed.

Moisture. Water constitutes a raw product in the manufacture of food, acts as a medium for the transportation of soil salts and, through transpiration from the leaves, tends to equalize extremes of temperature. Only a small portion of the total amount of water absorbed by the roots is utilized in the manufacture of food, the greater portion being transpired through the small openings (stomata) in the leaves. A small amount of water is transpired through the bark, but the amount is practically constant for winter and summer. On the other hand the loss through the leaves is greatest in summer during the period of growth, and very low in winter after the leaves have fallen. During hot, dry weather a large deciduous (hardwood) tree may transpire several barrels of water per day. In winter, after the leaves have fallen, the same tree may not transpire more than a quart or two. Where the ground freezes solid in winter small trees often die because the roots cannot absorb enough water from the soil to balance the amount transpired. This is known as "winter-killing."

The amount of water present in the soil is an important factor in the distribution of trees, certain trees demanding considerable water while others are able to survive on little. Too much water, however, has much the same effect as too little, since a soil filled with water (saturated) has no room for air which is also necessary to the roots. If the level of ground water comes near the surface, none but a few of the shallow-rooted trees will thrive, for the tap-rooted trees demand a deep soil and a level of ground water at considerable depth. Few trees will thrive in a swamp where the surface of the ground is under water. If the surface water be

drained away, conditions are favorable for the growth of a number of other trees. If the drainage be extended to several feet below the surface, many of the deep lateral-rooted trees will thrive. Drained to a depth of ten or fifteen feet, conditions are favorable for the development of tap-rooted trees. As a rule, trees which thrive normally in wet ground do not survive transplanting to dry situations, and vice versa. Under natural conditions Red Cedar (Juniper), Shortleaf Pine and Red Oak are confined to dry situations; Walnut, Cherry, Hickory and White Oak find their best development in the deep, well-drained soils of northern slopes; Cypress and White Cedar thrive in saturated soils where the surface of the ground is below water the greater portion of the year.

Soil Salts. Mineral elements from the soil and carbon dioxide from the air constitute the raw materials from which the tree manufactures its food (sugar). Carbon dioxide is absorbed through the leaves. Because of its universal distribution as a constituent of air it has no influence in the distribution of trees. Soil salts in solution are absorbed by the roots. The chief elements necessary to tree growth are lime, magnesia and potash with small amounts of nitrogen, potassium, iron and sulphur. In the leaves the soil salts are united with carbon, hydrogen and oxygen forming sugar to be used in building new tissue. The more valuable salts, as nitrogen and potassium, remain in the leaves and fruit and are returned to the soil as the leaves fall and decay. The wood of the tree contains about one per cent mineral matter, principally potash. Hardwoods contain a higher per cent of potash than softwoods.

Trees differ markedly in their requirements for soil salts, certain species (Pine) thriving in almost sterile soils (sand), others (Walnut, Hickory, Ash) demanding a soil rich in mineral elements. Excessive amounts of certain soil salts may render a soil unproductive for trees as well as for farm crops. An alkali soil is the result of salt (sodium carbonate) or lime (calcium carbonate) in excess. Such a soil often may be corrected by drainage, thereby leaching out the excessive amounts of salts. Willow and Aspen (Populus) thrive on a soil slightly alkaline in nature.

Slope and Aspect. Both these factors influence tree growth indirectly, as they affect light and moisture. Aspect (slope towards a cardinal point) is of great importance in the distribution of trees. A northern aspect receives less light (since an equal area of sunlight is spread over a greater surface), has a lower rate of evaporation than any other aspect, (since the sun's rays are not so direct), and contain more water. The southern aspect, on the other hand, receives the direct rays of the sun and is drier and warmer and the light is more intense. Consequently the northern aspect may support a forest of Hemlock, Beech, Maple, Walnut and Hickory, while the southern aspect supports an open stand of Pine and Black Jack

Oak. Damage as a result of drouth, insects and disease is greater on southern aspects. The eastern aspect is somewhat similar to the northern while the western resembles the southern.

How Trees Reproduce Themselves

Seed. All trees reproduce themselves by seed. A few species produce a large crop of seed every year but most species require from one to several years recuperation. Trees in the open are more apt to seed every year, due to the large crown and the extensive root system producing a large store of food. Trees in a woodlot produce seed in the top of the crown only—that portion which receives direct sunlight. A large part of the seed produced is infertile (unsound). About 5 per cent of Yellow Poplar seed is sound; 60 to 80 per cent of Pine seed, and 80 to 95 per cent of Oak, Walnut, and Hickory. With certain species the seed germinates before, or as soon as it falls, while with others the seed remains dormant in the soil for one or two years. The seed of a few trees germinate in dense shade but with most species either full or partial sunlight is required for development. The seedlings of many species require some shading for the first year or two after germination but later demand full sunlight.

Most trees are very particular as to the character of the seedbed. Pine seed must be brought in contact with the mineral soil while seed of Yellow Poplar and Maple germinate readily in or on a moist humus. The seed of Oak, Walnut and Hickory are susceptible to damage by drying and must be brought into contact with moist soil. Red Cedar, on the other hand, is able to germinate on a dry soil.

Trees vary greatly in their power to scatter seed. Light-seeded species (Aspen, Birch, Paulonia) may be carried many miles in a high wind. Even the heavier seed of White Pine, Maples, Ash, Yellow Poplar are often carried a mile or more from the parent tree. The nut trees, or heavy-seeded species, must depend on some other agency than wind for seed dissemination. Usually this is achieved through the agency of rodents, although these little animals are at the same time the greatest destroyers of seed.

Sprouts or Coppice. When a hardwood tree is felled, girdled or otherwise seriously damaged new shoots are sent up from the stump. This property is confined to the hardwoods, with the exception of the Redwood of California. The ability to coppice varies for different species and also for the same species at different ages. Oak, Chestnut, Hickory, Locust, Beech and Maple coppice freely but within certain age limits, stated roughly, between twenty and fifty years, or while the trees are from six to twelve inches in diameter. Two kinds of sprouts, stump and crown, are recognized. Stump sprouts originate at the top of the stump, crown sprouts at or just

below the ground level. Crown sprouts are preferable, since they rapidly develop root-systems of their own and become independent. Stump sprouts are always dependent and apt to deteriorate as the old stump decays. Sprouts develop much more rapidly than seedlings but are shorter lived, and consequently produce inferior material. At forty or fifty years the seedling overtakes and then surpasses the sprout.

Sprouting is most vigorous when felling takes place during the dormant period (winter) and decreases towards the growing period (summer). In fact, felling during August and September is apt to destroy the sprouting capacity of the stump.

Root Suckers. When surface roots are broken many species have the property of developing sprouts from the severed portion of root. This is very noticeable in the case of road grading adjacent to a windbreak or hedge of black locust. If such sprouts are carefully raised they may be transplanted in the same manner as seedlings. This is an inexpensive method of starting a new windbreak or hedge.

Cuttings. Certain species of the hardwoods may be propagated by means of a section of the branch or stem. Usually cuttings are taken from shoots or branches one or two years old. They should be made during the dormant period, from eight to twelve inches long and both ends should be cut smooth. Cuttings are planted in a sloping position, about three-fourths of the stick being buried in moist soil. Willow and Aspen (Populus) are readily propagated in this manner.

The Woodlot

A woodlot is an association of trees growing so closely together that full development of the crowns is prevented. Isolated individual trees in an old field or park, develop without interference and take on a very different form. In the forest, there develops a "struggle for existence," with the result that each tree endeavors to out-strip and over-top its neighbors. Consequently, the stems are long and cylindrical and the crowns are small and irregular. In the open, the tree has no competition and each develops a huge crown and extensive root-system. Consequently, the stem is short, the branches are long and persist near the ground, and the form is a regular figure.

Crowding each other closely in the forest, the development of side branches is interferred with and most of the tree's energy is expended in rapid height growth, with the result that the forest grown tree may be two or even three times the height of the tree of the same age grown in the open. Since lumber is the product desired, and the long, cylindrical, clear (branchless) stem produces both quality and quantity, it follows that forest grown trees must be the object of forestry.

Just as the tree is composed of distinct parts, so the forest or woodlot is made up of certain parts; viz., the forest-canopy or crown-cover, the undergrowth, the forest floor and the region of root-development.

Forest Canopy. The crowns of the individual trees of the forest unite to form the canopy or crown cover. In a young plantation of even-aged trees the stems are all clear to a height of ten or twelve feet. Where the branches begin to persist is the underside of the forest canopy.

The crown cover is the food manufacturing plant of the forest. It serves also to protect the stems and forest floor against excessive evaporation, against the drying effects of wind, and from the extremes of temperature. Conditions for wood production are not ideal unless the canopy is complete and the surface of the ground is uniformly shaded from direct sunlight. Complete shading prevents the development of grass and weeds which interfere with reproduction and furnish fuel for ground fires. Complete shading also maintains a constant humidity and temperature in the forest. The density of the crown cover is measured in tenths of unity. For instance, full density, where no direct sunlight reaches the ground, is indicated by 1; half density where half of the surface of the ground receives direct sunlight, is measured as .5, etc.

Undergrowth. This is made up of reproduction (seedlings, sprouts, root-suckers), shrubs and bushes. When the canopy is open the undergrowth may serve a useful purpose in the protection of the soil from excessive evaporation, and from erosion (washing). Ordinarily, however, the undergrowth of bushes and shrubs (blackberry, sumac, willow) interferes with the reproduction of trees. If very dense, such an undergrowth may interfere with the growth of larger trees, since the shrubs and bushes compete with the trees for soil salts and moisture. The future life of the woodlot is dependent upon the development of a sufficient number of seedlings from the undergrowth to take the place of the trees to be removed.

Forest Floor. The layer of more or less decomposed litter (leaves, twigs, fruit, bark), along with grass and weeds, constitutes the forest floor. Conditions are ideal when a heavy layer of moist humus is overlaid with several inches of litter, but such a condition of affairs exist only under a complete forest canopy. If the canopy be broken, the additional light results in the development of grass, weeds and undergrowth. A heavy sod or a rank growth of weeds drains the surface soil of moisture and imposes too severe a struggle for existence upon the tender seedling. On the other hand, a scattered ground-cover of berry bushes (huckleberry), herbs and weeds necessitates no competition and may be of considerable benefit in protecting the soil.

Between the layer of dry litter on the surface and the mineral

soil, is a layer of black and rich humus. This has resulted from the decomposition of litter and contains large amounts of valuable soil salts. Often this humus is used as a manure for field crops. It is, however, very valuable to the forest and its removal may result in permanent injury through excessive evaporation. As a result of the steady increase in humus over a long period of years, a gradual change takes place in the composition of the forest. Only a few trees—of comparatively little value—are able to thrive on a sterile soil. Practically all trees, including woods of highest value, flourish in a rich soil. An accumulation of undecayed vegetation (swamp) results in a sour soil.

A ground fire often destroys all organic matter, including ground-cover, litter and humus, leaving the soil in an impoverished condition. Many years must elapse before it regains its productive capacity.

Region of Root Development. This comprises the soil and sub-soil, and the tangled and interlaced root-systems of the forest. The amount of raw food materials required by forest trees from the soil is much less than that necessary to the production of field crops. Provided the roots find moisture, many trees thrive in an almost sterile soil. No soil exists which is too infertile to produce some form of tree growth. The more valuable species (Walnut, Beech, Oak, Hickory), however, demand a deep, fertile soil.

The fertility of the surface soil has little influence upon the development of trees, after the seedling stage is past. Practically all of the mineral elements are drawn from the sub-soil. As the more valuable elements are stored in the leaves and fruit, and these fall to the ground and decay, it is understood how forest growth results in the improvement of the surface soil. In parts of Europe a crop of trees is often included in the crop rotation for agricultural land.

The roots extend in all directions in the ground, often farther than the branches. In the forest the roots interlace and the competition for soil salts and moisture becomes very great. Here and there a tree dies, the struggle becoming too great. In an old forest the roots drain the soil to such an extent that seedlings cannot become established.

Composition of Woodlot

Whether composed of one species or several, the stand is known as "pure" or "mixed." It is a pure stand when eighty or more per cent of the trees are of one species; a mixed stand, when two or more species are present in approximately equal mixture. Conifers are more apt to occur naturally in pure stand (Longleaf Pine of Georgia and Florida, White Pine of the Lake States, Douglas Fir of the Rocky Mountains), while hardwoods occur usually in mixed

stand (Yellow Poplar, Hickory, Oak in the coves of the mountains). Conditions of climate and soil give one species the advantage, resulting in pure stand.

A mixed stand possesses certain advantages:

1. The production of a greater variety of product.
2. The production of quality—cleaner and straighter stems.
3. A better protection against fire, insects and disease.
4. Less drain upon the soil—species differ in requirements.

On the other hand the management of a mixed stand is more difficult and the cost of logging one species at a time is higher.

Character of Stand

If the trees of a woodlot do not vary by more than twenty years (less for a coppice forest), it is known as an "even-aged stand." Conversely, if the difference is greater than twenty years, the stand is known as "uneven-aged." A woodlot which is so uneven-aged as to contain a regular proportion of every size from seedlings to mature trees, all in uniform mixture, is known as a "selection" stand or forest. In such a woodlot there will be a few mature trees to be removed each year, whose places will be taken by immature trees already on the ground. The chief problem will be to maintain the proper proportion of trees of each age and size, so that an equal number will mature each year.

The ideal form of farm woodlot is one of uneven age, composed of several species in mixture. From it the farmer is able at any time to secure the kind and size of material he desires. Certain trees may be cut for fuel; others will furnish high grade material for the manufacture of double-trees, spokes and tongues or in the repair of agricultural implements; and still others furnish construction material for buildings. A small forge and work-shop along with a good woodlot is desirable for the use of the farmer.

Farm Forestry

Question Paper

Lesson II

The student will discuss the following topics, not confining himself to the lessons but using information gained from all sources. Write freely on the questions as topics for discussion rather than a questions to be anwered briefly. All answers should be written without the direct aid of book or lesson.

Answers must be plainly written in ink.

Send answers to the President, Georgia State College of Agriculture, Athens, as soon as completed and a new lesson will be forwarded. In no case will a succeeding lesson be sent until the questions of the previous lesson have been satisfactorily answered.

Always give name, address and certificate number.

1. How much heat, moisture and light are required by trees for their proper growth and development?
2. What is "tolerance?" Give examples of common trees.
3. What are the parts of a woodlot?
4. How does a woodlot differ from a park? Name and describe different forms of farm woodlots.
5. What is humus? How is it formed and how used?
6. How do trees reproduce themselves? How are they propagated?

The University extends a cordial welcome to all educational, agricultural, commercial, manufacturing, financial and industrial bodies, and bodies of like character, having for their object the welfare of the state, to use on special occasions, free of rent, such public buildings of the University as the Chancellor and President of the Agricultural College may approve.

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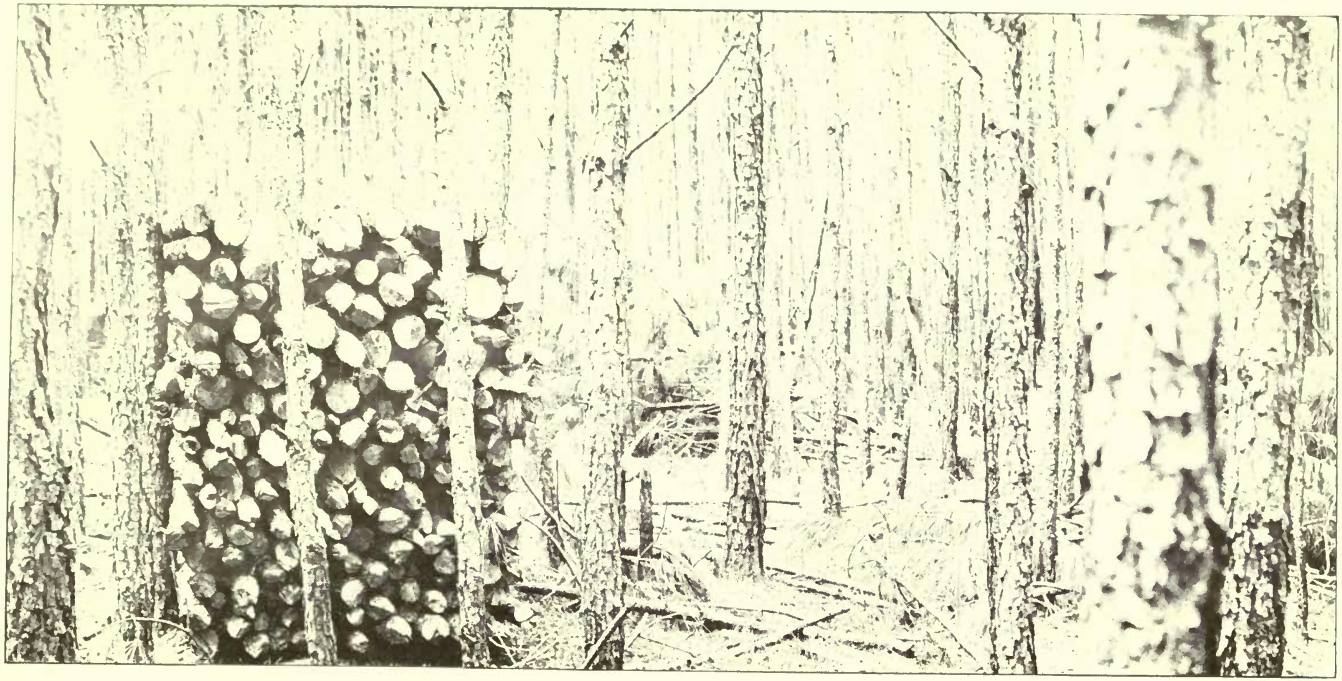
VOLUME I



Yellow pine woodlot in Georgia. The reproduction came in naturally on an old field and is about twenty years old. A thinning results in five or six cords of wood per acre, besides decreasing the struggle for existence of the trees remaining. This results in a greatly increased rate of growth. With a little care, and protection from fire, such a woodlot will yield a handsome return in box-board material and cord-wood at forty years and this on land which had been abandoned as valueless for agricultural purposes. In addition, the forest prevents further erosion of the soil, increases the fertility and depth of the surface soil and protects adjacent fields from the mechanical and drying effects of wind.

ACKNOWLEDGEMENTS

The Executive Committee of the Forest Club desires to express its keen appreciation of the assistance received in the preparation of this annual. To Edward Hyatt, Superintendent of Public Instruction, California, for most of the extracts from speeches and articles by leading men of the United States (this material having appeared in a booklet edited by Mr. Hyatt, entitled, "Conservation of Resources in California"); to the American Forestry Association for cuts loaned; and to the Board of Advisors for their helpful criticism.

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The firms advertising in this annual have made its publication possible. We ask your very kind consideration of their goods, feeling that we may safely act as sponsor for quality and honest dealing. Please mention the Annual when requesting information.

FOREWORD

The movement for the conservation of natural resources is new in America—it has always been new in a young country. In the older countries it is considered the duty of the government to control the utilization of those natural resources upon which is based the prosperity of the nation—no one questions this right. Yet, even in America at the height of her national prosperity, thinking people are astounded at the waste of national wealth; the soil is washing out to the sea, destroying navigation and water power; the forests are being recklessly exploited or destroyed by fire; mineral wealth is utilized as though it were limitless. Certain of our natural resources, once gone, can never be replaced; others, again, may be reproduced. In fact, natural resources may be divided into two distinct classes, those restorable and those nonrestorable. For instance, soil fertility is a restorable resource, since it may be renewed through better methods of farming, but soil itself is a nonrestorable resource, since ages are required for the disintegration of rock in the formation of new soil. Coal, oil and the metals are nonrestorable, since the total amount is limited and science has not yet discovered a means of creating a new store. Forests, on the other hand, are restorable, so long as the soil retains its ability to grow trees. Indeed, forests not only produce a material very necessary in the arts, but prevent erosion, increase the fertility of the surface soil and ameliorate extremes of climate. If one thinks of the different natural resources in relation to this classification, it is easy to decide which resources should be husbanded and made to last as long as possible, and which should be placed under management and utilized so as to increase the production. Farm management results in increased yields of grain and meat; forest management results in increased yields of lumber, paper pulp, turpentine and all the various byproducts of distillation. The greater the intensity of management, the richer the returns will be.

Conservation means "wise use," not non-use. Applied to the soil it means a management which will yield the greatest returns possible, compatible with maintaining and increasing the productive capacity of the soil, whether it be in agriculture, forestry or as health resorts for the people. Instead of exploiting the soil, conservation demands a management of the soil as though it were an investment yielding an ever increasing annual return. The science of agriculture is another name for conservation of the soil. Applied to the forest, conservation means the careful use of what timber we have, the production of more timber on land not adapted to agriculture, and the maintaining of a permanent supply of wood for those industries dependent upon this class of raw-products.

Conservation of natural resources and permanent prosperity go hand in hand—they are inseparably linked. It has been said that the United States will draw its supply of raw products from other countries when her own are exhausted, but these people forget that there is already a big drain upon all countries possessing great natural

resources and the demand as it grows will make prices prohibitive No, we must conserve our own supply if our country is to remai great—we, every man, woman and child of our country, are responsibl

Particularly do we appeal to teachers—you have it in your powe to impress the coming generation with the importance of the calamit which is about to overtake them. Your pupils of today are the law makers of tomorrow.

The forest on fire, destruction to everything in its path. Every year thousands o acres of forest are destroyed in the United States. Practically all of this loss coul be prevented if each would do his share.

THE CASE OUTLINED

What does it mean?

Just what does it mean—this Conservation of Natural Resources? Simply the wise care and use of our forests, our mines, our soil, our streams. These are the fundamental sources of wealth that have been given to us by nature.

Why is our country great?

Why is our nation one of the greatest in the world? Is it because our people are stronger or better than the rest of the world? Not at all. Our greatness rests upon the wonderful, the amazing, natural resources of North America. The great fortunes, the great cities, the great achievements of this nation, past and future, all depend upon our natural resources.

Where does our money come from?

Whence comes the money of the thousands of rich Americans who are the wonder of Europe? Whence come the funds to construct the great skyscrapers,, to rebuild ruined cities, to make fleets of warships, transcontinental railroads, inter-oceanic canals and the other titanic undertakings that we are continually carrying out?

From our storehouse of Natural Resources.

Our wealth comes from American copper, or wheat, or lumber, or coal, or oil, or gas, or iron; or from the railroads or ships transporting these materials; or from the utilities of the cities that manufacture these products. The source of all our power, our civilization and our luxury is in the storehouse of our natural wealth. And the natural resources came to the country with so little effort that we have no appreciation of their tremendous value.

Suppose they were gone?

But suppose the storehouse was empty—that our natural wealth was gone? What would American enterprise amount to if it had nothing to exploit? What figure does a poverty-stricken nation cut in the world? What rich and populus nations in history have not gone down into groveling insignificance by squandering their natural resources?

Unthinking babes.

Up to date we have been careless, heedless children with all our resources, giving them away, destroying them, wasting them with lavish hands, and with no thought of the morrow. He who can destroy most of our public property in the shortest time most excites our childish admiration. We have been busy playing our little games, paying no attention while some of the boys have set the house on fire.

The Conservation Movement.

But now an awakening seems to be coming. Its first tangible appearance was a Conference of Governors of the states and territories of the United States at the White House in Washington, presided over by President Roosevelt. Very many of the wisest and ablest men of the United States took part in this Conference—statesmen, philosophers, captains of industry. The Conference was followed by the formation of a National Conservation Commission, and later by the formation of Conservation Commissions in many of the states.

The general plan.

But any plan will fail—unless it can be backed up, supported, and urged on by a strong, determined, ever alert Public Opinion.

Therefore, the movement must extend to the people, to the teachers, to the children. Each man, woman and child must rise to meet his duty. Commissions and legislatures can accomplish nothing unless there is behind them the patriotic spirit of the people. The movement for the Conservation of Natural Resources will go as far as public opinion will carry it—it can go no further.

Aristotle said, "All who have meditated on the art of governing mankind have been convinced that the fate of empires depends on the education of the youth."

WHAT PEOPLE ARE THINKING

This movement is so new that many of us do not yet appreciate its momentum. Most of us never even thought of it until within the last few years. Nothing can give us a better idea of it, perhaps, and nothing can be more interesting than to see what other people are really thinking and saying about it; particularly so if the other people are persons we respect or persons who have had unusual opportunity to know what they are talking about. With this in view the following expressions of individual opinion have been collected.

These can be used by a clever teacher in many ways. For instance, in the morning exercises, one can be read aloud by a pupil, or explained by the teacher. Another may be given as a declamation or a reading at some entertainment or patriotic celebration. Others, again, will yield quotations and strong points for debates, essays and similar school activities.

Naturally, the teacher must feel the spirit and enthusiasm of the conservation movement to do the most good—and we believe in the manhood and womanhood of Georgia.

President of the American Forest Association.

"Those who are genuinely and intelligently devoted to the support and spread of the principles of Forestry know that Forestry is not merely a fad or hobby of the Nature lover; it is a highly important and patriotic movement: the Pioneers of Forestry in our country were in reality the Pioneers in the development of the great principles of Conservation that are now engaging the attention of the whole land. It may be well to take account of the stock of the strength of the movement today. Forestry has been called the Keystone of Conservation—perhaps an equally apt designation would be to term it the foundation or beginning of the Conservation Movement and today its principles are being taught in the great schools of Forestry maintained at so many of our leading institutions of higher education.

The American Forestry Association, founded over thirty years ago, is a voluntary organization for the inculcation and spread of a forest policy on a scale adequate to the economic needs of our Nation, and any person is eligible for membership. The Association is independent, has no connection with any Federal or State Department or policy, and is devoted to a public service conducive to national

prosperity. It welcomes accessions to membership and urges upon you all to become interested in the study and promotion of Forestry. Membership in the Association is a small tax, and you will find that subscription to *American Forestry*, the magazine published by the Association, will be an investment highly remunerative in interest and value."

HENRY STURGIS DRINKER.

Chancellor of the University of Georgia.

"In Georgia we are so largely descended from pioneers, that the inherited instinct to cut down trees largely controls us. The axe was the symbol of progress for so many years that it is hard to get the idea out of the head. It was a great achievement to conquer a wilderness, but we went too far. In many places we have not left enough for fire wood, and nearly everywhere there is scarcity of building timber.

It has reached the point where we must grow trees instead of cutting them down. I am interested in this matter from the standpoint of a land-owner as well as a citizen and educator. My partner's rule is, "when I make a stump I build a house." As a result of this practice we have a supply of excellent timber on each of our farms. It has the advantage of enabling us to build economically. It is one phase of living at home. Also we can keep warm without crossing our land line for fuel.

The opportunity for growing woods in Georgia is unsurpassed. Good timber will grow of itself anywhere in the state. From the cypress in the swamps of south Georgia, to the white pine on the mountains in the north, all that the timber asks is to be let alone.

I have been told, and I believe it is true, that we have a greater variety in our trees than is found in any other state.

You turn out a field and it will soon be thick in pines, gums, and poplars. Give it a few years and oaks and hickories and other trees will come, come of themselves. Of course much time and waste will be saved, if we plant the land and protect the young trees from fire.

I urge two propositions:

1. Stop the destruction of timber, particularly the destruction of young trees.

2. Plant waste land. Nature will do this in time, anywhere in Georgia, but time will be saved and efficiency added if we will assist nature.

It looks like a pity to waste anything as useful and as beautiful as a tree. It seems folly to waste that which takes a lifetime to restore. It is the part of wisdom to provide a necessity for the next generation, which, in the course of nature, they cannot provide for themselves. We vote bonds and pass them on to the next generation. Why not plant trees and pass them on as an offset?"

DAVID CRENSHAW BARROW.

President of the Georgia State College of Agriculture.

"Waste is the chief crime of America. The prodigality of our natural resources may have accounted in some measure for this but

Purple Mountain, China. Many years ago the forest cover was removed from this mountain and the soil has entirely disappeared. Springs have dried up and the streams are alternately torrents and dry channels. Recently a forest school was established and the students are endeavoring to reforest this mountain, but the work is only partially successful and the cost is high.

it can neither palliate or excuse the destruction of the gifts which a kindly Providence bestowed upon us in such unwonted lavishness. While reckless, useless waste and extravagance in dealing with our natural resources is witnessed on every hand it has nowhere been better exemplified than in dealing with our forests. One can hardly picture the extent, variety, beauty and splendor of the tree growth which covered the greater part of the United States less than fifty years ago. In such states, for instance, as Georgia the primeval forest has all but disappeared.

On thousands of farms there is not even today a respectable wood lot. Timber for the construction of a tenant house must be purchased from the lumber dealer in the adjacent town or city. On many farms there is barely sufficient wood available for the cook-stove and often not enough to heat the house adequately. Yet there are thousands of acres of land the virgin fertility of which has been depleted and which have been eroded, washed away and destroyed in large measure by reason of the useless destruction of our forests. One might almost think when he views the landscape that trees were the primal enemy of man.

Today we are using trees three times faster than they can reproduce themselves. How much longer is this uncalled-for waste and extravagance to continue? Why not realize that in growing trees on waste or idle land we can recoup ourselves as quickly as in any other manner. We can make the forest a friend and neighbor, a protection to the land, a source of water supply and a power in adding to the unearned increment of any landscape or community. While utilizing a part of our waste lands for the production of trees we are making them a source of revenue as well as pleasure.

There is not a farmer in Georgia who would not add to the value of his holdings at least $100.00 per year through the planting of trees and the conservation of his wood lot. There are 261,000 farmers in the state. Would not the item of $2,610,000 look well as an asset at the end of each and every year?"

ANDREW M. SOULE.

An Ex-President of the United States.

"The necessity for a comprehensive and systematic improvement of our waterways, the preservation of our soil and of our forests, the securing from private appropriation the power in navigable streams, the retention of the undisposed-of coal lands of the Government from alienation, all will properly claim from the next administration earnest attention and appropriate legislation.

Without the resources which make labor productive, American enterprise, energy, and skill would not in the past have been able to make headway against hard conditions. Our children and their children will not be able to make headway if we leave to them an impoverished country. Our land, our water, our forests, and our minerals are the sources from which come directly or indirectly the livelihood of all of us. The conservation of our natural resources is a question of fundamental importance to the United States now.

The truth is that the overwhelming necessity for our doing some-

thing to conserve our natural resources is going to put us to a new test of the practical character of our system of government. It is going to involve the question of whether, with the changing conditions, with the closer relations and the interdependence of the various parts of this country, our National Constitution will furnish the means of meeting that necessity. Now, I have no doubt that it will."

WM. H. TAFT.

A Famous Churchman.

"No policy of our National Government is more in keeping with those democratic principles upon which our Republic is founded than the conservation of our natural resources, and none is to have a greater influence upon the future prosperity of our land. Our fertile soils, our inland waters, our mines, and our forests are God-given heritages which belong no more to the present generation than to generations that are to come. It is our duty as American citizens to regard these resources as sacred trusts, to preserve them, and to use them wisely and with moderation, that we may, as far as possible, provide against the days of want that are surely approaching; and that when these days are at hand they may not come as a crushing retribution, but as a wholesome discipline by which we shall be taught the great lessons of thrift and foresight."

CARDINAL GIBBONS.

The Great Commoner.

"It should be our purpose, not only to preserve the nation's resources for future generations by reducing waste to a minimum; we should see to it that a few of the people do not monopolize that which in equity is the property of all the people. The earth belongs to each generation, and it is as criminal to fetter future generations with perpetual franchises, making the multitude servants to a favored faction of the population, as it would be to impair, unnecessarily, the common store.

Money spent in care for the life and health of the people, in protecting the soil from erosion and from exhaustion, in preventing waste in the use of minerals of limited supply, in the reclamation of deserts and swamps, and in the preservation of forests, still remaining and the planting of denuded tracts—money invested in these and in the development of waterways and in the deepening of harbors is an investment yielding an annual return. If any of these expenditures fail to bring a return at once the money expended is like a bequest to those who come after us. And as the parent lives for his child as well as for himself, so the good citizen provides for the future as well as for the present."

WILLIAMS JENNINGS BRYAN.

A University President.

"This small revolving globe we dwell upon has been used as a home by us humans, by us and our ancestors, for a goodly row of centuries. But we were too few and weak to master it and put it clean beneath our feet. It mostly got the best of us. Of late we

have come to get the best of it. It used to thwart us, and steer us, and tell us what we must do. Now we tell it what we want it to do, and make it do it for us. We have fettered its strengths with steel and made them work for us. We force its down-hill waters to carry us up hill. We use its own treasures of fuel to belittle its size and dignity; to curb it and humble it, and even to reshape it.

This is all very well, but of late men have been finding this robbing and humiliating of the prostrate body of nature so easy and so interesting as to make it a form of sport. They rob and exploit without reference to any present need, just to show what they can do. It is like the killing of the buffaloes for the fun of shooting, until all at once it appeared they were practically exterminated.

This generation will have for one thing at least a great name in history. Men of the future centuries will surely call it the generation of the great destroyers, and historians and economists will write of the riotous days of nineteen hundred, when the people used up all the petroleum, all the natural gas, all the anthracite and most of the other coal, and most of the handy iron. It will be the period when the forests were cut down or burnt up, the lands stolen, and the waters given away. We are sure to be the subject of earnest remark."

BENJAMIN IDE WHEELER.

The Secretary of the Interior.

"Why should a great resource, which is owned by the people at large, be used by private interests, by somebody who is looking only to his own benefit, and not to the benefit of the people of the country? The people as a whole own these natural resources. They are not divided. But the people as a whole, as I say, own them, and it is for them to determine whether those resources shall be used for the benefit of all, or shall be turned over to be used unregulated for the benefit of those who may perchance first get a foothold in any special locality. In any law that is passed, in any theory of disposition that is adopted, we must look not only to their conservation and use, but we must look to the prevention of their monopolization in the hands of a few favored interests."

JAMES R. GARFIELD.

A Great Labor Leader.

"In our mad rush for spoils and profits we not only waste and destroy those material resources with which God has so bountifully endowed us, but we press forward in the race, sacrificing, unnecessarily, the lives and the comfort of our fellow-beings. It seems to me that the time has come when we should stop for a moment and think —not alone of those inanimate things that make for comfort and prosperity, but also of the men, and the women, and the children, whose toil and deprivation have made and will continue to make our country and our people the most progressive and the most intelligent of all the nations and of all the peoples of the earth."

JOHN MITCHELL.

Davos, Switzerland. The high mountains are kept in forest, yielding a fair return on the investment, preventing erosion, furnishing labor to thousands, enhancing the natural beauty of the country, and furnishing healthful recreation grounds for the people. Contrast the evident prosperity of this scene with the desolation of Purple Mountain.

A College President.

"The greatest results of the administration of President Roosevelt have been twofold: the awakening of the civic conscience in our country, and the movement towards the conservation of our natural resources. These two results are closely connected, and each movement strengthens the other. There is now nothing in American politics of greater practical importance than the preservation of our national domain, with all that it contains, and all this developed to the highest point of efficiency.

Of these elements, that of forest preservation now stands first in pressing importance and deserves the constant support of all good men. Very important is also the preservation of the birds, to which the Audubon societies are dedicated. The saving of the fisheries is likewise a matter of large moment to the future, and in this I am giving personally all the help I can.

As for the waters, soils and all such matters, our many centers of investigation and instruction in agriculture are giving splendid pledges for the future."

DAVID STARR JORDAN.

Another Ex-President of the United States.

"In utilizing and conserving the natural resources of the nation the one characteristic more essential than any other is foresight. Unfortunately, foresight is not usually characteristic of a young and vigorous people, and it is obviously not a marked characteristic of us in the United States. Yet assuredly it should be the growing nation with a future which takes the long look ahead; and no other nation is growing so rapidly as ours or has a future so full of promise. No other nation enjoys so wonderful a measure of present prosperity which can of right be treated as an earnest of future success, and in no other are the rewards of foresight so great, so certain, and so easily foretold. Yet hitherto as a nation we have tended to live with an eye single to the present, and have permitted the reckless waste and destruction of much of our natural wealth.

The conservation of our natural resources and their proper use constitute the fundamental problem which underlies almost every other problem of our national life. Unless we maintain an adequate material basis for our civilization, we can not maintain the institutions in which we take so great and just a pride; and to waste and destroy our natural resources means to undermine this material basis."

THEODORE ROOSEVELT.

Still Another Famous Ex-President.

"Those most proudly happy in their sanguine Americanism, and most confident of our ability to accomplish all things, must confess that our national life has been habitually beset with careless wastefulness, and that a palpable manifestation of this wastefulness is seen in th destruction of tree growth and the denudation of watersheds on our Western lands. Laws passed with the professed intent of protecting our forests have been so amiably construed as to admit of easy invasion; and their execution has too often been lax and per-

functory. In the meantime, public opinion on this subject, which might be as effective as legal enactment, has comfortably slumbered.

Even if we now abjectly repent of our sins of omission and commission in our treatment of the forests and streams which nature has given us, and reproach ourselves for the neglect of a trust imposed on us for the benefit of future generations, we must at the same time humbly confess that the punishment we have suffered by flood, by drouth, by tornado, by fire, by barrenness of soil, and by loss of timber value, is well deserved.

In these circumstances it is exceedingly gratifying to have an appropriate opportunity to congratulate those who have constantly labored in the cause of forestry and forest preservation, as well as those interested in the cognate subject of irrigation, upon the prospect that these topics are to have more prominent places in governmental care.

Through the teachings of intelligent forestry it has been made plain that in our Western localities ruinous floods and exhausting droughts can be largely prevented, and productive moisture in useful degree and at needed periods secured, by reasonable and discriminating preservation of our forest areas; the advocates of irrigation have been led to realize that it is useless to provide for the storage of water unless the sources of its supply are protected; and all those who, in a disinterested way, have examined these questions concede that tree growth and natural soil on our watersheds are more valuable to the masses of our people than the footprints of sheep or cattle.

The opportune time has arrived when effective public interest in forestry and forest preservation should be persistently aroused and stimulated."

GROVER CLEVELAND.

A Famous Mining Engineer.

"The ever-increasing rapidity of exploitation consequent upon the exigencies of modern engineering and economic practice inevitably leads to an alarming diminution of the lives—if I may use that term—of our mineral products. The culmination of our mining industry is to be reckoned by decades, and its declension (if not practically its economic exhaustion) in generations, not in centuries."

JOHN HAYS HAMMOND.

An American Political Economist.

"If we want to prolong American prosperity and maintain the high level of American wages, our wage being double that of the other nations of the earth, we must protect our facilities and enlarge our ability to produce and manufacture the things that we manufacture at the lowest cost. * * * If we had no advantage in the marketing of our goods, either in excellence or quality or cheapness of production, it simply would mean that American labor would be reduced to the labor of all other nations of the world, and if we want to maintain its high level we must protect the facilities that will enable us to produce our goods at the very lowest possible cost."

WILLIAM S. HARVEY.

It is no easy task to induce the public mind to understand or try to understand what the bird life means to the country. This little fairy world is accepted by the great majority of people as a mere accident in the great course of events, and useful only to help develop marksmanship among the young boys. Birds do not have any place of importance in the mind or life of the average human being. Usually, the bird student or bird lover is considered a little cranky. He is often regarded as a *rainbow chaser*, or one "hard put" to find something of interest in the world.

Dear readers, the birds have been placed here in this world for a great and serious purpose. They deserve our best thought and all the protection we can give them. It has been recently calculated that without bird life, our insect enemies would multiply so rapidly that within a very few years, the whole surface of the earth would not grow enough plants to feed them, and they would first starve to death all other known animals, and then starve themselves down to a stand. They would let only enough plants grow to feed those that survive the mighty struggle in their own ranks.

How about this relationship between birds and insects? The bird population of Georgia alone is something like 75,000,000, including all species. This great army of friends goes forth every day in the fields and woods to find food. Seventy per cent of all of them eat insects and insect eggs. All of them eat some insects at some time in their lives. We can safely and conservatively say that if it takes 150,000 insects on an average to make a bushel, and if each insectivorous bird eats from 200 to 400 insects daily, this wonderful army would eat at least 60,000 bushels of insects every day of their active lives in Georgia alone. For this calculation we use only the lowest figures in each case.

We should ask ourselves then if it is worth while to protect our bird life? Some of the birds eat a few berries, and other fruit. Other species eat some grain and other field crops. Once in awhile a species develops a taste for buds on certain fruit trees. In every case the bird helps to protect the crop from the insect world, and is according to law entitled to a little of the proceeds of the farm and orchard and the forest. But were it not for the birds, neither the farm nor the orchard could prosper. This has been clearly shown in certain parts of Europe, and in the New England states. The birds seem to be most active in their pursuit of the species of insects commonly found in orchards and fields. For this reason they get by far the larger per cent of them. We must conclude that the conservation of bird life is necessary and should be promoted in every way.

In addition to their usefulness, birds are beautiful. Nature has endowed them with the peculiar gift of flight, which has enabled them to master the air. They are as sure of wing as we are of foot, and do not hesitate to lift themselves above the rugged parts of the earth's surface, rivers and ravines, and even long arms of the sea. They have become so much a part of the upper air that we would not willingly do without them. We love to look at them as they fly from tree to

tree, and from mountain crest to mountain crest. We enjoy the beauty of their gorgeous colors. We enjoy their comedies and deplore their tragedies. We can lessen the dangers that lurk along their pathway if we only stop to think. We can put up nesting boxes for them, and we can give them a morsel to eat during the hard winter months when their natural food supply is scarce. We can love them and befriend them in return for the great good they do us, and is this not worth while? R. J. H. DeLoach.

The State Geologist of West Virginia.

"Just as sure as the sun shines, and the sum of two and two make four, unless this insane riot of destruction and waste of our fuel resources which has characterized the past century shall be speedily ended, our industrial power and supremacy will, after a meteor-like existence, revert, before the close of the present century, to those nations which conserve and prize at their proper value their priceless treasures of carbon." I. C. White.

A Captain of the Steel Industry.

"We are nationally in the position of a large family receiving a rich patrimony from thrifty parents deceased intestate. * * * Now, the first duty of such a family is to take stock of its patrimony; the next to manage the assets in such manner that none shall be wasted, that all be put to the greatest good of the living and their descendants."

Andrew Carnegie.

Logged and burned-over area. If fire had been kept out the forest cover would again have become established in a few years. After the fire, however, the area becomes virtually a waste unless planted to trees.

The Governor of Utah.

"The great, broad principle underlying the subject of conservation is whether or not each succeeding generation can be sustained on the land without impoverishing it in any respect. Stated as a question it is, 'Will each generation have the land as rich as the preceding one?' It seems a simple question, and yet the safety and the lives of our children and our children's children will depend upon the answer. The forests, the streams, the soils, the minerals, and all the other natural elements of wealth should remain as nearly as possible undiminished as the centuries pass. All of this is in the hands of the people, with the possible exception of the preservation of the mineral wealth."

CUTTER.

A Great Educator.

There are at least two reasons why we should love and protect birds:

1. Because of their economic value. We are so constituted that many of us cannot be reached except on the materialistic side alone. The argument for the preservation of birds is strong enough, however, to convince the most skeptical. Scientists have enumerated 300,000 different insects and others yet remain to be classified. Every living plant, tree, and shrub has these enemies; even the hardiest of our trees, the oak, the elm, and others have insect foes that frequently destroy large areas of forest. The brown tail moth, for instance, has destroyed every tree of certain varieties in some localities. The government experts say that the Hessian fly is responsible for the destruction of ten per cent of the annual wheat crop of the United States. The chief protection against such losses is the ever present winged army of birds in field and forest. The separate divisions protect the tree from root to summit. The thrush, towhee and bob white search the ground for larvae and weed seed, the brown creeper, woodpecker, and nuthatch are busily engaged summer and winter in looking into every crevice of the bark while the crested titmouse and a score of equally experienced comrades search twig and leaf for their insect foods. Commonly a bird eats half its own weight in a day. Above ground the phoebe and night hawk do their utmost to make life more pleasant by diminishing the number of both flies and mosquitoes. If the time should ever come when these feathered soldiers of the field and forest should be exterminated it is certain that the loss to our crops would be immense and life would be much less pleasant.

2. After the material side surely something can be said for the aesthetic. The marvelous beauty of many birds attracts occasionally even the densest and most unseeing eye. Ordinarily anyone would be startled into at least momentary admiration at sight of the brilliant colors of Lord Baltimore on glimpsing the oriole, this bird of flame. One who has once seen the nonpareil near our southern coast is not likely to soon forget it. The same is true with many of the smaller and shyer birds such as the hooded warbler and the redstart. If every one sets out to hunt them with bird glasses instead of a gun interest is sure to follow. Even the most hardened and unappreciа-

tive would hardly desire for the day to dawn when we should see few of these musical bouquets although that very thing has come to pass in the case of certain birds, notably the wild pigeon.

M. L. BRITTAIN.

The Governor of Oregon.

"The conservation of the water supply is absolutely dependent upon the preservation of the upland forests. Opposition to the policy comes not from those interested in the development of the country and the perpetuation of our institution, but from the predatory classes, who care for naught but temporary gain."

CHAMBERLAIN.

The Governor of Idaho.

"We have built here a great nation, without a thought of tomorrow. We will grow still greater, even if we follow the same old methods that we have followed in the past. But we can not reach our full share of greatness as a nation unless, before it is too late, we throw safeguards around those resources that have made us the mightiest nation on the earth, so that they can be preserved and protected, that they may be developed to the greatest extent for the benefit of this and future generations."

GOODING.

CURRENT LITERATURE

The following longer selections from magazines, addresses, newspaper articles, will give more complete and well rounded views of the conservation idea as a whole. Why should not this collection be just the thing for a reading circle or an improvement club to use? It is up to date, interesting, and vital to our State and to our Nation.

Is it not strange that our schools, preparing for citizenship, do not study this Conservation of Natural Resources, so vital to every one of us, so necessary to the very existence of the nation? Our boys and girls spend hours and days and weeks in studying intently the virtues and defects of the Articles of Confederation, dead a hundred years! But they can not discover in their schools that men are throwing away and giving away the land and the water upon which the real life of the nation is builded. They toil at length over the animosities of the Civil War, which were better forgotten; but they do not learn that their birthrights of soil are being swept down the rivers and out to the sea and that their birthrights of water-power are being seized by those who will become their masters and their rulers of the future.

Are not these matters worthy of consideration in our schools and by our teachers? Do not the teachers owe a duty to the coming generation to educate them to the dangers of "soil robbing," of forest fire devastation, of wasteful methods of logging and turpentining, of destroying the cover of vegetation on steep slopes, of permitting individuals to gain absolute control of natural stores of coal and minerals the supply of which is so very limited? This subject demands earnest thought. Have you thought of it?

WE ARE ALL RESPONSIBLE

EDWARD HYATT.

When expressing our indignation at the wicked waste of the people's heritages it is well to remember that it is the people who are to blame for it. You and I and all of us are the criminals, not merely the men and the corporations who have so largely profited by the wasted resources. It is easy to work up wrath and blow off steam about them; but we must remember that they have played the game according to the rules, and that we, the people, make or consent to the rules of the game—the laws. The big boys often try to change the rules and use them unfairly, doubtless, as in smaller games; but if all the other children attend to it, take an interest in it, stick together, they can make the rules right and keep the big fellows within bounds.

It is well to remember this: most of us, if we could, would do just what the "predatory rich" have done.

One of the worst things that has been done, probably the very worst, has been the taking away of the timber lands from the people. But how has this been done? By buying out small owners for small prices. Our careless and reckless law gave to any one 160 acres of timber land if he or she would make oath that it was for his own use, not to be used for the benefit of some one else. In my travels I found many people, nice people, school teachers, ministers, ladies and gentlemen, locating timber claims—and selling them as soon as title was complete, for a few hundred dollars—three hundrd, five hundred, perhaps; yet the timber itself was really *worth* many thousands of dollars, to say nothing of the land on which it stood.

Thus, for an insignificant sum for our own selfish immediate use do we nice people sell the birthrights of our children's children. Thus the great timber corporations acquire empires of land and princely fortunes in timber. Thus does our country lose its heritage for all time. Wherefore remember that we, the people, have our share of responsibility in this thing. We accept these laws and help make them. We take a small share of the swag ourselves when we can get it.

The reason for the wasting and plundering and going to smash of this vast and splendid estate of ours is not hard to find. It is from a simple and natural cause, a universal law—*because we, the owners, have neglected it.* Any property, any enterprise, goes to wreck and ruin if it is not attended to, guarded, watched over, by its owners. What would happen to a great store or a mill or a mine if it were abandoned to whomever happened along? How would a farm prosper if none of its owners took the trouble to look after it? Why, even a $500 house in a little village will soon be damaged beyond repair, broken, run down, carried away, when it is not cared for by its owners! And who get the blame in such case? Not the boys who throw stones through the windows nor the petty thieves who carry off the fence for kindling wood—but the people who own it and are responsible for it. WE ARE ALL RESPONSIBLE.

The result of severe forest fires. Not only is there an enormous loss in the mature timber which is badly fire-scarred and open to attacks by wood-boring insects and disease, but the reproductive capacity of the forest is destroyed, the humus of the soil has disappeared and erosion rapidly uncovers bed-rock. When such areas are acquired by the Government, they are planted at once, before the soil has entirely disappeared.

TEACHING CONSERVATION

EDWARD HYATT.

But how can a teacher teach Conservation? By exuding it through the pores! If it gets in it will come out!

A wise teacher will find a hundred ways to drop good ideas into the hearts of her children.

For instance, in the careful use of the school supplies. Economy and wise care are virtues greatly to be desired in all our citizenry. The teacher is not working for the sake of saving a few cents for the school fund; but for the *habits* of the children, their way of looking at things, during all their future lives. Carelessness, extravagance, recklessness, are dangerous to the nation. The difference between conservation and reckless waste may be taught in the use of such a common thing as *paper*, for example. Indeed, paper is really one of our national resources, as it is made of wood pulp, and wood pulp is made from trees. A big edition of a Sunday newspaper requires perhaps a dozen acres of woodland. Every sheet of paper, every desk, every box, every splinter of wood that we see or use, represents trees, trees that were chopped from our forests. Every one of our eighty million people use more than seven times as much wood per year as do the people all over Europe. Every big city fire destroys a great and splendid forest. Millions upon millions of acres of woodland continually go into the ties along our railroad lines. Countless other forests are rotting away deep under ground in the coal and other mines.

The teacher who goes into the subject with interest, himself will find no lack of striking and interesting and valuable things to pass along to his flock; things that point to civic patriotism; things more vital to their fatherland than the waving of battle flags and defiance of the foreign foe!

CULTIVATE THE FORESTS

This is a clipping from a fine article upon the Statesmanship of Forestry by Arthur W. Page in the World's Work Magazine.

Many people consider the approaching timber famine with the same feeling of regret and helplessness with which they listen to the story of the extinction of the buffalo. They feel that both are wild things which must inevitably perish before the advance of civilization. But the forests, unlike the buffalo, thrive in captivity. A large proportion of the trees in a wild forest are not best suited to our use. They are of the wrong species—like weeds in a garden—are too old or crooked and have a variety of other blemishes; and, while doing us little good themselves, they prevent the growth of better timber. To destroy all the original growth and then plant a new forest on the devastated area seems illogical, but it is neither impracticable nor unprofitable, as the experience of Germany and experiments in this country show. It is much easier, however, and more profitable, gradually to turn the wild forests into cultivated ones.

The French began to do this in the fourteenth century. * * * France, as thickly settled as it is, has maintained its cultivated timber for five hundred years, while the West with its scattered population is about to make an end of its wild forests in seventy-five years. In contrast to the forestry conditions of France are those of southern Tunis. It was once a very fertile country, but the Arab conquest destroyed all the trees and now the ruins of its old capital, Suffetula, stand in an uninhabited desert. "Not long after the conquest," says M. Jusseraud, "an Arab chronicler recalled in his book the former times of prosperity and added: 'But in those days, one could walk from Tripoli to Tunis in the shade.' "

CONFESSION TO NEXT GENERATION

Caustic clipping from a graduating address to the Fresno High School by Dr. Frederick Burk.

"We dislike to go on with these embarrassing confessions, but you will learn the whole wretched story yourselves sometime, and we may as well tell you. As for the coal and iron, our fathers left us enough to last for two or three thousand years if it had been economically mined according to some system established by law. We regret to tell you, upon the authority of Andrew Carnegie and John Mitchell, that we've wasted in getting out what we could use what should have lasted eighteen hundred or two thousand years. The coal may hold out another two hundred years and the iron one hundred years, but both will come high in your time. We wish we did not have to mention the oil and the natural gas, but we may as well tell you that we've sucked them out of the earth almost completely and wasted them.

Dear next generation, such is part of the shameful explanation truth compels us to make to you concerning the waste and loss of your patrimony. We've skimmed the cream and have led jolly lives—we do sincerely hope you like skimmed milk, and little of it. When you are shivering with the cold in a coalless country, when you are nursing one blade of grass to grow for you where two grew for us, when you have ceased automobiling on account of the high price of oil, then you'll remember us in our riotous plenty. Don't be too angry with us. We robbed you. We took the bread out of your mouths, you our babes, and fed it to the vultures who were fattening upon our national dishonor. But our sins have been the sins of ignorance rather than of willfulness. Your fathers were happy, devil-may-care fellows, whose courage, as war patriots, you must in justice honor, but who never had any comprehension of the meaning of a civil patriot nor the slightest realization that it required any of the qualities of courage, self-sacrifice for the common good, and intelligence which in war patriotism we have exemplified."

THE LOSS OF OUR SOIL

This striking statement is from The Outlook, edited by Lyman Abbott.

We are in the habit of speaking of the solid earth and the eternal hills as though they, at least, were free from the vicissitudes of time, and certain to furnish perpetual support for prosperous human life. This conclusion is as false as the term "inexhaustible" applied to other natural resources. The waste of soil is among the most dangerous of all wastes now in progress in the United States. In 1896 Professor Shaler, than whom no one has spoken with greater authority on this subject, estimated that in the upland regions of the states south of Pennsylvania three thousand square miles of soil had been destroyed as the result of forest denudation, and that the destruction was then proceeding at the rate of one hundred square miles of fertile soil per year. No seeing man can travel through the United States without being struck with the enormous and unnecessary loss of fertility by easily preventable soil wash. The soil so lost, as in the case of many other wastes, becomes itself a source of damage and expense, and must be removed from the channels of our navigable streams at an enormous annual cost. The Mississippi River alone is estimated to transport yearly four hundred million tons of sediment, or about twice the amount of material to be excavated from the Panama Canal. This material is the most fertile portion of our richest fields, transformed from a blessing to a curse by unrestricted erosion.

THE LARGEST NATIONAL TASK

From the address of President Roosevelt at the meeting of the Conservation Conference held in Washington, D. C.

I welcome you to Washington and to the work you have gathered to do. No service to the nation in time of peace could be of greater worth than the work which has brought you together. In its essence your task is to make the nation's future as great as its present. That is what the conservation of our resources means. This movement means that we shall not become great in the present at the expense of the future, but that we shall show ourselves truly great in the present by providing for the greatness of our children's children who are to inherit the land after us. It is the largest national task of today, and I thank you for making ready to undertake it.

I am especially glad to welcome the co-operation of the states, through their Conservation Commissioners and otherwise. Such co-operation gives earnest of mutual assistance between states and nation, and mutual benefits to follow. Without it the great task of perpetuating the national welfare would succeed, if at all, with difficulty. If states and nation work for it together, all in their several fields, and all joining heartily where the field is common, we are certain of success in advance. We are concerned with the people's rights; if this means national rights, well and good; if it means states' rights, well and good; we are for whatever serves the cause of the people's rights.

The results of the inventory of resources will be laid before the

present conference by the National Conservation Commission. I shall not attempt to review these results further than to say that the more striking facts brought out at the conference last May are amply confirmed. These facts are sobering. No right-minded citizen would stop the proper use of our resources, but every good American must realize that national improvidence follows the same course and leads to the same end as personal improvidence—and no man is a good American if he does not think of future Americans, any more than a man is a good citizen if he does not think of his children's welfare; for there isn't any man whom we despise more than the man who has a good time himself and whose children pay for it. So with the nation; that nation is contemptible that riots in abundance by wasting the heritage it should leave to the citizens that are to come afterwards. Needless waste must stop. The time to deride or neglect the statements of experts and the teaching of the facts has gone by. The time to act on what we already know has arrived. Common prudence, common sense, and common business principles are applicable to national affairs just as they are to private affairs, and the time has come to apply them in dealing with the foundations of our prosperity.

Rolling surface of country in southwestern Georgia where unhindered erosion is menacing the soil. If the non-agricultural land were in forest it would yield valuable returns in wood besides being protected from erosion.

THE WASTE IN MUD

This article is from The Saturday Evening Post of March 27th. It is a fine example of modern American newspaper English. It tells the story in a deliciously whimsical, humorous way. Yet the grim facts stick out boldly all through it, in spite of its quips and jests. It is by Emerson Hough.

With the exception of that certain wicked uncle, of whom nothing ever was expected and of whom no good could be predicted, all your family, like the average American family, no doubt regularly went to church. Probably the majority stayed over for Sabbath-school in the little church with white walls and black walnut pews. You could not have been in a better place. At church or Sabbath-school you all stood in a row and sang that easy, lilting old hymn which says:

Little drops of water, little grains of sand,
Make the mighty ocean and the pleasant land.

You could not have sung a better song. We all used to sing that song with cheerfulness, indeed with enthusiasm—*Lil*-tle drops of wa-a-a-ter, *lit*-tle gra-ay-ins of sand, make the mighty *o-o*-shun, *an'* the pleh-heh-sent la-a-a-nd! That was the way it ran. After we had sung it we all went home and forgot all about it. The next Monday morning Dad went back to farming, just the way his Dad had, and the Dad who antedated that one, world without end; and not one of those Dads was ever wise enough to know the hymn was right, or to figure out what the hymn meant or ought to mean. It is a splendid hymn, full of vast elemental truth, and it has a lot to do with farming.

Heretofore, your folks and mine hadn't thought that geology had much to do with farming, any more than religion had. As a matter of fact, they both do. The only trouble is, the average American, like you and me, does very little thinking in religion, politics or business. The farmer knows the country immediately around him. The city man does not even know all of the city where he lives, only a little corner of it. It is this carelessness in religion, politics, business and geology which gives the sad-eyed Mr. James J. Hill still further opportunity to grieve over the future of this country.

What Mr. Hill sees in the time when five hundred millions of Japanese and Chinamen will be making all our manufactured goods under a scale of living so much cheaper than the American standard as to crush out all American competition. This means not only the fiercest struggle ever known for trade, but the fiercest struggle ever known for a mere living. It is the war between the Oriental standard of living and the American standard as we now know it. The decisive battle of that war must be fought on the American farm, not in the California legislature. The American standard of living is based on the theory of an exhaustless bank account. Our account has never been overdrawn, and we have never had our bankbook balanced. It is only now that a few of our wiser men begin to see that it is time for us to get a balance from the clerk at the desk. We have been checking out, like inebriated mariners, what we had or thought we had in this rich bank of America, land of the free, country of endless opportunity. Now we have used up our forests, are exhausting our mines at fear-

some speed, have exterminated most of our wild game, endangered the food supply which comes from the waters, and, in general, done all we could to put an end to our great resources, recklessly spending not only our interest but also our principal. We have not even left unscathed the pleasant land. Not only are we using up at mad speed the natural products of the soil, but also are using up *the soil itself.*

If you think that the soil is exhaustless, or that it can be replaced, it might behoove you to take a homœopathic dose of geology and also take another guess. Mr. Roosevelt and most of the Congress of the United States would like to have us all take the trouble of studying the ground we stand on. Mr. Roosevelt's recent message asked us to pass our bank-books in at the window for a balance. It is an unpleasant thing to do. There are always so many more vouchers out than we thought. The balance is always so much smaller than we thought, and the bank has such an unpleasant way of being right in its figures. Yet the time has come for a show-down between the American people and America itself.

Out on the Blackfoot Reservation there stands a tall, lone mountain, rising like a monument above the surrounding plain, and nearly detached from the Rockies, which lie behind it. This peak the Indians call Chief Mountain. Here the Blackfoot sometimes comes to pray. In his mysticism his prayer runs: "O Thou, at whose feet the buried years lie fallen." That is to say, there is in his mind the thought of the slow forces of Nature. He reverences the idea of erosion. He would understand and not forget that hymn if he sung it, which in effect tells us that all we have in this world comes of the relations of soil and water. There will be a few million American farmers who will learn that same truth some time. The somewhat mad and drunken American people have ignored and inverted that truth heretofore. They have done all they could to go bankrupt, to ruin one of the richest portions of the earth's surface, one of the pleasantest lands ever taken over for human habitation, one obviously intended by the Great Forces as the place for the development of the highest form of civilization and the most splendid flowering of human endeavor.

What is the pleasant land, and where does it come from? Of course, the average man supposes that the soil was always there, like Uncle Joe Cannon, Niagara Falls and the tax deficit; but, as a matter of fact, the soil grew. In that vast story the action was rather more deliberate than that of a vaudeville sketch. Geology is not dramatic in that neurotic sense of the world which customarily we employ today. Yet you and I, and this country and other countries, are figures in the great drama. It might not harm us to note what a leading scientist says as to the time of the action of the play:

"For average rock under ordinarily favorable conditions in our range of climate, the usual estimate has been a foot of waste in four thousand to six thousand years, which includes the channel cutting and bank undermining. These are too rapid for ordinary soil-waste under our normal natural conditions. Without any pretensions to a close estimate, I should be unwilling to name a mean rate of soil formation greater than one foot in ten thousand years on the basis of observation since the glacial period. I suspect that, if we could posi-

tively determine the time taken in the formation of the four feet of soil next to the rock over the average domain where such depth obtains, it would be found above rather than below forty thousand years. Under such an estimate, to preserve good working depth, surface wastage should not exceed some such rate as one inch in one thousand years. When our soils are gone we too must go, unless we shall find some way to feed on raw rock or its equivalent."

So there is something in the story of the pleasant land. Search all the dictionaries through, comb out all the rhetoric books, and you couldn't get a happier phrase than that: "The pleasant land." It is excellent. It is perfect. Like any other savage, you feel a deep thrill of delight when you see the vast pictures of the unhurt out-of-doors. You have delight in the sight of green trees, of growing grasses and nodding flowers. This panorama of hill and dale, of rolling lands and forest-covered valleys and lofty mountains pleases you. Why? It is because all this was laid out in the intent of Nature to *produce* you and me and *support* us. It is beautiful in the beauty of utility. It is laid out on precisely the right lines to keep up the balance of the aforesaid little drops of water and little grains of sand, of which the one supports the other in the making of this pleasant land. It got its contours out of that balance. We grew out of the contours. This vast and splendid landscape is the portrait of our mother. We forget the hymn about it. Like a weak, irritable, nasty-tempered child, we strike the great Mother in the face, presuming on her vast indifference or her vast pity. And all the while Man is only the last animal that has been invented, and some time there will be a successor for him. If we destroy the soil we hasten that day when the successor shall come. Now the undeniable truth is that we are spending more than our inch of soil per thousand years.

Civilized man, money-mad business man, crazed man, average man, is doing all he can to destroy the balance between the little drops and the little grains. Not only is he doing all he can to invite the successor of man in the scheme of life, but he is hastening all he can that incidental intermediate thing—to give it, perhaps, the only interesting form into which the statement can be put in the terms of commercial Today—the show-down between the American standard of living and that of other peoples who never had so big a bank account as ours, and who, therefore, learn to save.

This hymn of the soil is the one great hymn. It sings of the one great heritage of life. We speak of this or that man "owning" thus or so much of the earth's surface. That, of course, is impossible. He takes it or borrows it, perhaps, but he can own no more than six feet of it, and that only for a short time. The soil belongs to Life. The "buried years" resent any embezzlement of our great heritage. The soil is owned by plants, by animals, by men of this or that nation, this or that age, that past, yonder future. If we sin against the soil, ours will be the Great Punishment—which is to say, extinction, oblivion. If you plow badly, it is you for the star-dust!

Even before Wall Street was invented there was more water than anything else in the world. Finally, on the little crust of land some tiny plant began to grow, no one knows just when. Perhaps at one

time the plant could not have told whether it was a plant or an animal, but, anyhow, in time it turned into some green thing which looked tempting to some old Ichthyosaurus, and the latter, of a pleasant spring morning, while tired of eating salt stuff and canned goods, crawled up out of the water and made a meal on the first recorded salad. It looked good to him and he came back. Other members of the Saurus family got on to the snap and also came up out of the water, all sorts of long-tailed and long-billed creatures, which, to make the story short, in time became land animals. All these animals in the original balance of things not only used that land, but helped to extend its total salad-producing acres. They trampled, they spread

Unhindered erosion over a long period of years in Stewart County. Erosion started with the removal of the forest. Hundreds of acres of valuable soil carried down the streams out to the ocean. Could have been prevented with a little care.

seeds, they increased the soil products. Vegetable mould increased. The little drops of water fell on it, and plants grew again on the pleasant land. The Saurus family moved in and permanently frequented the head lettuce, cabbage and turnip greens of that day.

All went merry as a marriage bell, until, in time, Man came along. The old ways did not suit him. He began to farm, at first by means of a crooked stick, and at last by means of the Harvester Trust. Incidentally, he forgot all about the buried years, and, with skill and speed and malice which would have caused any self-respecting Saurus to blush with shame, did all he could to wreak destruction upon the forests of the earth, on the mines, on the waters, and on the soil itself.

He overdrew his bank account, more in America than ever has been known in all the long, slow history either of the world or of the earth.

It would not be worth while to make here merely a series of sweeping general statements, or to make statements not definitely understandable. As it happens, the chapter and verse are ready at hand. It is entirely feasible not only to organize the waste in American soil, but to measure it. The late Professor N. S. Shaler estimated the destruction of agricultural lands, chiefly through old-field erosion, in the southern Atlantic and Gulf States at several thousand square miles; and in portions of this region the waste involves a complete removal of a superficial geologic deposit, well adapted to forming a productive soil, from underlying older formations ill-suited to the development of fertile soils and subsoils, in which case the loss is irremediable.

Other estimates of soil-waste rest on the determination of soil-matter transported by our running waters. The most extensive measurements of this kind were those of Generals Humphreys and Abbott, made on the Mississippi over half a century ago. These showed that the Mississippi then carried annually into the Gulf something over four hundred million tons of solid matter, in addition to great quantities of earth-salts, carried in solution, and of sand or other coarse material rolled or swept along the bottom.

At the time of these determinations settlement in the Mississippi Valley was comparatively limited, and, as shown by local observations on different rivers, the effect of extending agriculture has been to *increase* the soil-matter carried by the Mississippi *fully twenty-five per cent;* while comparative determinations made on several other streams indicate that the rivers of the country outside of the Mississippi basin carry into the sea about as much soil-matter as the great river itself—that is, that the annual soil-wash of the United Sates aggregates fully one billion tons! Our balance of trade is going some, isn't it? Also, unfortunately, our soil, which raised that balance of trade, is going some.

A fraction of the matter transported by the waters is coarse (sand and gravel), but fully ninety per cent consists of rich soil-stuff washed from the surface or leached from the subsurface of fields and pastures and (in less degree) of woodlands. Reckoned on the basis of value as fertilizer, the material could hardly be appraised at less than one dollar per ton; so that the annual loss to the agricultural interests of the country can hardly fall short of a billion dollars—equivalent to an impost as great as most other taxes combined, and one yielding *absolutely no return.* It is worse than that. Most of us have known stocks to pass a dividend. How would you feel if the whole stock and everything back of it were wiped out? What would we think of the management that allowed such an event to happen? But this is happening and under our own management.

The foregoing are estimates made by a United States soil expert. Other competent Government authorities can offer us definite food for additional thought, if we care to hearken. The greatest loss of our soil, we are told, is from *preventable* erosion. The total soil-wash of the country is a billion tons a year. This would make a pile of adobe

as high as the Washington Monument and a *mile long* on each of the four sides! Cleared and plowed lands, the source of food products, are the ones which suffer.

Most of the soil-wash—at least seven hundred and eighty-five million tons every twelve months, probably—is dumped into the ocean and lost forever. This would fill four channels as big as the Panama Canal, according to the original specifications. So says the cold-eyed soil expert.

Four hundred million tons of soil are washed from the borders of the Mississippi and Missouri rivers and their tributaries every year and poured as mud into the Gulf of Mexico. So says the wild-eyed Washington statistician.

Muddy waters carry more impurities than clear, and so endanger health more. They have greater power for cutting away the banks of streams. Deposits in the channels, drifting sand bars and changing courses are caused entirely by *silt in muddy streams.* Had you ever thought of that? Read the hymn backward. Thrown out of balance, water and sand *un*-make the pleasant land.

From the State of Missouri alone enough soil is carried away annually to make a prism one mile square and six hundred feet high. The Missouri River bears into the Mississippi every twelve months enough earth to make a mud-pile a mile square and four hundred feet high. The billion tons of soil which are washed away every year would spread a layer like Nile mud over Indiana, Illinois or Iowa. But what good does it do buried in the depths of the mighty ocean? It may help some future Saurus family, but it won't help yours.

Whole towns have been washed away by the change of currents in silt-laden streams. In some neighborhoods an entire farm has been taken up and carried across to the other side of a river. Within the past year the town of Pine Bluff, Arkansas, was threatened with destruction, many of the buildings toppling over into the turbid flood.

Bad plowing is the cause of a great deal of soil-waste. The farmer of America each year digs a Panama Canal with his little plow. Each year he digs out of the heart of his little forty, eighty or one hundred and sixty acres of land a block of dirt really bigger than the entire cut of the whole Panama Canal. The riches of his farm take wings. He did not see them go. He does not understand that he is literally plowing his farm into the mighty ocean. Not only do we waste, *but that waste accelerates each year.* That is the horrible feature of all these resource-wastes—they increase geometrically with awful swiftness. The buffalo went "all at once." The trees, the fish, the ore, will go "all at once." We do not like high prices, but higher prices than we now can dream are coming to us Americans unless we can get down to a practical basis on religion, politics and business—unless we can understand that little old hymn we used to sing.

When axe and plow work together as agents of destruction and not as creative influences, then we are not using good business sense. Yet that is what we have done—ripped the covering from the soil, and then ripped off the soil itself. In that way we destroy a primary value. In that way, also, we raised the price, cut down the supply of food, of clothes, of habitation, for the average man. The average

American has let a few men steal him blind, and now he is stealing himself blind. The soil is the connecting link between organic and inorganic life. It is the foundation of organized society and of all civilization. It is the place where all the bank accounts come from.

Any man who touches the soil, and even the city man who does not, ought to understand it. The main truths are simple enough, like most big things. It is easy to see that depth of soil, and therefore richness in product, is inverse as to slope, because the soil washes thin on the hillsides and runs thicker on the flat. Therefore, on the flats it raises more vegetation, which in turn furnishes more mulch, which in turn holds more moisture, which in turn produces more vegetation. The great circle of the conservation of forces is a simple and beautiful thing. Slope, water supply, organic action, all these govern soil as in the days of the Saurus family. That is the Hymn of Life. Good plowing is good religion. Good politics is good religion. Good business is good religion. Good geology is good religion, too, and the circle runs around and around, beautiful and complete, if only we care to look at it in that way.

When the Government gets the little drops of water regulated in Wall street, and when we begin to understand the relation of those little drops and little grains on our farm, we shall begin to see in America the arrival of a golden age, one of growth in art, in beauty, in mentality, in altruism. Even at this stage of our development we ought to have intelligence equal to that of the average Ichthyosaurus. What Uncle San is trying to show us is, that without water there is no civilization, and that without proper relation of water and soil there is industrial anarchy. Bad handling of water means less crops, less soil, more polluted streams, more choked up channels, more floods, more waste and ruin, the balance of things thrown out of plumb, and the world literally turned upside-down. The Hymn of Life is one which in time the great Teacher of the Universe is going to force us to remember, whether we wish to remember it or not. It is not Washington, but the Universe, which is handing a message to us.

What, then, ought we to do to get out of the Ichthyosaurus class and to give our beneficent protective tariff something to protect? In the first place, it is not up to Uncle Sam, but up to us. Louis XVI said, "The State, it is myself!" That was in France, and some time ago. The State, it is ourselves, here in America. The remedy does not begin with your neighbor, but with yourself, and with you it begins as soon as you realize that no bank account will stand perpetual checking against it. Uncle Sam is willing to help any one of us begin the study of the soil today.

The soil experts of the Government are no more able to classify farms than the average farmer—every farmer knows that there may be heavy, sticky soil! thin, light, sandy soil; clay soil; open and friable mould. Any farmer knows that the great idea is to retain the natural moisture under the soil and not let it run off on the surface. The experts show that deep plowing is a good thing in certain soils, to get the water down into the earth. If the land is very flat, deep tilling may be necessary to get this surplus water out, so that the soil may drain dry and disintegrate. Most farmers know

that, in a general way; but Uncle Sam can teach the average farmer a wrinkle or two to right the balance of the little drops and the little grains.

On the hillsides which wash so badly, the soil expert says we ought to study contour farming, as it is called. A vertical or slanting furrow will soon become a vertical gully. The horizontal furrow at the same elevation all around the hill has, on the other hand, a tendency to stop the running off of water. Great benefit, also, comes from using strips of grass land, lying in bands of the same elevation around the sides of a dangerous hill. Terracing of farms is new in this country, where we have always just gone West instead. We see the terraces of Chinese and Japanese lands, and suppose they must have been made at the expense of great labor, but in reality it was Time and Nature that made them. The soil which is washed out of the horizon-

Karst, Hungaria. Once a beautiful forest. With the destruction of the forest the soil disappeared. Masonry walls necessary to hold the little soil that remains. Agricultural community—but practice confined to two crops, grapes and cabbage.

tal furrow is in part or in whole stopped when it strikes the edge of the grass land. In many years it banks up more and more. If not controlled it would not bank up, but simply run down the hill and fly away into the mighty ocean.

In rolling lands the canny farmer plants crops toward the tops of the hills to produce cover and mulch, and so to stop wash. He reserves some of his bottom lands for grass, to catch the soil-wash and use it. If he did not, some of his farm would run away, and not only impoverish him, but, perhaps, work injury to his neighbor. It is not good farming to farm every inch of a rich bottom. A few bands of trees would break the driving force of rain. The roots would stand against soil-wash and regulate the flooding which make bottom farming so risky in some localities. The average farmer may not believe in

the sense of this, any more than the average lumberman would hesitate to cut away the forest; but the fact remains. Of course, in any very broken country, so says Uncle Sam, there should be forestry mixed with farming; otherwise, the rainfall goes off in torrents. Even Uncle Sam sometimes forgets this, for, after establishing forest reserves, he very often leases them out as sheep or goat ranges. These animals trample little paths, which soon become gullies, which, in time, become great avenues of waste. I have seen mountains in New Mexico ruined by goats.

For fuller particulars, any anxious inquirer might do much worse than refer to the Department of Agriculture, where many of these great, slow problems are now under careful consideration. As to actual remedy, however, nothing can be done so long as we ourselves remain ignorant or careless in politics, religion and business. We must see higher than the walls of our little grooves. Also, we must see about us in our own little grooves. Waste begins on your own forty acres, right at your door. You are the unit, the individual citizen. From you it is a step up to your hundred, under the old Saxon law. Thence you go to your town, your State, your National Government. Your wish can prevail, if you like, at each and every step of that advance. You can say to that legislator who thinks of himself and not of you, that you would rather have in his place a man who stands for guarded resources, for large reserves of forests, rich soil, a proper water flow, an unimpeded navigation, for fair play all along the line. It all begins with you and me. We have a good country and a good government, but they won't run themselves. The reform of a great many things begins away this side of Washington, District of Columbia. Some of it can begin in the caucus, or the primary, or the forty-acre field. Common-sense and enforced laws now, or the piper to pay after a while—which is better?

At our present nice little industrial gait, here in America, we are burning the candle at both ends, quite regardless of the fact that when it is burnt out, it can never be renewed. Such American fortunes as were made out of theft of America's common resources must surely, one day and in some way, pay the price. But let us little fellows who have not "succeeded" in the world see to it that we keep our own hands clean.

This was a very wonderful and beautiful country. Having seen it before civilization took it all over, perhaps, some of us do not care so much for civilization as we might.

Perhaps some of us would rather be Indians and pray to Chief Mountain, or would rather have been members of the Saurus family, before there was any such thing as taxes and when potato salad was free. Yet here we are, each in his little groove, and, if we have to play the game, we ought to understand th game and know what the game is about.

At least one truth is, we don't own the soil. We borrow it. We ought to hand it over to the successor of our species in as good condition as when we asked the loan. The Saurus family played the game as fair as that with us; and the finest Sauri in the world were raised right here in the United States. Perhaps they didn't forget the hymns they sang.

CONCENTRATION AND DEVELOPMENT OF WATER POWER

The central fact in the water power situation of today is concentration of control. Ten groups of power interests control 65 per cent of all the developed water power in the United States. Some of these groups are still further related through interlocking directors between the groups themselves.

But the rapid growth of concentration and control is even more striking than the amount of it. Two years ago the ten greatest groups of water power interests controlled in round numbers, 3,270,000 horsepower developed and undeveloped. Today the ten greatest groups control 6,270,000 horsepower. Thus the amount of concentration has nearly doubled in two years.

In view of these facts, on November 20, 1913, the following amendment of the resolutions of the National Conservation Congress was passed by an overwhelming vote:

> WHEREAS, Concentrated monopolistic control of water power in private hands is swiftly increasing in the United States, and far more rapidly than public control thereof; and
>
> WHEREAS, This concentrating, if it is fostered, as in the past, by outright grants of public power in perpetuity, will inevitably result in a highly monopolistic control of mechanical power, one of the bases of modern civilization, and a prime factor in the cost of living; therefore,
>
> *Be it resolved,* That we recognize the firm and effective control of water power corporations as a pressing and immediate necessity urgently required in the public interest;
>
> That we recognize that there is no restraint so complete, effective, and permanent as that which comes from firmly retained ownership of the power site;
>
> That it is, therefore, the solemn judgment of the Fifth National Conservation Congress that hereafter no water power now owned or controlled by the public should be sold, granted, or given away in perpetuity, or in any manner removed from the public ownership, which alone can give sound basis of assured and permanent control in the interest of the people.

"BLIND MOUTHS"

An editorial from Century Magazine. It is a very fine example of scholarly modern English.

Literature is full of trenchant expressions of the recklessness of greed, such as "after us, the deluge!" "Devil-may-care" and "Out of sight, out of mind"—but none of them compared with the lightning-like revelation of selfishness made by these two words of Milton's. Conveying, as they do, the sense of an all-consuming appetite, the very maw of darkness, they would seem to have come from the poet's vituperative prose, rather than from the flowing elegy of the gentle Lycidas.

"What has posterity ever done for us that we should do anything for posterity?" is a saying as striking for the falsity of its suggestion as for the edge of its wit. The most obvious material and natural reasons impel us to work for posterity. Our happiness consists largely in procuring the happiness of our children and our grandchildren, whose happiness in turn will consist in the happiness of *their* children and grandchildren. However attenuated this altruistic sentiment may become with further extension, it is enough for practical purposes if it shall reach forward four generations. We bless our ancestors for the building of roads and the planting of trees and it is what posterity will do for us in the way of benediction that rightly animates any one above the beasts. Indeed, it is hardly too much to say that civilization itself lies in the fact—and to the extent—that "out of sight" is *not* "out of mind."

* * * * * * * *

It is with the conservation of the forests that we are here concerned, for without them there would be far less range to administer. Until 1890 our land policy was all steam and no brake. Under a false individualism, due to consideration for the bona fide settler and the Civil War veteran, the larger interests of the region, which included their interests, were forgotten. Recklessness and waste were rampant. By false entries, bribery, and local terrorism millions of acres were acquired and held by individuals and corporations, and what was intended for the homemaker fell into the grasp of commercial exploiters, whose operations have not only left trails of devastation, but have poisoned the politics of many states.

During Mr. Harrison's administration * * * came a new policy. By a legislative provision, passed March 3, 1891,, the President was authorized to withdraw from public entry and set apart and reserve in any state or territory such portions of the public lands as might in his opinion be desirable for the preservation of the forests and waters. Then began a campaign of education throughout the country so continuous that he must be ignorant indeed who does not know the impressive reasons why the upland forests must be preserved. The lingering tragedies of those Mediterranean countries—Greece, Italy, France, Spain, and the African coast—which permitted wholesale destruction of their forests, have been rehearsed for our warning:

Till old Experience do attain
To something of prophetic strain,

while the success of the present far-sighted policies of Germany, France, and other countries have been cited for our encouragement.

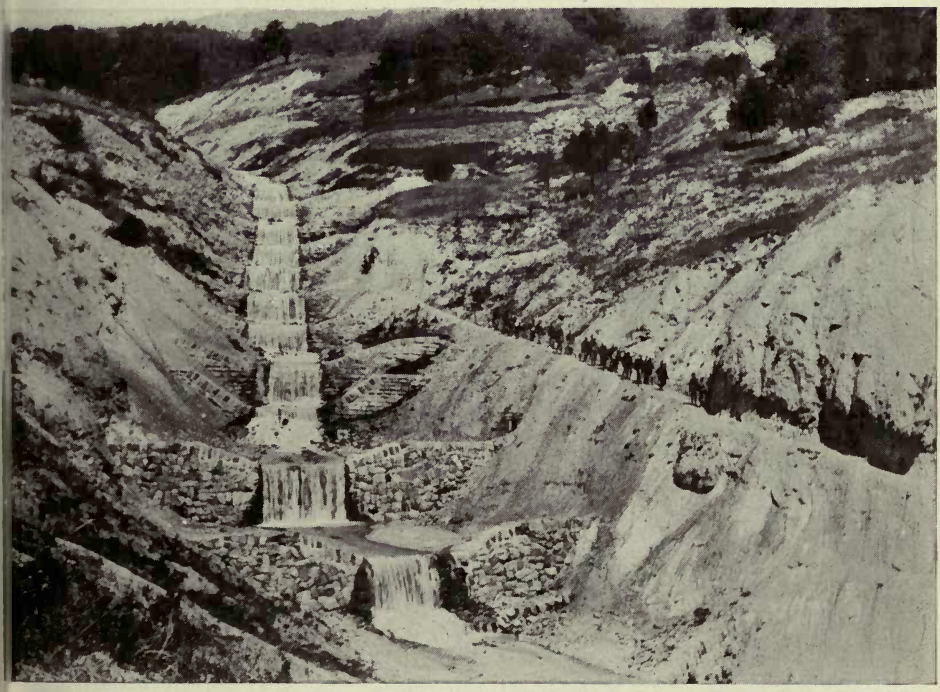
* * * The walnut and white pine of the Lake States are virtually exhausted; the leather trust is everywhere decimating the hemlock for tanbark, while the soft woods, saplings as well as larger growth, are being indiscriminately devoured by the pulp mills. Meanwhile, the senseless tariff on lumber tempts the rich companies to further depletion of our resources, rather than permit the builder to buy in the cheaper and inexhaustible market of Canada. Could folly farther go?

Reversing the witticism, let us ask, What has posterity ever done to us that we should do such things to posterity?

WHEN THE FORESTS ARE GONE

Teachers of geography and others interested in such matters will find a wealth of good material in a large volume by George P. Marsh Entitled "The Earth as Modified by Human Action." The following paragraphs give a vivid idea of conditions in certain parts of France. It is the part of wise people to profit by the experience of others, to take warning from others' misfortunes.

"When the forest is gone, the great reservoir of moisture stored up in its vegetable mould is evaporated, and returns only in deluges of rain to wash away the parched dust into which that mould has been converted. The well-wooded and humid hills are turned to ridges of dry rock, the débris from which encumbers the low grounds and chokes the watercourses, and—except in countries favored with an equable distribution of rain throughout the seasons, and a moderate and regular inclination of surface—the whole earth, unless rescued by human art from the physical degradation to which it tends, becomes an assemblage of bald mountains, of barren, turfless hills, and of swampy and malarious plains. There are parts of Asia Minor, of northern Africa, of Greece, and even of Alpine Europe, where the operation of causes set in action by man has brought the face of the earth to a desolation almost as complete as that of the moon; and



The Alps, France. Following the revolution the mountains were denuded as a result of reckless lumbering, excessive grazing by sheep and fire. The soil has disappeared and the streams are alternately raging torrents and dry channels. At great expense masonry dams have been constructed to prevent the debris covering valulable agricultural land below.

though, within that brief space of time which we call "the historical period," they are known to have been covered with luxuriant woods, verdant pastures, and fertile meadows, they are now too far deteriorated to be reclaimable by man, nor can they become again fitted for human use."

"The Alps of Provence present a terrible aspect. In the more equable climate of northern France, one can form no conception of those parched mountain gorges, where not even a bush can be found to shelter a bird, where, at most, the wanderer sees in summer here and there a withered lavender, where all the springs are dried up, and where a dead silence, hardly broken by even the hum of an insect, prevails. But if a storm bursts forth, masses of water suddenly shoot from the mountain heights into the shattered gulfs, waste without irrigating, deluge without refreshing the soil they overflow in their swift descent, and leave it even more seared than it was from want of moisture. Man at last retires from the fearful desert, and I have, the present season, found not a living soul in districts where I remember to have enjoyed hospitality thirty years ago."

"It is certain that the productive mould of the Alps, swept off by the increasing violence of that curse of the mountains, the torrents, is daily diminishing with fearful rapidity. All our Alps are wholly, or in large proportion, bared of wood. Their soil, scorched by the sun of Provence, cut up by the hoofs of the sheep, which, not finding on the surface the grass they require for their sustenance, gnaw and scratch the ground in search of roots to satisfy their hunger, is periodically washed and carried off by melting snows and summer storms."

I will not dwell on the effects of the torrents. For sixty years they have been too often depicted to require to be further discussed, but it is important to show that their ravages are daily extending the range of devastation. The bed of the Durance, which now in some places exceeds a mile and a quarter in width, and, at ordinary times, has a current of water less than eleven yards wide, shows something of the extent of the damage. Where ten years ago, there were still woods and cultivated grounds to be seen, there is now but a vast torrent; there is not one of our mountains which has not at least one torrent, and new ones are daily forming.

"In the days of the Roman Empire the Durance was a navigable, or, at least, a boatable, river, with a commerce so important that the boatmen upon it formed a distinct corporation.

"Even as early as 1789 the Durance was computed to have already covered with gravel and pebbles not less than 130,000 acres, which but for its inundations, would have been the finest land in the province."

A NEW PATRIOTISM

This article from the World's Work Magazine is certainly worth thoughtful reading by all Americans. Don't fail to note its fine, patriotic spirit. It is Gifford Pinchot, who has had every opportunity for twenty years to know whereof he speaks. It is said that he accepted no salary for his work as chief forester of the United States, but turned it back into the treasury for the good of the cause, devoting the best years of his life to a labor of love.

The people of the United States are on the verge of one of the great quiet decisions which determine national destinies. Crises happen in peace as well as in war, and a peaceful crisis may be as vital and controlling as any that comes with national uprising and the clash of arms. Such a crisis, uneventful and almost unperceived, is upon us now, and unwittingly we are engaged in making the decision that is thus forced upon us. And, so far as it has gone, our decision is wrong. Fortunately, it is not yet final.

The question we are deciding with so little consciousness of what it involves is this: What shall we do without natural resources? Upon the final answer that we shall make to it hangs the success or failure of this nation in accomplishing its manifest destiny.

Few Americans will deny that it is the manifest destiny of the United States to demonstrate that a democratic republic is the best form of government yet devised, and that the ideals and institutions of the great republic taken together must and do work out in a prosperous, contented, peaceful, and righteous people; and to exercise, through precept and example, an influence for good among the nations of the world. That destiny seems to us brighter and more certain of realization today than ever before. It is true that in population, in wealth, in knowledge, in national efficiency generally, we have reached a place far beyond the farthest hopes of the founders of the republic. Are the causes which have led to our marvelous development likely to be repeated indefinitely in the future, or is there a reasonable possibility, or even a probability, that conditions may arise which will check our growth?

Danger to a nation comes either from without or from within. In the first great crisis of our history, the Revolution, another people attempted from without to halt the march of our destiny by refusing to us liberty. With reasonable prudence and preparedness we need never fear another such attempt. If there be danger, it is not from an external source. In the second great crisis, the Civil War, a part of our own people strove for an end which would have checked the progress of our development. Another such attempt has become forever impossible. If there be danger, it is not from a division of our people.

Our Third National Crisis.

In the third great crisis of our history, which has now come upon us unawares, our whole people, unconsciously and for lack of foresight, seem to have united together to deprive the nation of the great natural resources without which it can not endure. This is the pressing danger now, and it is not the least to which our national life has been exposed. A nation deprived of liberty may win it, a nation divided

may reunite, but a nation whose natural resources are destroyed must inevitably pay the penalty of poverty, degradation, and decay.

At first blush this may seem like an unpardonable misconception and over-statement, and if it is not true it certainly is unpardonable. Let us consider the facts. Some of them are well known, and the salient ones can be put very briefly.

The five indispensably essential materials in our civilization are wood, water, coal, iron, and agricultural products.

We have timber for less than thirty years at the present rate of cutting. The figures indicate that our demands upon the forest have increased twice as fast as our population.

We have anthracite coal for but fifty years, and bituminous coal for one hundred.

Our supplies of iron ore, mineral oil, and natural gas are being rapidly depleted, and many of the great fields are already exhausted. Mineral resources such as these when once gone are gone forever.

We have allowed erosion, that great enemy of agriculture, to impoverish and, over hundreds of square miles, to destroy our farms. The Mississippi alone carries yearly to the sea more than 4,000,000,000 tons of the richest soil within its drainage basin. If this soil is worth a dollar a ton, it is probable that the total loss of fertility from soil-wash to the farmers and forest owners of the United States is not far from a billion dollars a year. Our streams, in spite of the millions of dollars spent upon them, are less navigable now than they were fifty years ago, and the soil, lost by erosion from the farms and the deforested mountain sides, is the chief reason. The great cattle and sheep ranges of the West, because of over-grazing, are capable, in an average year, of carrying but half the stock they once could support and should still. Their condition affects the price of meat in practically every city of the United States.

These are but a few of the more striking examples. The diversion of great areas of our public lands from the home maker to the landlord and the speculator, the national neglect of great water powers, which might well relieve, being perennially renewed, the drain upon our non-renewable coal; the fact that but half the coal has been taken from the mines which have already been abandoned as worked out and in caving-in have made the rest forever inaccessible; the disuse of the cheaper transportation of our waterways, which involves but little demand upon our nonrenewable supplies of iron ore, and the use of the rail instead—these are other items in the huge bill of particulars of national waste.

The Disregard of the Future.

We have a well-marked national tendency to disregard the future, and it has led us to look upon all our natural resources as inexhaustible. Even now that the actual exhaustion of some of them is forcing itself upon us in higher prices and the greater cost of living, we are still asserting, if not always in words, yet in the far stronger language of action that nevertheless and in spite of it all, they still are inexhaustible.

It is this national attitude of exclusive attention to the present, this

absence of foresight from among the springs of national action, which is directly responsible for the present condition of our natural resources. It was precisely the same attitude which brought Palestine, once rich and populous, to its present desert condition, and which destroyed the fertility and habitability of vast areas in northern Africa and elsewhere in so many of the older regions of the world.

Destruction of soil in southwestern Georgia illustrating the manner in which a small area of forest arrests erosion. The annual loss of soil in the country totals millions of dollars; preventative measures would cost a very small percent of this.

The conservation of our natural resources is a question of primary importance on the economic side. It pays better to conserve our natural resources than to destroy them, and this is especially true when the national interest is considered. But the business reason, weighty and worthy though it be, is not the fundamental reason. In such matters, business is a poor master but a good servant. The law of self-preservation is higher than the law of business, and the duty of preserving the nation is still higher than either.

The American Revolution had its origin in part in economic causes, and it produced economic results of tremendous reach and weight. The Civil War also arose in large part from economic conditions, and it has had the largest economic consequences. But in each case there was a higher and more compelling reason. So with the third great crisis of our history. It has an economic aspect of the largest and most permanent importance, and the motive for action along that line, once it is recognized, should be more than sufficient. But that is not all. In this case, too, there is a higher and more compelling reason. The question of the conservation of natural resources, or national resources, does not stop with being a question of profit. It is a vital question of profit, but what is still more vital, it is a question of national safety and patriotism also.

We have passed the inevitable stage of the pillage of natural resources. The vast wealth we found upon this continent has made us rich. We have used it, as we had a right to do, but we have not stopped there. We have abused, and wasted, and exhausted so much that there is the gravest danger that our prosperity today will have been made at the price of the suffering and poverty of our descendants. We may now fairly ask ourselves a reasonable care for the future and a natural interest in those who are to come after us. No patriotic citizen expects this nation to run its course and perish in a hundred, or two hundred, or five hundred years; but, on the contrary, we expect it to grow in influence and power, and, what is of vastly greater importance, in the happiness and prosperity of our people. But we have as little reason to expect that all this will happen of itself as there would have been for the men who established this nation to expect that a United States would grow of itself without their efforts and sacrifices. It was their duty to found this nation, and they did it. It is our duty to provide for its continuance in well-being and honor. That duty it seems as though we might neglect. Not in willfulness, not in any lack of patriotic devotion, when once our patriotism is aroused, but in mere thoughtlessness to drop the interests of the moment long enough to realize that what we do now will decide the future of the nation. For, if we do not take action to conserve the natural resources, and that soon, our descendants will find them gone.

Let me use a homely illustration: We have all known fathers and mothers, devoted to their children, whose attention was fixed and limited by the household routine of daily life. Such parents were actively concerned with the common needs and precautions and remedies entailed in bringing up a family, but blind to every threat that was at all unusual. Fathers and mothers such as these often remain serenely unaware while some dangerous malady or injurious habit is fastening itself upon a favorite child. Once the evil is discovered, there is no sacrifice too great to repair the damage which their unwitting neglect may have allowed to become irreparable. So it is, I think, with the people of the United States. Capable of every devotion in a recognized crisis, we have yet carelessly allowed the habit of improvidence and waste of resources to find lodgment. It is our great good fortune that the harm is not yet altogether beyond repair.

The profoundest duty that lies upon any father is to leave his son

with a reasonable equipment for the struggle of life and an untarnished name. So the noblest task that confronts us all today is to leave this country unspotted in honor, and unexhausted in resources, to our descendants, who will be, not less than we, the children of the founders of the republic. I conceive this task to partake of the highest spirit of patriotism.

LEARNING FROM HISTORY

The following is an extract from a paper by A. B. Benton, before the Tri-counties Reforestation Committee, in Southern California. It certainly affords food for thought.

The editor of one of our great weekly journals has written: "Probably the work for which President Roosevelt will be longest remembered is his efforts for the conservation of our national natural resources."

The fountains must be renewed, the field must be planted, the fire must be checked, and by us or we will justly merit the contempt of mankind. We are not the first, but the last of the nations who have squandered their birthright. The splendid nations of old time, Egypt, Babylonia, Asia Minor, Greece, India, China; where our race began its career, where the arts and letters and commerce and architecture were born and nourished in glorious achievement for centuries and centuries—do you think their lands were sterile then? Do you conceive them as poorer in lavish gifts of nature than is our land? Do you suppose the teeming millions of their inhabitants so prospered in the deserts which we find there now? Believe me, the deserts there are of men's making, and their desolation was brought about by their own hands. We look on the poor ruins of these once mighty empires with a complacent pity, but I have little doubt that the spirits of the men of old, if they are cognizant of our doings, have greater reason for a scornful pity than have we, for they began civilization and had little before their time to take warning, while we, latest of all, I verily believe have been as reckless as any of the great nations, ancient or modern.

There are many, even in this day, who can learn nothing from history for their own profit. The world of men for thousands of years has been experimenting with civilization of higher and lower types. Enough of their experiences have been written to teach us every lesson we need to learn had we the wit to read them aright. The treasures of ancient and medieval research, their economics and philosophy have been opened to this age a thousand-fold more widely than to any age whatsoever before us. If it, with the histories of the good and bad of all ages before it, not in dead language, nor locked in secluded temples and cloisters, but in its living tongues, and in multiplied libraries—if, with all this before it, it follows the blunders and mistakes and follies of the old ages because it will not see, and seeing learn, then our civilization deserves not only to perish as miserably as the most miserable failure of them all, but will richly merit the epitaph of Justice Dogberry to "be written down an ass!"

We voters of America are the bankers of the nation's resources. Infinitely more valuable is our trust than that of money, stocks or bonds, because once dissipated, it may not be replaced. If we are to preserve for our children the heritage we receive from our fathers, we must alarm the people out of their thoughtless indifference. Public thieves must be punished, fires must be checked, individual rights must be purchased when demanded for the public good. Wantonness of waste by careless owners and destructive greed for immediate gain by selfish owners must be controlled. This is a mighty task, more difficult than some of the greatest our ancestors performed in the old days. But if it be not accomplished, the shame of defeat will rest on this generation, for this is pre-eminently our battle. We may not throw its burden backward to our fathers, or forward to our children. The former could not see its swift coming, the latter will have little to fight for if we fail in preserving for ourselves and them the resources by which only we or they can win continued prosperity.

NATIONAL FORESTS AND NATIONAL PARKS

The forest policy of the U. S. Government is of interest to every citizen. Henry S. Graves, the present forester, has this to say in his report for 1913.

The fundamental aim in administering the National Forests is to develop their resources for the permanent upbuilding of the country. The whole object of their administration would be defeated by closing the forests to development and maintaining them as a wilderness. The aim of administration is essentially different from that of a national park, in which economic use of material resources comes second to the preservation of natural conditions on æsthetic grounds. When National Forest land occurs which is chiefly valuable for agriculture, its free homesteading not only aids local development and advances the general public welfare, but also directly helps in the administration and development of the forests themselves. The upbuilding of agriculture in the forests where agricultural land occurs is on a par with the building up of industries through the use of timber, forage, and other resources of the forests. The National Forests can not be developed properly without people. The usefulness of the forests is in direct ratio to the number of people who use their resources. The presence of developed farms within the forests aids in fire protection. Every cleared strip is a fire line; every ranch is a vantage point for fire fighting; every rancher may be made a forest protector. It is, therefore, the aim to further the agricultural development of all land which may be better used for growing field crops than for growing trees. Further, it is the aim and duty of every forest officer to aid settlers in the forests in the development of their farms by allowing free use of timber for domestic purposes, and in other ways.

The aims of the forest policy are:

To prevent losses of this public property by fire.

To utilize the ripe timber which can be marketed.

To cut the ripe timber in such a way as to insure restocking of the land and the continuance of forest production.

To sell ripe timber at a price representing, as required by statute, the appraised market value and a proper return to the public which owns it.

To sell ripe timber in such a way as to prevent its speculative acquisition and holding.

To prevent monopoly of public timber and to use it as far as possible to maintain competitive conditions in the lumber industry.

To provide first for the requirements of local communities and industries, including free use and sale at cost to settlers as authorized by statute.

An agricultural community near Fiume, Hungaria. Buildings of stone and concrete, roofs of tile or thatch. Gound floor devoted to farm stock, upper floors to the family. Result of the dearth of cheap building material.

To make timbered lands of agricultural value available for settlement, under conditions which prevent speculative acquisition but encourage permanent and genuine farming.

To return as soon as possible the cost of protection and administration and to yield a revenue to the states, which are entitled by statute to 25 per cent of all gross receipts as an offset to the loss of local taxes through Government ownership of the forests.

SOME ASPECTS OF FORESTRY

By Treadwell Cleveland, Jr.

Many people in this country think that forestry had never been tried until our Government began to practice it upon the national forests. Yet forestry is practiced by every civilized country in the world, except China and Turkey. It gets results which can be got

in no other way, and which are necessary to the general welfare. Forestry is not a new thing. It was discussed two thousand years ago, and it has been studied and applied with increasing thoroughness ever since.

The principles of forestry are everywhere the same. They rest on natural laws, which are at work everywhere and all the time. It is simply a question of how best to apply these laws to fit local needs and conditions. No matter how widely countries may differ in size, climate, population, industry, or government, provided only they have forests, all of them must come to forestry some time as a matter of necessity.

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The countries of Europe and Asia, taken together, have passed through all the stages of forest history, and applied all the known principles of forestry. They are rich in forest experience. The lessons of forestry were brought home to them by hard knocks. Their forest systems were built up gradually as the result of hardships. They did not first spin fine theories and then apply those theories by main force. On the contrary, they began by facing disagreeable facts. Every step of the way toward wise forest use, the world over, has been made at the sharp spur of want, suffering, or loss. As a result, the science of forestry is one of the most practical and most directly useful of all the sciences. It is a serious work, undertaken as a measure of relief, and continued as a safeguard against future calamity.

Roughly, those countries which today manage their forests on sound principles have passed through four stages of forest experience. At first the forests were so abundant as to be in the way, and so they were either neglected or destroyed. Next, as settlements grew and the borders of the forest receded farther and farther from the places where wood was needed and used, the question of local wood supplies had to be faced, and the forest was spared or even protected. Third, the increasing need of wood, together with better knowledge of the forest and its growth, led to the recognition of the forest as a crop, like agricultural crops, which must be harvested and which should therefore be made to grow again. In this stage silviculture, or the management of the forest so as to encourage its continued best growth, was born. Finally, as natural and industrial progress led to measures for the general welfare, including a wiser and less wasteful use of natural resources, the forest was safeguarded and controlled so as to yield a constant maximum product year after year and from one generation to another. Systematic forestry, therefore, applied by the nation for the benefit of the people, and practiced increasingly by far-sighted private citizens, comes when the last lesson in the school of forest experience is mastered.

* * * * * * * *

China holds a unique position as the only civilized country which has persistently destroyed its forests. What forestry has done in other countries stands out in bold relief against the background of China, whose hills have been largely stripped clean of all vegetation, and

whose soil is almost completely at the mercy of the floods. Trees have been left only where they could not be reached. Almost the sole use for lumber now is the manufacture of coffins. The heavy two or three inch planks for this purpose are so scarce, and the cost of transporting them by coolies is so high, that they sell for $2.00 or $3.00 apiece.

Nowhere in the world is the forest cleaned off down to the very soil as it is in China. When the trees are gone, the saplings, the shrubs, and even the herbage are taken. Slender poles are used to build houses; inconsiderable shrubs are turned into charcoal. In the lower mountains of northeastern China, where the stripping process has reached its extreme phase, there is no trace of anything worthy of the name of forest. In the graveyards and courts of the temples a few aged cedars have been preserved by the force of public opinion, and poplars and fruit trees planted about dwellings are protected as private property by the peasant owners.

In the province of Shantung, where deforestation is practically complete, fuel and fodder for cattle are literally scratched from the hillsides by boys who go out from villages with their iron rakes in autumn to secure winter supplies. Grazing animals, searching every ledge and crevice, crop the remaining grass down to the very roots.

A dearth of wood is not the only forlorn result of forest devastation—a dearth of water and the ruin of the soil follow in its train. In western China, where forest destruction is not yet complete, enough vegetation covers the mountains to retard the run-off of the rains and return sufficient moisture to lower levels, where it can be reached by the roots of crops and where springs are numerous. But on the waste hills of eastern China the rains rush off from the barren surfaces, flooding the valleys, ruining the fields, and destroying towns and villages. No water is retained at the higher levels, so that none is fed underground to the lower soils or to the springs. As a result, even on the plains the water level is too far beneath the surface to be used. Without irrigation and the ingenious terracing of hillsides, by which the rains are made to wash the soil into thousands of miniature fields whose edges are propped up by walls, agriculture would be entirely impossible. Even irrigation calls for the immense labor of drawing the needed water from wells.

In a word, the Chinese, by forest waste, have brought upon themselves two costly calamities—floods and water famine.

OUR NEIGHBOR'S FOREST

The Government of British Columbia has put into forest reserves at one stroke a hundred and fifty million acres—five eighths of all the land in the province. In British Columbia the lumberman who wishes to cut trees must deal with the Government, whose enlightened policy, giving the people the control of their timber resources, is carried out by the local government of the province, unlike some of our western states, which hang back in sullen protest while salvation is forced upon them by a distant national authority.

THE VITAL TRUTH

Stewart Edward White, the noted writer of camping and outdoor stories, lives in Santa Barbara. Even his honeymoon was spent in the open, on a horseback trip through the high Sierras round Mount Whitney. He has written a fine article for the American Magazine under the caption "The Fight for the Forests," from which the following is extracted, by permission.

"When a man makes his camp in the wilderness he hunts first of all two requisites. If they exist in abundance, he is happy and comfortable; if they lack, he must take his rest, and move on to more favored localities. These two requisites are wood and water.

And, curiously enough, these two necessities of man's abiding depend absolutely one on the other. Without rainfall the forests will not grow. Without the forests the rainfall is destructive, rather than beneficent. In a naked country—whether artificially or naturally so—the water comes in great torrential floods followed by droughts. A covering of forest, on the other hand, retains the rainfall as would a sponge, distributing it slowly through regulated streams, holding it back against the needs of the dry season. Wherever the forests have been cut away, we are treated each spring to destructive floods, as has been many times proven in the valleys of those great rivers draining the sites of the old pine forests in the East. Contrariwise, in California, where the necessities of irrigation cause the people to pay great attention to such matters, it has been found by actual measurement that the stream-flow has increased twenty-five per cent since the establishment of efficient protection for the forest cover.

Since these things are so, it follows naturally that sooner or later nations would see through the haze of immediate expediency to the vital truth, forced home boldly on the individual camper.

From this realization would come a system of forestry.

In Switzerland we find the earliest intelligent treatment of the question. Switzerland's mountainous situation would have rendered her peculiarly liable to complete extinction by flood, avalanche and the erosion of the agricultural soil, once the natural protection was removed. But today Switzerland is prosperous and very much alive. Over one thousand years ago she possessed a forest system, and had developed scientific forestry by the fifteenth century. As early as Louis XIV, France awoke to the fact that her forests and her life were draining away together. But it was too late. Today she is spending $34 an acre to reforest her watersheds. The same experience is costing Italy $200 an acre. Italy is not a wealthy nation; yet she is appropriating cheerfully this enormous sum in the realization that on it depends the question as to whether or not she will have to strike her tents. If we of the United States were called upon to replace at even Italy's figure the trees not growing on the watersheds protected by our reserves, we should have to spend about three billion dollars!

Only a few years ago the forest was our enemy here in America. Every step of the way must be cleared by the pioneer's axe and guarded by his rifle. A tree was a foe to be gotten rid of as expeditiously as possible. To ingrained and inherited hostility succeeded indifference,

which is but just beginning to yield ground to a more enlightened sentiment. This enlightened sentiment further encounters determined and unscrupulous opposition from the land-grabbers, the lumber stealers, the candidate for free grazing, and all the rest of the various pirates and parasites that prey upon and cling to the rich spoils of our public domain.

A CONTINENT DESPOILED

Rudolf Cronau is a well-known artist and writer, of German ancestry. Under the above title he has written a vivid article in the American Magazine, with the following introduction:

On my writing-desk lies a pile of photographs, some taken with my own camera, some obtained from friends or through the courtesy of

Portion of a city forest. Bavaria. Notice the well-kept nursery and the beautiful stand of spruce in the rear. This forest is grown from seedlings, planted by hand eighty years ago. The revenue from the forest pays for all improvements in the city.

the United States Forest Service and the Geological Survey. Besides, there are maps and papers covered with statistical figures.

If you look over this collection, you will be struck with horror, for these views disclose scenes so repulsive, that, if they were not photographs, you would believe them products of the sickly brain of some artist like the famous Belgian painter Wuerz, or the Russion Wereschagin, who, with cruel pleasure, indulged in portraying only the most unpleasant and disgusting scenes of this world.

Let us take up a few of these photographs.

Here we have the gloomy view of a forest destroyed by fire. As far as the eye can penetrate the picture, you see hundreds and thousands of straight black trunks, pointing as so many big needles toward heaven. There is not a limb left on one of the trees. Every branch

is eaten away. And not a living thing is seen in this dreadful wilderness, nor will anything flourish there for years to come.

This second picture discloses another scene of devastation; a primeval forest as it was left by lumbermen after they had taken out the choice timber. What reckless barbarians these men have been! Everywhere we see the unmistakable evidences of frightful waste. The ground is covered with fragments of noble trees, and with young saplings crushed to pieces by fallen timber.

The next photographs show deforested hillsides and farm lands, damaged by rainstorms which gnawed deep gullies into the naked ground and carried away all fruitful soil. And here we have villages and cities suffering by the flood of rivers. The water reaches into the first and second stories. Mills and houses have been swept away and landed in distant places.

After that we look into a bird's nest, in which we see a heap of young birds, dead from starvation. Another of these ghastly photographs affords a glance over rocky shores, strewn with the putrid bodies of thousands and thousands of seal pups, who perished while waiting in vain for the return of their slain mothers.

And then we see horrible views showing long rows of human corpses, distorted by explosions, burned by fire, crushed by fallen rocks, or maimed by railway engines or street cars.

There are dozens and dozens of such repulsive photographs. If thrown as lantern slides upon a screen and explained by a lecturer, this collection of views, maps, and figures would cause a cry of terror among the panic-stricken audience, and many, shocked to the bottom of their hearts, would leave, never to forget that horrible exhibition.

You ask where these photographs have been taken and what the whole collection means. As an American citizen, I feel ashamed to say that all these views, without exception, were made from actual scenes in the United States, and that, together with the maps and statistical tables, they are incontrovertible and convicting evidences of grave sins of which our nation is guilty. Some of the material has been used in preparing my little book, "Our Wasteful Nation," which is not an outcome of yellow journalism, dealing in sensations, but the honest work of a man who loves this country fervently as any native-born American, and who is inspired by the wish to help it along, that it some day may gain the proud title, the best among all lands.

Perhaps native-born American writers are so accustomed to the extravagance of American life, that they fail to see the amazing amount of our prodigality, which to the stranger becomes evident at once.

FUTURE OF MAN IN AMERICA

One of the wisest and best informed men of our country is President Van Hise of the University of Wisconsin. Since this work has been in press he has printed in the World's Work Magazine a comprehensive article on Conservation, which closes as follows:

"It would be interesting, but idle, to prophesy as to the changes in our social structure which will result when people begin to be pinched

by meager soil, by lack of sufficient coal and wood. The people of that time will doubtless solve their problems as best they may, and any speculations we might make at this time would certainly be far from future realization, but that the problems of pinching economy will confront our descendants is beyond all question; and, therefore, the paramount duty remains to us to transmit to our descendants the resources which nature has bequeathed to us as nearly undiminished in amount as is possible, consistent with living a rational and frugal life. Now that we have imposed upon us the responsibility of knowledge, to do less than this would be a base communal crime."

A PRACTICAL VIEW

From an article by H. Von Schon, a hard-headed working engineer, in Engineering Magazine.

"A bare, hard-baked surface absorbs but little water; a forested area with its deep layer of leaves, brush and humus is a sponge which becomes saturated with the water; it is a natural storage reservoir. The rapid storm surface run-off erodes the top soil and carries it in suspension, dropping it somewhere in the lower channels; timbered slopes obstruct this surface run-off; it gathers force but slowly; it finds no loose earth or gravel to carry along; the foliage canopy of the trees breaks the force of the downpouring rain, which reaches the ground gradually; finally, the snowfall on the open hillsides melts quickly under the influence of the wind and the sun, while that in the forest remains to melt gradually and then to sink into the ground.

"That water waste with its collateral flood destructions of life and property, the constantly increasing erosions of the fruitful top soil, and the consequent impoverishing of what remains, and the sedimentation of river channels, are primarily caused by the cutting away of the forests in the headwater region of rivers, was recognized and acted upon by some of the European peoples hundreds of years ago; little Switzerland enacted a forest-conservation statute as early as 1680, which has been enforced in a most business-like manner since; 20 per cent of the mountain republic's area is in conserved forests, some 2,000,000 acres; the cost of maintenance and supervision is $1.32 and the net revenue, $2.25 per acre annually.

"Germany's forest area is 35,000,000 acres; its system of forest preservation was inaugurated one hundred and fifty years ago. France has 23,000,000 acres of forests, all under admirable preserve laws. The combined population of these two countries exceeds that of the United States about 15,000,000. They now expend annually on forest preservation some $11,000,000 and enjoy a net revenue of about $300,000,000.

THE SLAUGHTER OF THE TREES

Part of a striking and vivid article by Emerson Hough in the May (1908) number of Everybody's Magazine. Its startling statements appear to be substantially correct. Everybody's has kindly given permission to use this article.

In fifty years we shall have whole states as bare as China. The Appalachians will be stripped to bedrock. The Rockies will send down vast floods, which can not be controlled. The Canadian forests north of the Great Lakes will be swept away. Our Middle West will be bare. The Yazoo Delta will be ripped apart, because no levee will be able to stand the floods of those days. We shall be living in crowded concrete houses, and at double the rent we now pay. We shall make vehicles of steel, use no wood on our farms. We shall pay ten cents for a newspaper, fifty cents for a magazine, as much for a lead pencil. Cotton will be immensely higher. Beef will be the privilege of the few. Clothing will cost twice what it costs today. Like Chinamen, our children will rake the soil for fuel or forage or food. We shall shiver in a cold, and burn in a heat, never before felt in this temperate zone, meant by God as a comfortable growing place for splendid human beings—*unless we wake up.*

My friend, yesterday a man took the meat from your table. Today a man burned down your house. Do you care?

My friend, yesterday this was America, a rich and beautiful land. Today much of it is a waste and a wilderness. Is that anything to you and me?

My brother, in ten years a man is going to force you to rent a house of him, and to pay double what you do now. In twenty years very few of us will be able to afford even rented houses. In thirty years America will no longer be able to build houses of wood—unless you shall, meantime, remember that you own America, you who found it, fought for it, and who ought to have a pride in it, if only for the sake of what it might have been. Does this cause you any personal concern?

My friend, before a certain great revolution, the peasants who could not own timber of their own, gleaned firewood in the forests of nobles, who swept their backs with the lash of insolence. In England men once prized the scant right to reap with peasant's billhook or shepherd's crook as high as they could reach among the dead branches of the trees. Soon you will perhaps fight among your kind and kin for the right to glean in another man's forest by hook or crook—you, who but now owned the widest and richest forests in the world. Do you care?

In Europe one may not fell a tree without paying, without asking. As Americans, we laugh at such restrictions. We are fools. Do you care? We call this the land of the free. It is not such now. We boasted of our land of opportunity open to all the world, but opportunity has been taken from the average man. Do you object?

Do you think such statements as these sensational, brutal, coarse? My brother, what pen shall be so bitter and abominable as shall make

you writhe and say, "This is not true," and then make you look around and find that it all is true, and more is true?

When we first owned this country, one half of its total area was covered with the grandest forests that ever grew in any portion of the world—the richest, the most useful, the most valuable for the building of a civilization. Yes, we had trees. We had forests that set the first writers who saw this country wild with admiration, men who came here from reforested Europe. They were all ours. Now they are gone. Are they reared in lasting structures of a great civilization? No; at least one half of them are ashes or rotted mould. Half of what we have left today also will be ashes or rotted mould. They will never rest in the beams and walls of abiding homes.

Had we gone on across this continent and left the remnants of our standing woods, we still should have abundance; but we have gone back a second and a third time, gleaning more exactly each little bit

Fire in the mountains. All such fires have small beginnings. If they were then discovered, to extinguish them would be a small labor. On the National Forests fire guards are stationed in look-out towers or on prominent points so that fires may be reported at once. Some of the states protect their forests in the same manner.

of wood, until we have reaped our forests as sheep reap the grass lands, leave nothing behind to grow. We have used ever-increasing appliances for speed and thoroughness, to supply an ever-increasing demand, at ever-increasing prices. We are converging in ever-increasing numbers, with an ever-increasing zeal, upon what is left; and in our haste to get it all, we are permitting an ever-increasing waste and ruin of the original supply.

Our very classification shows how sweeping has been the devastation. We now classify as "pine" all sorts of pine—Norway pine, Jack pine, pitch pine—although we know that true white pine, once the only wood dignified with the name, is, as a great lumber tree, practically an extinct species. As to the hardwoods, twenty years ago we used only oak, walnut, hickory, cherry, maple, birch; now we add cottonwood, beech, sycamore, all sorts of gum trees, anything that will

saw into a board. The desolation in the hardwood forests of the South is as unspeakable as in the pine forests of the North. Stave-makers, tie cutters, vehicle and machinery makers, have ripped open the hardwood regions of Tennessee, Mississippi, and Arkansas, until the end is as close there as it is in the vaster pine woods.

On the Pacific coast we used not long ago only the finest of redwood, gradually then the Douglas fir or spruce. Now we cut in the West hemlock, cedar, lodge-pole pine, anything that will hold a saw blade. For a long time we thought these great Western stores exhaustless, just as not long ago we thought the forests of Michigan and Wisconsin exhaustless, where now remains in great part only a horrible wilderness.

All the time poorer species and grades of timber are employed all over America, East and West. All the time the "estimates" of our remaining timber increase. But all the time the standing trees themselves decrease; all the time the fires rage; all the time the waste goes on, immense logs, the butts of giant trees, being left in the woods to rot because it does not pay to get them out of the woods "at the present price of lumber." All the time the loss to the people of America goes on, and the price to the people of America goes up; and all the time the people of America either do not know or do not care.

We ought to care, and if we know the facts no doubt we should care. What, then, are some of the facts? Plenty of facts, and very obvious ones, lie at hand for any one interested in any sort of building or manufacture requiring the use of lumber. What was $8 or $10 is now worth $25 to $30 a thousand. Ordinary clear building and finishing lumber costs from $30 to $125 a thousand. The price of all lumber has in five years risen over fifty per cent. We use lumber now that twenty years ago would have been rejected with scorn by any builder. Yet prices are going up, and still up; and the lumbermen wish these prices "protected," and ask that the Sherman law be revoked. In spite of these facts, the professional optimist in lumber attempts to soothe us with the assurance that there is plenty of timber "farther west"; that it will last "indefinitely" at the "present rate."

But the lumberman bases all his timber estimates on the present rate of cutting and on the present rate of demand. True, no one can prophesy or estimate the accelerated, the cumulative demand of the future. Decade after decade of our past has shown us that we could not dream big enough to cover the actual figures of this demand. Yet this unestimated factor is the element of danger for the future.

The lumberman does not figure on the million or more of immigrants we take in each year to house, not to mention an occasional American native born. Worst and most absurd of all, he figures on the timber supply lasting on the basis of its all being used. Yet of all the timber now left standing in America, to represent our entire future supply, this lumberman, judged by his record, will use less than one half. The other half will never be taken out of the woods at all. Three fourths of that half may never even be cut, but may be set on fire and burned as it stands. Much as we had in forest resources in the past, we never could afford to have lumbering operations destroy as much as they sawed. But that is what they did. What should be our attitude today

toward the threatening destruction of one half of our alarmingly small remaining supply?

Last year we cut nearly forty billion (40,000,000,000) feet of lumber, board measure. It may be interesting to know in what proportions the different states furnished this supply. In relative order a partial list is as follows: Washington, Louisiana, Wisconsin, Michigan, Mississippi, Arkansas, Minnesota, Texas, Pennsylvania, Oregon, California, North Carolina, and so down. Today Washington furnishes 11.5 per cent of our lumber, and Louisiana 7.4 per cent. Let us look now at some of the demands for trees that at first might seem unimportant.

Our railroads are said to use one third of the industrial timber cut. They require, on the basis of present demand, 100,000,000 ties per year, and they are always wondering where they are going to get them. The demand is for better ties, not poorer. Bad ties mean wholesale murder, forfeiture of mail contracts, reduced dividends. A tie contains about thirty-five feet of wood. All sorts of wood are now being used for ties, from hemlock at twenty-eight cents to white oak at fifty-one cents, an average of forty-seven cents per tie. Suppose we could cut one hundred ties to the acre; we should require a million acres a year for ties. Hardwood grows, under favorable conditions, a little more than forty cubic feet per acre per year. Not a very fast crop, is it? Railroad men sincerely wish it might be faster. The Santa Fe road has recently arranged to plant a few thousand acres with eucalyptus, from which it will some time make ties. Each road now has its tie lands. These lands no longer furnish a public supply of lumber.

Alongside the ties run the telegraph poles, not so perishable, but requiring continual renewal. Two years ago we cut 3,526,875 poles over twenty feet in length. Three fifths of these were cedar, 28 per cent chestnut. We cut hundreds of thousands of smaller poles, also, not to mention vast quantities of what is called lodge-pole pine, for other uses. We annually reap for telegraph and telephone poles somewhere between three and four million acres of land.

Our tanneries two years ago required 1,370,000 cords of bark. In the same year we cut 11,858,260 shingles and 3,812,807 laths. This represents one of the real savings in lumber manufacture—the utilization of material much of which otherwise would go to waste. Then we had to timber our mines, and for that we used 165,000,000 cubic feet, not board measure, much of which was the best of hardwood.

If you stood on the top of a tower in the greatest hardwood forests of the South, one sweep of the scythe of civilization would mow it farther than you could see, for one month's use in vehicles, manufactured furniture, and farm implements. Prices for this kind of wood have risen from 25 to 65 per cent since 1899. In seven years the production of hardwood has fallen off 15 per cent; and those were the six years of its greatest demand.

There is absolutely no hope for vehicle and machine makers except a more careful use of the hardwood forests of the South and the Southeast; nor indeed can that be called a solution now. In these forests grow also many softer woods, once scorned. Continually we adjust, compromise, become European and not American. Tight-barrel cooperage is a heavy drain on white oak. In 1906 we made 267 million tight-

barrel staves. We sent to Europe last year about five million dollars' worth of white oak staves. Meantime California can not get casks for her wine, because white oak now costs too much to ship to California. She is trying redwood for wine casts now, and grumbling mightily. Slack-barrel cooperate in elm, gum, beech, basswood, and fourteen other woods not long ago thought worthless, cut 1,097,063,000 staves in one year. All these little demands foot up an enormous and menacing total in acreage.

The highest estimate of our remaining hardwoods is four hundred billion feet. For lumber, ties, posts, manufactures, fuel, etc., we use twenty-five billion feet per annum or more. At that rate it will take us sixteen years to use up all the rest of our hardwood—if we do not burn it, and if the demand remains the same! A pleasant prospect, is it not?

Some one has figured that a big Sunday newspaper needs twenty acres of pulp wood to make the paper for one edition. The Chicago Tribune, a chance instance, uses 200,000 pounds of paper each Sunday, or 400,000 each week. Do your own multiplying. We use of domestic spruce alone for pulp wood in one year 1,785,680 cords. The average stand of spruce pulp wood in the regions where it is cut is probably about ten cords per acre; so that of such spruce land we require at least 178,500 acres annually. A ton of paper takes about two cords of spruce in the making—to be exact, about 1,750 pounds of paper pulp.

We use other woods for pulp now, hemlock, balsam, pine, poplar; 3,661,17 cords was our total for 1906. We used in that year 2,327,844 tons of pulp. Since each ton probably cost on the average two cords of some sort of wood, not allowing anything for waste, there were over four million cords cut somewhere, mostly in the United States; which means something like a million acres a year for pulp. Call it a half million for close measure. Do some figuring. If it costs twenty acres a Sunday, or forty acres a week, or 2,080 acres a year to print one daily newspaper, what does it cost in acreage to print all the newspapers in all the cities and towns of America? Add to this the enormous editions of our magazines. Add to this the paper used in books. The total staggers the imagination, and yet the amount of timber cut for pulp in the United States annually is less than 5 per cent of what is cut for lumber.

It would seem that we can not afford much longer to read. Neither shall we long be able to write. Last year we made more than 315,000,000 lead pencils. A lead pencil is not very large, but the total number of lead pencils required 7,300,000 cubic feet of cedar. We have cedar enough to last us just twelve years.

More than 100,000 acres of timber in the whole United States are cut over every working day. We use many times more timber per capita than any other nation.

We have left not over 450,000,000 acres bearing commercial timber. Cast up in your mind some of the small demands of industry noted above. Multiply this by three or four to represent the total, including all sorts of sawn lumber. Remember that you are dealing in terms of millions of acres. Divide 450,000,000 by your total number of mil-

lions of known demand. What is the result? Do you find it pleasant? Do you remain willing to listen to the charming of those who are either ignorant or hypocritical in their "estimates?"

Longleaf Pine in virgin stand, Georgia. If the mature trees only were removed and the forest protected from fire, such a forest would become perpetual and an investment of ever-increasing value.

A WORLD PROBLEM

Report of the Secretary of Agriculture for 1912.

It may fairly be said that half a generation ago the fear of a wood famine was a matter that had not entered the field of vision of the average man. Some sagacious ones, it is true, were giving practical but unostentatious evidence of their capacity to see ahead by gathering into their ownership all the cheap timberlands that they could acquire. Thus were laid the foundations of great fortunes. Timber reservations by no means began with the Government. The proceeds of lumbering in the virgin forests of the Northeast and in the matchless Lake State pineries, once Government owned, were often reinvested in southern yellow-pine lands or in the cream of western timber. This, however, was foresight exercised for private ends. Those who put their money into such investments counted—and with reason—on diminishing supplies to force up the value of their holdings. But those who urged the necessity of public action to provide for future public needs were thought to be disturbing themselves unduly in matters which were proper subjects for the attention of Providence rather than of men. To concern oneself overmuch lest wasteful use of the resources placed at human disposal might leave posterity with nothing to use argued a lack of confidence in the Divine wisdom which has put us in a world designed for the satisfaction of all essential needs. If the forests should ever fail, there would be something better to take their place.

This optimistic point of view was fostered by the very circumstances which in reality gave greatest cause for apprehension. Unexpected and momentous changes had revolutionized the conditions on which had been predicated the early forecasts of approaching need. While by falsifying these forecasts they had operated to lull the public mind into a feeling of unjustified security, they had actually created a situation a hundredfold more serious than before. In the eighteenth and early nineteenth centuries the question of forest supplies was purely local. Transportation except by water for any great distance was out of the question for so bulky a commodity.

Awakening to the Problem.

With the development of railroads affairs took on a wholly new aspect. Continental supplies were subtsituted for local. In the mid-century the forests about the Great Lakes began to melt away, going east, west, and south, to rise again in countless homes of an expanding nation. From open prairie to seaboard cities, from the factory towns and hamlets of New England to the growing commercial centers and the multiplying crossroad villages of the Middle West, they fed prosperity, and fireswept desolation blotted the land of their origin.

Thus was created a problem which is now not nation-wide, but world-wide. New York bids against South America and the Orient for the timber of the Pacific Northwest. Southern pine goes by water from the Gulf to Great Britain or the North Atlantic States; by rail, to meet the output of Montana's forests on the plains. In 1911 the United States exported domestic forest products to a total value of

over $100,000,000, of which Europe took over $55,000,000 worth and South America about $25,000,000 worth. All the countries of eastern Europe must import timber to meet the excess of their needs over the home supply. Meanwhile, with an estimated home consumption of 23 billion cubic feet of wood annually, our depleted and abused forests are producing by growth probably less than 7 billion feet. The Bureau of Corporations of the Department of Commerce and Labor estimates the existing supply of saw timber in the United States at less than 3,000 billion board feet, which is equivalent to about 500 billion cubic feet. Economists now recognize that, taking the world over, wood consumption exceeds its growth, and that a crisis approaches.

NATURAL GAS

Dr. White, the State Geologist of West Virginia, presented in vivid fashion a picture of the waste of our purest form of fuel.

A great geologist once said, "The nations that have coal and iron will rule the world." Bountiful nature has dowered the American people with a heritage of both coal and iron richer by far than that of any other political division of the earth.

It was formerly supposed that China would prove the great storehouse from which the other nations could draw their supplies of carbon when their own had become exhausted, but the recent studies of a brilliant American geologist in that far-off land, rendered possible by the generosity of the world's greatest philanthropist, tell a different story. The fuel resources of China, great as they undoubtedly are, have been largely overestimated, and Mr. Willis reports that they will practically all be required by China herself, and that the other nations cannot look to her for this all-important element in modern industrial life.

A simple glance at a geological map of the United States will convince any one that nature has been most lavish to us in fuel resources, for we find a series of great coal deposits extending in well scattered fields almost from the Atlantic to the Pacific, from the Lakes to the Gulf, while even over much of New England and the coastal plains, vast areas of peat, the primal stage of coal, have been distributed. But coal of every variety from peat to anthracite is not all of nature's gifts to fortunate America. Great deposits of both petroleum and natural gas occur in nearly every state where coal exists, and in some that have no coal. What greater dowry of fuels could we ask when we find them stored for us within the bosom of our mother earth in all three of the great types—coal, petroleum, and natural gas—only awaiting the tap of the pick and drill to bring them forth in prodigal abundance?

What accounts can we as a nation give of our stewardship of such vast fuel treasures? Have we carefully conserved them, using only what was necessary in our domestic and industrial life, and transmitting the remainder, like prudent husbandmen, unimpaired to succeeding generations? Or have we greatly depleted this priceless heritage of power and comfort, and source of world-wide influence,

by criminal waste and wanton destruction? The answer should bring a blush of shame to every patriotic American, for not content with destroying our magnificent forests, the only fuel and supply of carbon known to our forefathers, we are with ruthless hands and regardless of the future applying both torch and dynamite to the vastly greater resources of this precious carbon which provident nature has stored for our use in the buried forests of the distant past. The wildest anarchists, determined to destroy and overturn the foundations of government, could not act in a more irrational and thoughtless manner than have our people in permitting such fearful destruction of the very sources of our power and greatness. Let me enumerate some of the details of this awful waste of our fuel resources that have been going on with ever-increasing speed for the last forty years.

First, let us consider how we have wasted natural gas, the purest form of fuel, ideal in every respect, self-transporting, only awaiting the turning of a key to deliver to our homes and factories heat and light and power. Partial nature has apparently denied this great boon to many other lands. It is practically unknown in France, Germany, and Great Britain, our chief competitors in the world of industry. Even wood and coal must first be converted into gas before they will burn, but here is a fuel of which nature has given us a practical monopoly, lavish in abundance, already transmuted into the gaseous stage and stored under vast pressure to be released wherever wanted at our bidding. The record of waste of this our best and purest fuel is a national disgrace.

At this very minute this unrivaled fuel is passing into the air within our domain from uncontrolled gas wells, from oil wells, from giant flambeaus, from leaking pipe lines and the many other methods of waste at the rate of not less than one billion cubic feet daily and probably much more.

Very few appear to realize either the great importance of this hydro-carbon fuel resource of our country, or its vast original quantity. Some of the individual wells, if we may credit the measurements, have produced this fuel at the rate of 70,000,000 cubic feet daily, the equivalent in heating value of 70,000 bushels of coal, or nearly 12,000 barrels of oil. In my humble opinion the original amount of this volatile fuel in the United States, permeating, as it does, every undisturbed geologic formation from the oldest to the most recent, rivaled or even exceeded in heating value, all of our wondrous stores of coal.

Suppose that it were possible for some Nero, inspired by a mania of incendiarism, to apply a consuming torch to every bed of coal that crops to the surface from the Atlantic to the Pacific, and that the entire coal supply of the Union was threatened with destruction within a very few years, what do you think would happen? Would our state legislatures sit undisturbed panoplied by such a carnival of fire? Would the governors of thirty states remain silent while the demon of flame was ravaging the coal resources of the republic? Certainly not; there would be a united effort by the governors and legislatures of all the states in the Union to stay the progress of such a direful conflagration; even the sacred constitutional barriers wisely erected

between state and federal authority would melt away in the presence of such an awful calamity, and the mighty arm of the nation would be invoked to help end the common peril to every interest. And yet this imaginary case is an *actual one* with the best and purest fuel of the country, equal probably in quantity and value for heat, light, and power to all of our coal resources. This blazing zone of destruction extends in a broad band from the Lakes to the Gulf, and westward to the Pacific, embracing in its flaming pathway the most precious fuel possessions of a continent. No one can even approximate the extent of this waste. From personal knowledge of conditions which exist in every oil and gas field, I am sure the quantity will amount to not less than one billion cubic feet daily, and it may be much more. The heating value of a billion cubic feet of natural gas is roughly equivalent to that of one million bushels of coal. What an appalling record to transmit to posterity!

Forest fire at night—a most awe-inspiring sight| Then, most of all, one is imprssed with the terribleness of the waste—and the relentless power of the fire. The growth of perhaps a hundred years is destroyed in a few hours.

From one well in eastern Kentucky there poured a stream of gas for a period of twenty years without any attempt to shut it in or utilize it, the output of which, it has been figured, was worth at current prices more than three million dollars. Practically the same conditions characterized the first twenty-five years of Pennsylvania's oil and gas history, and the quantity of wasted gas from thousands of oil and gas wells in western Pennsylvania is beyond computation. In my own state of West Virginia, only eight years ago, not less than 500,000,000 cubic feet of this precious gas was daily escaping into the air from two counties alone, practically all of which was easily preventable, by a moderate expenditure for additional casing. When it is remembered that one thousand cubic feet of natural gas weighs 48 pounds, and that 6,000 cubic feet of it would yield a 42-gallon barrel

of oil when condensed, so that a well flowing 6,000,000 feet of gas is pouring into the air daily the equivalent of 1,000 barrels of oil, what would our petroleum kings think, if they could see this river of oil (for the equivalent of a billion feet of gas is more than 160,000 barrels of petroleum, and of practically the same chemical composition as benzine or gasoline) rushing unhindered to the sea? Would they not spend millions to check such a frightful waste of this golden fluid? And would they not be the first to appeal to the national government for aid in ending such great destruction of property? And yet because natural gas is invisible, and its waste is not so apparent to the eye as a stream of oil, or a burning coal mine, the agents of these oil magnates have not only permitted this destruction of the nation's fuel resources to continue, but they have prevented by every means in their power the enactment of any legislation to stop this frightful loss of the best and purest fuel that nature has given to man.

There can be no doubt that for every barrel of oil taken from the earth there have been wasted more than ten times its equivalent in either heating power, or weight even, of this the best of all the fuels, and also that much more than half of this frightful waste could have been avoided by proper care in oil production and slight additional expenditures.

In justice to the great oil-producing corporations, it must be acknowledged that they have not permitted much waste of petroleum except what has been sprayed into the air by their awful waste of gas, and also that their handling of petroleum has been from the beginning a model of business economy and management. The great mistake of the oil-producing interests has been in not properly apprehending the enormous fuel value of the natural gas they were destroying, and in not demanding legislation for its protection instead of successfully throttling and preventing it in every state of the Union except one—Indiana. When the people of that great state awoke to the fact that their richest mineral possession was being rapidly wasted, they rose to the occasion, and although it was largely a case of "locking the stable door after the horse had been stolen," they effectually prevented any further useless waste of natural gas. This Indiana statute which has been declared constitutional by our highest courts, says in effect to the oil producers: "You can not take the oil from the ground where nature has safely stored it, until you provide a method of utilizing the accompanying gas, or volatile oil as well," and it also says to both the producer and consumer of natural gas, that it is against "public policy to waste this valuable fuel, and that it will not be permitted to either party." This Indiana statute for the conservation of petroleum and natural gas should be enacted into law in every state where this precious fuel exists; and why has it not been done?

JAMES J. HILL

The railroad magnate of the Great Northern is recognized not only as a captain of industry, but as a high authority on the land and resources of the United States. His thoughts are well worth weighing.

"Of all the sinful wasters of man's inheritance on earth," said the late Professor Shaler, "and all are in this regard sinners, the very worst are the people of America." This is not a popular phrase, but a scientific judgment. It is borne out by facts. In the movement of modern times, which has made the world commercially a small place, and has produced a solidarity of the races such as never before existed, we have come to the point where we must to a certain extent regard the natural resources of this planet as a common asset, compare them with demands now made and likely to be made upon them, and study their judicious use. Commerce, wherever untrammeled, is wiping out boundaries and substituting the world relation of demand and supply for smaller systems of local economy. The changes of a single generation have brought the nations of the earth closer together than were the states of this Union at the close of the Civil War. If we fail to consider what we possess of wealth available for the uses of mankind, and to what extent we are wasting a national patrimony that can never be restored, we might be likened to the directors of a company who never examine a balance sheet.

The sum of resources is simple and fixed. From the sea, the mine, the forest and the soil must be gathered everything that can sustain the life of a man. Upon the wealth that these supply must be conditioned forever, as far as we can see, not only his progress, but his continued existence on earth. How stands the inventory of property for our own people? The resources of the sea furnish less than five per cent of the food supply, and that is all. The forests of this country, the product of centuries of growth, are fast disappearing. The best estimates reckon our standing merchantable timber at less than 2,000,000,000,000 feet. Our annual cut is about 40,000,000,000,000 feet. The lumber cut rose from 18,000,000,000 feet in 1880 to 34,000,000,000 feet in 1905; that is, it nearly doubled in twenty-five years. We are now using annually 500 feet board measure of timber per capital, as against an average of 60 for all Europe. The New England supply is gone. The Northwest furnishes small growths that would have been rejected by the lumbermen of thirty years ago. The South has reached its maximum production and begins to decline. On the Pacific coast only is there now any considerable body of merchantable standing timber. We are consuming yearly three or four times as much timber as forest growth restores. Our supply of some varieties will be practically exhausted in ten or twelve years; in the case of others, without reforesting, the present century will see the end. When will we take up in a practical and intelligent way the reforestation of our forests? * * *

The exhaustion of our coal supply is not in the indefinite future. The startling feature of our coal production is not so much the magnitude of the annual output as its rate of growth. For the decade ending in 1905 the total product was 2,832,402,746 tons, which is almost

exactly one half the total product previously mined in this country. For the year 1906 the output was 414,000,000 tons, an increase of 46 per cent on the average annual yield of the ten years preceding. In 1907 our production reached 470,000,000 tons. Fifty years ago the annual per capita production was a little more than one quarter of a ton. It is now about five tons. It is but eight years since we took the place of Great Britain as the leading coal-producing nation of the world, and already our product exceeds hers by over 43 per cent, and is 37 per cent of the known production of the world. Estimates of coal deposits still remaining must necessarily be somewhat vague, but they are approximately near the mark. The best authorities do not rate then at much over 2,000,000,000,000 tons. If coal production continues to increase as it has in the last ninety years, the available supply will be greatly reduced by the close of the century. Before that time arrives, however, resort to lower grades and sinking of mines to greater depths will become necessary, making the product inferior in quality and higher in price. Already Great Britain's industries have felt the check from a similar cause, as shown in her higher cost of production. Our turn will begin probably within a generation or two from this time. Yet we still think nothing of consuming this priceless resource with the greatest possible speed. Our methods of mining are often wasteful; and we not only prohibit our industries from having recourse to the coal supplies of other rountries, but actually pride ourselves upon becoming exporters of a prime necessity of life and an essential of civilization.

The iron industry tells a similar story. The total of iron ore mined in the United States doubles about once in seven years. It was less than 12,000,000 tons in 1893, over 24,000,000 tons in 1899, 47,740,000 tons in 1906, and over 52,000,000 tons in 1907. The rising place of iron in the world's life is the most impressive phenomenon of the last century. In 1850 the pig iron production of the United States amounted to 563,757 tons, or about 50 pounds per capita. Our production now is over 600 pounds per capita. We do not work a mine, build a house, weave a fabric, prepare a meal or cultivate an acre of ground under modern methods without the aid of iron. We turn out over 25,000,000 tons of pig iron every year, and the production for the first half of 1907 was at the rate of 27,000,000 tons. This is two and one half times the product of Great Britain. It is nearly half the product of the whole world. And the supply of this most precious of all the metals is so far from inexhaustible that it seems as if iron and coal might be united in their disappearance from common life.

We now turn to the only remaining resource of man upon this earth, which is the soil itself. How are we caring for that, and what possibilities does it hold out to the people for future support? We are only beginning to feel the pressure upon the land. The whole interior of this continent, aggregating more than 500,000,000 acres, has been occupid by settlers within the last fifty years. What is there left for the next fifty years? Excluding arid and irrigable areas, the latter limited by nature, and barely enough of which could be made habitable in each year to furnish a farm for each immigrant family, the case stands as follows: In 1906 the total unappropriated public

lands in the United States consisted of 792,000,000 acres. Of this area the divisions of Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, and Wyoming contained 195,700,000 acres of unsurveyed land. Little of Alaska is fitted for general agriculture, while practically all of the rest is semi-arid, available only for grazing or irrigation. We have (subtracting these totals) 50,000,000 acres of surveyed and 36,500,000 acres of unsurveyed land as our actual remaining stock. And 21,000,000 acres were disposed of in 1907. How long will the remainder last? No longer can we say that "Uncle Sam has enough to give us all a farm."

Equally threatening is the change in quality. There are two ways in which the productive power of the earth is lessened: first by erosion and the sweeping away of the fertile surface into streams and thence to the sea; and, second, by exhaustion through wrong methods of cultivation. The former process has gone far. Thousands of acres in the East and South have been made unfit for tillage. North Carolina was, a century ago, one of the great agricultural states of the country, and one of the wealthiest. Today as you ride through the South you see everywhere land gullied by torrential rains, red and yellow clay banks exposed where once were fertile fields; and agriculture reduced because its main support has been washed away. Millions of acres, in places to the extent of one tenth of the entire arable area, have been so injured that no industry and no care can restore them.

Far more ruinous, because universal and continuing in its effects, is the process of soil exhaustion. It is creeping over the land from East to West. The abandoned farms that are now the playthings of the city's rich or the game preserves of patrons of sport, bear witness to the melancholy change. New Hampshire, Vermont, northern New York, show long lists of them. In Western Massachusetts, which once supported a flourishing agriculture, farm properties are now for sale for half the cost of the improvements. Professor Carver, of Harvard, has declared, after a personal examination of the country, that "agriculture as an independent industry, able in itself to support a community, does not exist in the hilly parts of New England."

The same process of deterioration is affecting the farm lands of western New York, Ohio, and Indiana. Where prices of farms should rise by increase of population, in many places they are falling. Between 1880 and 1900 the land values of Ohio shrank $60,000,000. Official investigation of two counties in central New York disclosed a condition of agricultural decay. In one, land was for sale for abou the cost of improvements, and 150 vacant houses were counted in a limited area. In the other the population in 1905 was nearly 4,000 less than in 1855.

Practically identical soil conditions exist in Maryland and Virginia, where lands sell at from $10 to $30 an acre. In a hearing before an industrial commission, the chief of the Bureau of Soils of the Department of Agriculture said: "One of the most important causes of deterioration, and I think I should put this first of all, is the method and system of agriculture that prevails throughout these states. Unquestionably the soil has been abused." The richest region of the

West is no more exempt than New England or the South. The soil of the West is being reduced in agricultural potency by exactly the same processes which have driven the farmer of the East, with all his advantage of nearness to markets, from the field.

Within the last forty years a great part of the richest land in the country has been brought under cultivation. We should, therefore, in the same time, have raised proportionately the yield of our principal crops per acre; because the yield of old lands, if properly treated, tends to increase rather than diminish. The year 1906 was one of large crops, and can scarcely be taken as a standard. We produced, for example, more corn that year than had ever been grown in the United States in a single year before. But the average yield per acre was less than it was in 1872. We are barely keeping the acre product stationary. The average wheat crop of the country now ranges from twelve and one half, in ordinary years, to fifteen bushels per acre in the best seasons. And so it is on down the line.

Not only the economic but the political future is involved. No people ever felt the want of work or the pinch of poverty for a long time without reaching out violent hands against their political institutions, believing that they might find in a change some relief from their distress. Although there have been moments of such restlessness in our country, the trial has never been so severe or so prolonged as to put us to the test. It is interesting that one of the ablest men in England during the last century, a historian of high merit, a statesman who saw active service and a profound student of men and things, put on record his prophecy of such a future ordeal. Writing to an American correspondent fifty years ago, Lord Macaulay used these words: "As long as you have a boundless extent of fertile and unoccupied land, your laboring population will be found more at ease than the laboring population of the Old World; but the time will come when wages will be as low and will fluctuate as much with you as they do with us. Then your institutions will be brought to the test. Distress everywhere makes the laborer mutinous and discontented and inclines him to listen with eagerness to agitators who tell him that it is a monstrous iniquity that one man should have a million and another can not get a full meal. * * * The day will come when the multitudes of people, none of whom has had more than half a breakfast or expects to have more than half a dinner, will choose a legislature. Is it possible to doubt what sort of legislature will be chosen? * * * There will be, I fear, spoilation. The spoilation will increase the distress; the distress will produce a fresh spoilation. * * * Either civilization or liberty will perish. Either some Cæsar or Napoleon will seize the reins of government with a strong hand, or your republic will be as fearfully plundered and laid waste by barbarians in the twentieth century as the Roman Empire in the fifth." We need not accept this gloomy picture too literally, but we have been already sufficiently warned to prevent us from dismissing the subject as unworthy of attention. Every nation finds its hour of peril when there is no longer free access to the land, or when the land will no longer support the people. * * * Far may this day be from us. But since the unnecessary destruction of our land will bring new conditions of

danger, its conservation, its improvement to the highest point of productivity promised by scientific intelligence and practical experiment, appears to be a last command of any political economy worthy of the name.

If this patriotic gospel is to make headway, it must be by just such organized missionary work as is today begun. It can not go on and conquer if imposed from without. It must come to represent the fixed idea of the people's mind, their determination and their hope. It can not be incorporated in our practical life by the dictum of any individual or any officer of nation or state in his official capacity. It needs the co-operation of all the influences, the help of every voice, the commendation of nation and state that has been the strength and inspiration of every worthy work on American soil for one hundred and twenty years. We return, for our gathering in council and for our plan of action for the future, to the model given us by the fathers. State and Nation are represented here, without jealousy or any ambition of superiority on either side, to apply to the consideration of our future such co-operation as that out of which this nation was born, and by which it has won to worthy manhood. Reviving the spirit of the days that created our Constitution, the days that carried us through civil conflict, the spirit by which all our enduring work in the world has been wrought, taking thought as Washington and Lincoln took thought, only for the highest good of all the people, we may, as a result of the deliberations held and the conclusions reached here today, give new meaning to our future; new luster to the ideal of a republic of living federated states; shape anew the fortunes of this country, and enlarge the borders of hope for all mankind.

THE SECRETARY OF AGRICULTURE

Perhaps no one has had a better opportunity to know about the soil of this nation than James Wilson, the Secretary of Agriculture. He made the following remarks:

"The paper read by Mr. Hill this morning made a very deep impression upon me. The greatest asset we have in the United States is our soil; we are destroying that as rapidly as we can, and the oldest settled part of the United States has made the most progress in the destruction of our soil. Down on the Gulf coast the land has been peopled longer than the upper part of the Mississippi Valley. The heavy rainfalls, and the perpetual cultivation and growing of crops have helped erosion, and the soil has been destroyed in that way. It is going off very, very rapidly. The cure is a system of agriculture that will keep the soil filled with plant food, organic matter, humus. That is the cure; that is the way to keep up the soil. Somebody once asked an English gardener how he got such a fine lawn. He had a beautiful grass lawn which attracted attention. He said, 'We weeded, and we weeded; we manured and we manured, for eight hundred years'; and that is the way they got it."

THE CONVENTION OF GOVERNORS

The first conference of the Governors of the United States and Territories was held at the White House, in Washington, D. C., during the three days beginning May 13, 1908.

The East Room was prepared for the occasion, its severe simplicity somewhat brightened by draperies of green velvet on the walls, about the platform on which were seated the presiding officer, the speakers, the Supreme Court, and the President's Cabinet. Two great maps, the largest ever made by mechanical means, hung on the east wall. One showed the timber resources of the United States, while the other showed the mineral deposits. Between these maps was an arrangement for illustrating the different phases of conservation by means of superb transparencies. On the floor special chairs were arranged in semi-circles for the Governors; while to the rear and at the sides were seats for the Governors' advisers and the guests.

Practically all the states and territories were represented; it was a historic occasion; nearly every speaker laid stress on the declaration that the meeting was an epoch-making one, that from it would spring an organization of the Governors that through its deliberations and the weights of its opinions would exercise through the years to come a tremendous influence over the destinies and the affairs of the nation.

Some extracts from the most notable of the many addresses delivered at this famous conference will be appropriate here as a fitting close to our handbook on Conservation.

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SIGNIFICANCE OF THE MEETING

The savage knows and confesses his dependence upon the forces of nature. His whole life is circumscribed by the resources of forest, field, and stream. Indeed, he feels himself a part of nature, and scarcely separates his fate from that of his surroundings. The game of the prairie, the forest, and the river, the berries and herbs in their season, and the living waters supply him with food and drink. With the changing seasons he moves from place to place, pursuing plenty. He winters in rude huts filled with smoke from fires of fallen wood, hardly less at the mercy of the cold than are the hibernating animals. In the spring he wakes with nature, and his summers are prosperous and happy only as the wild crop of field and forest are plentiful. He rises and lies down with the sun. He survives only as he observes nature and fits himself to her ways.

But as savagery gives place to civilization, man frees himself more and more from those bonds which bound him so closely to nature. Slowly and painfully at first, and then far more rapidly and easily, he learns to control his material surroundings. He breaks the prairie with the plow, makes the beasts of the field his servants, strikes the pick into the mountain and the axe into the veteran of the forest. He now no longer waits upon the seasons. He builds himself a house against the cold and warms himself to the point of comfort in the midst of the winter blast. Instead of passively accepting the wild

German forest of Fir and Spruce in the Mountains. Under management many years. Notice straight, clear stems yielding a high grade of lumber. The macadam road is excellent, opening the forest to tourists as well as facilitating the removal of the wood crop. Such land yields its highest return in forest.

fruits as they ripen he compels the soil to yield a harvest a million-fold more abundant, and this harvest he stores up against days of want. Instead of migrating with the birds he fixes his home where he will, and pursues his work and his pleasure in his own time.

Discovery and invention place new implements in his hands. With his intelligence quickened and his body trained by new experience and new occupations, he continues to increase his mastery over time, temperature, and place. New material riches become available. He is able to satisfy his wants more readily and more certainly than ever before. The standard of his living is raised. He now possesses and enjoys, besides all that his fathers required, a host of things of which they knew nothing. Wants multiply with prosperity, till his life becomes highly complex. He is lord of nature, because he has learned how to appropriate her resources.

But if the resources of nature should fail, where would be his mastery then?

This is the point which we commonly overlook. Man has laid nature tribute, and has become powerful because nature was rich. Impoverish nature and her tribute stops. Ingenuity, capacity, labor, are incapable of extracting wealth from the gutted mine, from the fire-scorched brush land, from the sun-baked stream bed, from the impoverished soil. Civilization is achieved by the use of the resources of nature; it can endure no longer than the resources upon which it depends.

Living as we do today in the midst of conveniences which give us apparent independence of nature, it is almost inevitable that we should lose sight of this truth. It is difficult for us to realize that we, standing at the height of western civilization, are in fact vastly more dependent upon tributary nature than is the savage of the South Seas. Suppose the coal supply should give out in the middle of winter? Suppose a huge conflagration should sweep our forests from the hillsides? Suppose sudden floods should lay waste our fertile farm lands, scoring them with gullies or heaping them with sand? Would not any single one of these calamities bring upon us incalculable losses and suffering?

And yet these suppositions are not imaginary. We need to look only a very little way ahead, as things are going now, in order to see them realized, in effect. True, the failure of our resources will not come suddenly, and such of our resources as can be renewed need never fail if we use them wisely. But the exhaustible resources, chief among which are the mines, are coming to an end as certainly as if the end were today, while those resources whose exhaustion is due not to necessity, but to folly, have no future unless we insure it by our own provision.

It is clear, therefore, that the question how we shall make the best use of our natural resources, renewable or not renewable, is a pressing question of the hour. Where renewal is impossible, there is need of the strictest economy; and where renewal can be secured by prudence and foresight, the very existence of the nation demands that prudence and foresight be exercised.

This is the significance of the Conference of Governors on the Conservation of Natural Resources held at the White House, May 13-15, 1908, which took up for the first time the problem of conservation in all its details.

TREADWELL CLEVELAND, JR.

A NEW PATRIOTIC IMPULSE

The World's Work Magazine summed up the Governors' Conference in its editorial correspondence as follows:

It was the most notable company of men that has come together in our country in recent times. The official head of the nation, the Cabinet, the Supreme Court, certain members of Congress, the heads of the states, and, besides these, many of the most distinguished scientific men that we have and men of a sound grasp of public subjects who came as "advisers" to the Governors—two or three of the most noteworthy citizens of every state—among them the presidents of many of our foremost universities and schools of science; and, besides these, representatives of all the most important national organizations of scientific and commercial bodies.

About the general proposition that this extraordinary meeting was called to emphasize there was no difference of opinion. And the wealth of facts that were presented put the subject in every mind in a new way, and aroused every man to an ardent purpose. When one subject was put into every mind as the foremost subject of public action that this generation can have, and was so presented and emphasized as to win universal assent and to arouse a patriotic purpose, then all the machinery of publicity, of exhortation, and of public action that a democracy can have was put in action at one stroke.

The scientific papers presented to the Conference, giving exact data about agriculture, streams, forests, coal, and all similar subjects, were the most practical and helpful literature of waste and of methods of conservation ever put together. They will become a classic description of our great resources as they now are.

The brief speeches by many of the Governors were in the nature of an "experience meeting." They told of the work that the state governments are doing to save and to reclaim. And the resolutions adopted called on the government, local and national, and on the people to preserve our national wealth.

Every man came away from the most noteworthy gathering that he ever attended, with a new love of his country, a new attitude toward it, a new conscience about the land, the trees, and the streams; and we entered then on a new era in our national thought and in our attitude toward our land.

DECLARATION OF PRINCIPLES

Before adjourning, the Governors signed the following Declaration as embodying the results of the Convention:

DECLARATION.

We, the Governors of the States and Territories of the United States of Ameria, in conference assembled, do hereby declare the conviction that the great prosperity of our country rests upon the abundant resources of the land chosen by our forefathers for their homes, and where they laid the foundation of this great nation.

We look upon these resources as a heritage to be made use of in establishing and promoting the comfort, prosperity, and happiness of the American people, but not to be wasted, deteriorated, or needlessly destroyed.

We agree that our country's future is involved in this: that the great natural resources supply the material basis upon which our civilization must continue to depend, and upon which the perpetuity of the nation itself rests.

We agree, in the light of the facts brought to our knowledge and from information received from sources which we can not doubt, that this material basis is threatened with exhaustion. Even as each succeeding generation from the birth of the nation has performed its part in promoting the progress and development of the Republic, so do we in this generation recognize it as a high duty to perform our part; and this duty in large degree lies in the adoption of measures for the conservation of the natural wealth of the country.

We declare our firm conviction that this conservation of our natural resources is a subject of transcendent importance, which should engage unremittingly the attention of the nation, the States, and the people in earnest coöperation. These natural resources include the land on which we live and which yields our food; the living waters which fertilize the soil, supply power, and form great avenues of commerce; the forests which yield the materials for our homes, prevent erosion of the soil, and conserve the navigation and other uses of the streams; and the minerals which form the basis of our industrial life, and supply us with heat, light, and power.

We agree that the land should be so used that erosion and soil wash shall cease; and that there should be reclamation of arid and semi-arid regions by means of irrigation, and of swamp and overflowed regions by means of drainage; that the waters should be so conserved and used as to promote navigation, to enable the arid regions to be reclaimed by irrigation, and to develop power in the interests of the people; that the forests which regulate our rivers, support our industries, and promote the fertility and productiveness of the soil should be preserved and perpetuated; that the minerals found so abundantly beneath the surface should be so used as to prolong their utility; that the beauty, healthfulness, and habitability of our country should be preserved and increased; that sources of national wealth exist for the benefit of the people, and that monopoly thereof should not be tolerated.

We commend the wise forethought of the President in sounding the note of warning as to the waste and exhaustion of the natural resources of the country, and signify our high appreciation of his action in calling this conference to consider the same and to seek remedies therefor through coöperation of the Nation and States.

We agree that this coöperation should find expression in suitable action by the Congress within the limits of and coextensive with the national jurisdiction of the subject, and, complimentary thereto, by the Legislatures of the several States within the limits of and coextensive with their jurisdiction.

We declare the conviction that in the use of the national resources our independent States are interdependent and bound together by ties of mutual benefits, responsibilities, and duties.

We agree in the wisdom of future conferences between the President, Members of Congress, and the Governors of States on the conservation of our natural resources with a view of continued coöperation and action on the lines suggested; and to this end we advise that from time to time, as in his judgment may seem wise, the President call the Governors of States and Members of Congress and others into conference.

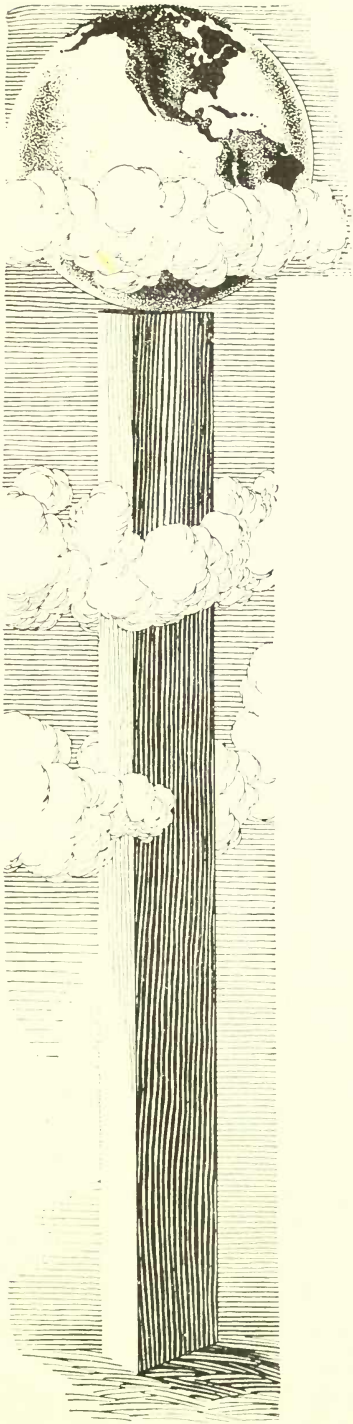
We agree that further action is advisable to ascertain the present condition of our natural resources and to promote the conservation of the same; and to that end we recommend the appointment by each State of a commission on the conservation of natural resources, to coöperate with each other and with any similar commission of the Federal Government.

We urge the continuation and extension of forest policies adapted to secure the husbanding and renewal of our diminishing timber supply, the prevention of soil erosion, the protection of head waters, and the maintenance of the purity and navigability of our streams. We recognize that the private ownership of forest lands entails responsibilities in the interests of the people, and we favor the enactment of laws looking to the protection and replacement of privately owned forests.

We recognize in our waters a most valuable asset of the people of the United States, and we recommend the enactment of laws looking to the conservation of water resources for irrigation, water supply, power, and navigation, to the end that navigable and source streams may be brought under complete control and fully utilized for every purpose. We especially urge on the Federal Congress the immediate adoption of a wise, active, and thorough waterway policy, providing for the prompt improvement of our streams and the conservation of their watersheds required for the uses of commerce and the protection of the interests of our people.

We recommend the enactment of laws looking to the prevention of waste in the mining and extraction of coal, oil, gas, and other minerals with a view to their wise conservation for the use of the people, and to the protection of human life in the mines.

Let us conserve the foundations of our prosperity.



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