THE PRACTICE OF SILVICULTURE

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WITH PARTICULAR REFERENCE TO ITS APPLICATION IN THE UNITED STATES

BY

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PREFACE

The "Practice of Silviculture" has been prepared for use as a text book to cover a field at present unfilled. So far as is known there is no recent book applicable to the forests of this continent covering the field of silviculture. Graves' "Principles of Handling Woodlands," published in 1911, and Schlich's "Manual of Forestry," Vols. I and II, revised in 1895 are practically the only works on the subject in the English language. Government and state publications contain, in more or less fragmentary form, a large store of knowledge concerning the practice of silviculture.

Forest Terminology in the Appendix is copied verbatim from the Journal of Forestry, Vol. XV, 1917, published by the Society of American Foresters.

The author does not claim originality for the greater part of the information. Available sources have been investigated and a selection and compilation made of such information as is deemed most useful to-day.

Presentation of the subject is from the standpoint of the teacher and the arrangement and discussion are shaped in a manner which it is believed will be clear to the student.

A possible criticism in connection with some parts of the book is that the treatment of the subject is too theoretical. In answer to this it may be said that the writer realizes, from fifteen years' experience in applying silviculture on forest properties and in teaching the subject, that, while, in the application of silviculture, methods as given in books often must be so modified and changed to fit local conditions as to

be scarcely recognizable, yet, for best results in teaching students, definite theories and methods must be elaborated and set off distinctly one from the other.

No attempt has been made to cover in an absolutely complete way and with full detail all branches of applied silviculture. Such a work can well be postponed another decade until American silviculture progresses further through the formative period. On the contrary the purpose has been to keep the text brief with the idea of producing a work to fill an immediate need, containing such information as appears applicable to-day or likely to be applicable (at least in some parts of the country) in the near future.

The lists of references following each chapter are not exhaustive but are intended to afford additional reading supplementing the text.

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CHAPTER I

GENERAL CONSIDERATIONS

Introductory. — B. E. Fernow [1] the Dean of American forestry aptly says, "silviculture, the production of wood crops, is the pivot of the whole forestry business."

Silviculture is defined as "the art of producing and tending a forest; the application of the knowledge of silvics in the treatment of a forest." * This definition indicates the relation existing between silviculture and silvics. The latter deals with the underlying principles which control the life of individual forest trees and stands. It furnishes the scientific basis upon which silviculture rests. In a broader interpretation of the term silviculture includes the foundations of silviculture; namely, silvics, the science, and the practice of silviculture or the art.

An understanding of silvics is a pre-requisite for the study of silviculture or for its intelligent application. Such knowledge is taken for granted in those who read this book, which does not include the subject of silvics within its scope.

Relatively little is known concerning silviculture. This may be attributed to three causes:

* Forest Terminology. See Appendix. This is a compilation of Terms in Forestry arranged by a committee of the Society of American Foresters. The definitions which it contains will be used frequently and accepted as standard except as otherwise specified.

First, silviculture as yet has been practiced to a limited extent and during a period of only a few years in North America, whereas it requires several decades to build up definite silvicultural practice.

Second, silvicultural practice is essentially a local consideration, varying in important details from forest to forest. Generalizations and the intelligent use of knowledge gained by others develop slowly under such a condition.

Third, application of knowledge to treatment of a forest is seriously hampered when such knowledge is fragmentary. Silvics, which in theory affords the scientific basis for silviculture, is still in its infancy so far as furnishing definite information for use of practitioners on numerous important problems is concerned.

Despite these difficulties and deficiencies a body of information has been built up as to methods and lines of procedure from which, as the starting point, the details of local silviculture must be worked out.

The need to-day for silviculture in practice is colossal and coextensive with the area of non-agricultural land. Business conditions control the practice of silviculture as in a similar way they do the practice of agricultural science on farm lands. Intensive silviculture, like intensive agriculture, pays only where markets for products are accessible and prices high. A crude application of silviculture is practicable to-day on a great majority of the forest lands.

Silviculture, like agriculture, requires expenditure or investment made in order to secure some crop or return of more value than would be obtained without such action. The return in agriculture comes within one year or at most within a few years after the expenditure is made, while in the practice of silviculture the return is delayed several decades. In either case the intensity of the work and the amount of

the expenditure justified is in proportion to the return to be realized.

The long interval before the crop can be harvested is an undoubted drawback, but in spite of this, expenditures in silvicultural and agricultural practice to increase productivity have a common economic basis. Indeed, when once adequately organized, forest properties producing timber crops may frequently pay as well as or better than lands producing agricultural crops.

The unmanaged or mismanaged forests, like poorly cared for farm lands, do not produce forest products of the kind, in the amount, or of the value which might be grown. Silviculture, by properly tending the wild forest and establishing new forests on open areas, increases productivity.

Production in Managed and Unmanaged Forests. — The unmanaged or mismanaged forest shows lower production than it should, due to one or more of the following defects.

(*a*) Species of quality inferior to those which might be growing occupy part or all of the area. Such species are the weeds of the silviculturist. They flourish at the expense of better varieties. Inferior species are particularly apt to appear after disturbance in the forest cover, due to such agencies as lumbering and fires. Silviculture must eliminate and keep inferior species from reappearing. "Inferior," as here used, is a relative term, since a species may be, under one set of circumstances, the best tree to grow and elsewhere a forest weed.

(*b*) The forest may be too sparsely or too densely stocked with trees for the best results. Either of these two extremes is detrimental, both having the final effect of reducing the value of the crop produced. Too sparse stocking results in part of the area being unproductive during a portion, at least,

of the life cycle of the forest, while too dense stocking leads, as in the case of a thick bed of beets (to draw an illustration from the garden), to stagnation and a small final crop.

Silviculture must provide and maintain throughout life enough trees to properly stock the area and no more.

(*c*) Part of the area which should be forested is without forest. Fires, logging and clearing, for agricultural use, lands which are unsuited for that purpose are chiefly responsible.

The deforested condition may be only temporary — natural seeding stocking the open lands — or may be, for all intents and purposes, permanent, due to the extent of the deforested lands and lack of trees to reseed them. Silviculture must prevent the creation of further open areas and restock those now existing.

(*d*) Crooked, misshapen and defective trees (even though of valuable species) are apt to accumulate in the forest not under silvicultural treatment and retard the development of better individuals. These trees should be removed.

(*e*) Losses, due to agencies such as insects, animals, fungi, wind, etc., are sustained, often without salvage of the damaged material and without efforts to check the injury from being spread to adjacent parts of the forest. Silviculture must afford protection to the forest.

(*f*) Due to mismanagement and lack of protection the forest may cease to properly protect the site on which it grows and lands adjacent to or indirectly related to the forest. The forest floor may be destroyed and the soil eroded or baked and cracked open to the detriment of the physical factors of the site. Lands depending upon the forest for protection may be eroded or covered with infertile soil and débris. Navigation on the lower reaches of streams rising in the forest may be interfered with, reservoirs be filled and irrigation works rendered useless.

Silviculture must prevent injuries to the site and also to lands and industries dependent upon the forest for protection.

(*g*) As a result of the various defects already mentioned the production, quantitatively, qualitatively and financially, of forest products figured on an acreage and a time basis is less than it might be.

The Purpose of Silviculture. — The purpose of silviculture might then be summed up as the creation and maintenance of such a forest as will yield the highest returns in a given time. Such a statement should be qualified, because the object which the owner of a forest has in view will be the controlling factor in the silvicultural work. The statement should be modified to read: The purpose of silviculture is the production and maintenance of such a forest as shall best fulfill the objects of the owner. Where the forest must be handled with the object of furnishing protection to other property, silviculture not entirely in harmony with the owner's desires may have to be applied, but this is an exceptional case. The objects of the owner may be of diverse character. The essential thing is that the object for which silviculture is applied be known and the treatment be shaped to the accomplishment of the desired end.

The commonest object for which silviculture is practiced is the production of the highest returns, financially, in a given time. Protection of watersheds and lands adjacent to the forest and development of the best æsthetic effects are other objects which may be of primary importance with certain owners.

The Field of Silviculture. — The field of silviculture divides logically into three parts defined as:

1. Treatment of the stand during the period of regeneration or establishment: a consideration of reproduction methods.

When a bare area is restocked with trees, either brought in

by artificial means or originating from natural reproduction, there ensues a term of several years during which the young plants are being established or adjusting themselves to the new environment. When this adjustment is successful and the reproduction completed the period of establishment or regeneration may be considered closed.

In every stand the time comes, sooner or later, when it is desired to harvest a portion or all of the timber and replace the trees removed by others of a new generation. Cuttings are made with the two purposes of removing the old trees and establishing reproduction. They are known as reproduction cuttings and the period over which they extend is known as the regeneration or reproduction period. Reproduction cuttings range from one to several in number and the regeneration period may extend from less than five to more than 50 years. In the case of the selection forest this period is identical with the rotation.

2. Treatment of the stand during that portion of the rotation not included in the period of regeneration: a consideration of intermediate cuttings.

After a new stand is established on open land or on wooded areas as a result of reproduction cuttings, a long period ensues during which the young stand grows and passes through various stages until mature and ready, in its turn, to be harvested and give place to a succeeding generation. The various cuttings made during its development from the reproduction stage to maturity are termed Intermediate cuttings. They have as their object the improvement of the existing stand without thought of reproduction. (See Fig. 1.)

3. Protection of the stand against injuries of many kinds. The more important are fire, insects, fungi, animals and wind. This subject leads into various specialized fields, such as fire protection, entomology, pathology and zoölogy.