Lectures on forestry

Fernow B E
Title: Lectures on forestry

Author: Fernow B E

This is an exact replica of a book. The book reprint was manually improved by a team of professionals, as opposed to automatic/OCR processes used by some companies. However, the book may still have imperfections such as missing pages, poor pictures, errant marks, etc. that were a part of the original text. We appreciate your understanding of the imperfections which can not be improved, and hope you will enjoy reading this book.
LECTURES ON FORESTRY

BY

B. E. FERNOW, LL.D.,

DIRECTOR OF NEW YORK STATE COLLEGE OF FORESTRY.

Delivered at the School of Mining, Kingston, Ontario, January 26th-30th, 1903.
INTRODUCTION

These lectures are the outcome of the efforts of Queen's University and the Kingston School of Mining to place before the people of Canada the leading principles of forestry in such a way as to make a beginning in forestry education. Dr. Fernow had previously (Jan. 21st, 1901) lectured here at a conference called 'to consider the best means for the preservation and renewal of our forests, for using them to advantage, and for providing proper education to these ends.' The interest aroused by this lecture and the conference which followed it decided the Board of Governors of the School of Mining to proceed with the establishment of a Department of Forestry in connection with the School, a project which had been cherished for several years. The Premier and the Minister of Education of Ontario looked favorably upon the proposal, and substantial aid was promised, to be given as soon as the buildings under construction afforded space for the new department.

The lectures which follow were delivered during the last week of January, and were attended by the advanced students of engineering, economics and biology. They were fully reported by the leading newspapers of Canada, and forestry at once became a subject of discussion in the public press. It was everywhere recognized that the School of Mining had made an important advance in education, and that these lectures, the first course on forestry given in Canada, were to be recorded as a historical event of great significance, marking as they did the beginning of a new outlook upon one of our greatest industries.

At the close of the lectures a committee of lumbermen and other friends of the movement was formed to assist in establishing the School of Forestry. The names of the committee are given below. The local members of this committee decided to print and publish the lectures, and this has now been done with the sanction of the Board of Governors.

The cuts illustrating Lecture X. were kindly lent by the Western Society of Engineers, Chicago. Mr. H. W. Wilson has also supplied a number of illustrations from his unique collection of negatives. Dr. Fernow revised the proof sheets and selected a number of the illustrations. The Committee desires to take this opportunity of thanking him for his cooperation.

Most of the subjects dealt with have been treated more at length in Professor Fernow's lately published work on The Economics of Forestry.

COMMITTEE.

Hon. Wm. Harty, M.P., Chairman .............. Kingston
Hiram Calvin, M.P., Vice-Chairman .............. Kingston
Edw. J. B. Pense, M.P.P. ....................... Kingston
T. W. Nash, C. E. ......................................... Kingston
R. J. Craig, Esq. ......................................... Kingston
J. H. Birkett, Esq. ......................................... Kingston
G. M. Macdonnell, K. C. .................................. Kingston
R. Carr-Harris, C. E. ..................................... Kingston
E. T. Steacy, Esq. ........................................ Kingston
E. W. Rathbun, Esq. ...................................... Deseronto
W. C. Caldwell, M.P. ..................................... Lanark
S. Russell, M.P. ........................................... Deseronto
A. T. Drummond, LL.D. .................................. Toronto
Jas. McFadden, Esq. ...................................... Renfrew
D. C. Cameron, M.P. ..................................... Rat Portage
John Bertram, Esq. ........................................ Toronto
John MacLaren, Esq. ...................................... Brockville
M. Avery, M. P. ............................................ Sharbot Lake
W. C. Edwards, M. P. ..................................... Ottawa
Hon. E. H. Bronson ....................................... Ottawa
J. R. Booth, Esq. .......................................... Ottawa
C. Jackson Booth, Esq. ................................... Ottawa
E. B. Eddy, Esq. .......................................... Ottawa
Hon. Peter White ......................................... Pembroke
Thos. Mackie, M.P. ....................................... Pembroke
Henry Cargill, M. P. ...................................... Cargill
Gillies Bros................................................. Braeside
John Mather, Esq. ........................................ Ottawa
Hiram Robinson, Esq..................................... Ottawa
E. C. Whitney, Esq. ...................................... Ottawa
McLaren Bros............................................ Buckingham
Walter Beatty, M.P. ....................................... Delta
McLaughlin Bros.......................................... Arnprior
F. J. Campbell, Esq...................................... Canada Paper Co., Windsor Mills
W. L. Goodwin, Secretary ................................. Kingston

Kingston, March 20th, 1903.
CONTENTS

Lecture I.—The Forest as a Resource, and Forest Industries.  - 7

Lecture II.—What is Forestry? - - - - - - - 15

Lecture III.—How Trees Grow. (Illustrated). - - - - - 17

Lecture IV.—The Evolution of a Forest Growth. (Illustrated). - 22

Lecture V.—Silviculture, or Methods of Forest Crop Production. - 37

Lecture VI.—Lumberman and Forester. (Illustrated). - - - 48

Lecture VII.—Forest Economy or Business Methods. - - - 59

Lecture VIII.—Wood and Its Characteristics. (Illustrated). - 65

Lecture IX.—Forestry Policy. - - - - - - - 68

Lecture X.—The Forester an Engineer. (Illustrated). - - - 74
LECTURE I.

THE FOREST AS A RESOURCE.

It may be stated without fear of contradiction that outside of food products no material is so universally used and so indispensable in human economy as wood. Indeed, civilization is inconceivable without an abundance of timber.

The nomad of to-day, who herds over the treeless plains and prairies, is still like the Scythian of ancient times; his life, his culture, his attainments are no more advanced. The successful settlement and civilization of our own treeless regions of the west became possible only through the development of means for the transportation of this most needful material. So general and far-reaching has its use become that a wood famine, however improbable its occurrence, would be almost as serious as a bread famine. We may become less wasteful, both as regards food and wood, but the necessity of wood, so far as we can foresee at present, will always be second only to the necessity of food, and far greater than that of any other material used in the arts.

Our civilization is built on wood. From the cradle to the coffin, in some shape or other, it surrounds us as a convenience or a necessity. It enters into nearly all our structures as an essential part. Over half our people live in wooden houses, and the houses of the other half require wood as an indispensable part in their construction. It serves to ornament them, to furnish them with conveniences, to warm them, to cook the food. More than two-thirds of our people use wood as fuel, and until recent times it was the only or principal means of smelting the ores and shaping the metals with which to fashion the wood itself. For every hundred tons of coal mined, two tons of mining timber are needed, and wood in large quantities is needed to mine our metals.

Every pound of iron, every ounce of gold, requires wood in its mining, wood in its manufacture, wood in its transportation. There is hardly a utensil, a tool, or even a machine, in the construction of which wood has not played a part, were it only to furnish the handle or the mould or pattern.

The articles, useful or ornamental, made wholly or in part of wood, are innumerable. Our houses are filled with them, our daily occupations necessitate them wherever we are. For our means of transportation we rely mainly on wood. Our 260,000 miles of railroad track (190,000 miles railroad in the U. S.), the carriers of civilization, lie on not less than 700,-000,000 of wooden ties and need 140,000,000 annually for renewals; they
run over more than 2,000 miles of wooden trestles and bridges, they carry their passengers and freight in over 1,000,000 wooden cars, and much of the millions of tons of freight is shipped in wooden boxes and barrels, and stored in wooden sheds. Ten million telegraph poles are needed to keep up communication between distant markets.

The forest furnishes the cooperage to market our vintage, to store our flour and fruit. The forest furnishes the plough handle and harrow frame to cultivate, the threshing machine and windmill to prepare the crops, the cart to bring them to market, the bottoms in which they cross the ocean to foreign marts, and even the tar and pitch needed to keep the cargo safe. While iron ships have largely replaced the wooden bottoms in ocean travel, our coastwise and inland shipping, which requires in the United States a tonnage twice as large as in the transatlantic trade, is carried mostly in wooden ships. We are rocked in wooden cradles, play with wooden toys, sit on wooden chairs and benches, eat from wooden tables. use wooden desks, chests, trunks, are entertained by music from wooden instruments, enlightened by information printed on wooden paper with black ink made from wood, and even eat our salads seasoned with vinegar made from wood.

The uses of wood, multifarious now, are constantly increasing. With the manufacture of wood-pulp and cellulose, an entirely new direction of use has been opened; originally designed to furnish a cheap substitute for linen paper, its application in many ways is growing daily, and promises for the future the largest drain on our forest resources, the manufacture of wood-pulp having increased more than three-fold in the last ten years.

To give briefly an idea of the extent of our own wood consumption. (including exports), we may say that, if five persons are counted to a family, each family in the United States and in Canada as well, uses on an average about 3,000 cubic feet or about 120,000 pounds of dry wood per year, the annual product of at least 60 acres of forest.

The reasons for this universal and varied application of wood may be found in several directions. In the first place, the general occurrence of forest growth and the ease with which wood can be obtained and shaped directly to the purpose in hand made it, naturally, the material of earlier civilizations; but there are certain qualities in addition which will make its use always desirable, if not necessary. In the combination of strength, stiffness, elasticity, and relatively light weight, it excels all other known materials. Not only is a stick of long leaf pine superior in strength to one of wrought iron of the same weight, but employed as a beam it will bear without bending a load six to eight times as great as an iron bar of the same length and weight. Moreover, the wooden beam will endure greater distortion than the metals without receiving a “set” or permanent injury.

The ease with which it can be shaped and keeps its shape, the softness and yet unchangeableness, but especially its non-conductivity of heat and
of electricity, which makes its use more comfortable than that of metals, in addition to its light specific weight and many other qualities, recommend it for many purposes in preference to other materials.

But above all things, its cheapness recommends it. We are paying now, leaving out fancy woods, at the most, 60 cents per cubic foot for the best wood, shaped, as against $5 to $10 per cubic foot for iron in sheets or bars. Moreover, it is the only material of construction which we can produce and reproduce at will, while we know that most other materials now in use must be sooner or later exhausted.

Other materials have displaced wood in some uses, but other uses have arisen for wood, and often the substitutes have again been displaced by wood, when its superiority or peculiar qualities have been more fully recognized. Even in such nicely balanced structures as the bicycle, for which metal seemed the only proper material, wood has proved itself superior, at least in certain parts.

A remarkable instance of this return to the use of wood instead of metal is that for factory and warehouse construction in order to reduce danger from fire, it having been found that in case of fire iron beams and posts are twisted out of shape by the heat, causing the collapse of the whole building, while with wooden posts and beams the chances of keeping the walls intact are much greater.

Coal has largely displaced wood as fuel, yet according to the census of 1880 more than half of the population relied still on wood for fuel, and there is no reason to believe that the proportion has changed measurably.

In fact, if we may be allowed to consider the figures of the census of 1880 still proportionately true, as far as bulk is concerned, our fuel consumption represents about three-fourths of our total wood consumption; and even in value this part represents nearly one-half of our entire enormous consumption of forest products of the United States, and exceeds in bulk more than ten times the iron and steel handled in that country.

The development of the cellulose and wood-pulp industry with the consequent extension in the use of paper, made from this material for all kinds of purposes where elasticity and durability combined with strength and lightness is demanded, from collars and cuffs and combs to car wheels, has given new and constantly growing employment to wood.

Considering, moreover, the very extensive and the very varied employment of wood, it will be apparent that substitution by other materials cannot be readily accomplished, and means inconvenience, and, in many cases, decrease of comfort. Hence, large wood supplies are, and unquestionably will continue to be, an indispensable requirement of our civilization, almost like water, air and food.

Besides wood supplies, the forest furnishes other material of no small value. Of these, two classes at least give rise to industries of considerable extent, namely, the tanning industry and the naval store industry.
The bark of certain trees, notably the hemlock, and the oaks among our native species, contain the chemical compounds known as tannic acids, which serve for the manufacture of leather.

Thus 1,500,000 cords of tan bark, worth about $10,000,000, which are used annually in the U. S., entailed formerly a sacrifice of nearly 1,000 feet of lumber per cord of bark; of this now probably the larger part is saved.

The naval store industry, concerned in extracting from the living trees of certain kinds of pine, especially the Southern long leaf pine, and from other species, the resinous contents, and by distillation obtaining turpentine, resin of various kinds, and tar, is indebted to the forest to the extent of about $20,000,000 per year in the United States.

A similar industry is the tapping of the maple for sugar, which is peculiar to the United States and Canada, producing with over 50,000,000 pounds of sugar, and 3,000,000 gallons of syrup, values to the extent of $6,000,000 annually.

Finally, by distillation of the wood itself and condensing of the gaseous products, considerable amounts of wood alcohol, wood vinegar, and acetates, creosote, and other tar oils useful in the arts, are derived, adding another $8,000,000 or more to the annual revenue furnished by the forest resource in the United States.

While the value of the raw forest products consumed every year in the United States at places of consumption, roughly shaped for further use, may be placed at $600,000,000! this is enhanced by their further manufacture to over $1,200,000,000, thus making the result of the forest industries second only to those of agriculture, the value of whose products reached in the census year (1890) nearly $2,500,000,000 while the total production of metals which could in any way replace wood—gold and silver and iron included—reached only $270,000,000, and the entire mining industry (quarries and every kind of mineral or earthy product included) but little over $600,000,000.

As civilization advances so does the use of wood increase, and during the last 40 years this increase has been most remarkable. Great Britain, having hardly any wood lands of her own, stands first as an importer of wood, importing last year wood to the value of $125,000,000 (20 per cent more than her pig iron product). During the last 40 years the amount of wood used in that country has been increased 200 per cent. while her population only increased 42 per cent. France in the last 70 years, with an increase of population of 20 per cent., has increased her consumption of wood 700 per cent. Germany is, next to Great Britain, the greatest importer of wood, increasing its imports by 400 per cent. in the last 40 years, or 3½ per cent. per annum. These remarkable increases are doubtless due in part to increased manufactures of wood for exportation, but the all-around increase is consequent upon the demands of advancing civilization.