FOREST ECOLOGY AND METTLER'S WOODS

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From the standpoint of the forester, Mettler's Woods, now the William L. Hutcheson Memorial Forest, is uniquely valuable as the best remaining example of old-growth oak forest on the Atlantic seaboard. This quality gives it distinction not only as a museum piece but even more as an outdoor research laboratory in which Nature's processes can be studied under conditions where man's interference is reduced to a minimum. Some consideration of the scope and aims of forestry will help to clarify both its potentialities and its limitations for this purpose.

Definitions of forestry are numerous and not always consistent. Many laymen identify it with fire fighting or tree planting. To some foresters it is the growing and harvesting of trees for sawlogs or pulpwood or other commercial products.

I like to think of it as the science, the art, and the business of managing forests for the continuous production of goods and services. Several concepts are packed into that brief sentence, which covers a lot of ground. Perhaps the very fact that forestry has so many facets is one of the reasons why there is so much misunderstanding concerning it. In dealing with so broad a field we all tend to see it from the angle of our own personal contact with it.

To begin with, there is no general agreement as to what constitutes a "forest" beyond the fact that it is a community in which trees are the dominant vegetation. Some include in the community only trees and other woody vegetation, others include all plants, and still others both plants and animals. To me, it is more realistic to regard a forest as an ecosystem which includes not only trees, other plants, and animals, but also the soil on which and in which they grow. It is a particular kind of land area.

Viewed in this light, the forest produces a wide variety of goods and services. Among these are wood and its innumerable derivatives; other tree products such as naval stores, maple syrup, and rubber; decorative materials such as Christmas trees, ferns, club mosses, and wild flowers; forage for domestic livestock and game animals; wildlife of all kinds; modification of the local climate and the microclimate; regulation of the amount and distribution of water runoff, with resulting influence on soil erosion and streamflow; opportunity for many forms of outdoor recreation; aesthetic enjoyment; and spiritual inspiration.

Forestry is properly concerned with the production of any or all of these goods and services—on a continuing basis. Naturally their relative importance varies greatly with time and place. Raw materials for industry, such as sawlogs and pulpwood, have always constituted the major product of the forest in terms of direct financial returns. This fact, together with the fact that we all use lumber and paper in one form or another, has led to the common conception that the production of tangible goods is

the sole responsibility of the forester. Actually the intangible services relating to soil, water, recreation, and inspiration, which it is difficult to express in monetary terms, are extremely valuable and are thoroughly deserving of both professional and popular attention. A friend of mine is fond of saying that we could get along reasonably well without wood but not without forests—a somewhat exaggerated but effective way of emphasizing the fact that there are substitutes for wood but not for forest influences.

Forest management that aims to produce several goods and services from the same area is commonly known as multiple-use, or multi-purpose, forestry. A national forest, for example, may simultaneously produce wood, forage, water, wildlife, minerals, and recreation, and may help to check erosion and floods. Actually there are very few forests that do not, intentionally or otherwise, serve more than one purpose, whatever the primary objective of the owner. Well-managed private forests, for example, generally aim to produce continuous supplies of wood for industrial use, while national parks are set aside to preserve unspoiled examples of magnificent scenery; but in both cases the forests furnish watershed protection and opportunities for recreation. Mettler's Woods and other natural areas provide aesthetic enjoyment, spiritual inspiration, and favorable conditions for scientific research—all of which are services of superior value.

The advantages of multiple-use are obvious, but there are definite limits to its practicability. Some uses are wholly or partly incompatible. We cannot conduct logging operations in these woods and still retain it as a natural area. We can grow and harvest some wood, forage, and wildlife on the same national forest or private property, but not maximum amounts of each. The more we try to combine uses, the more difficult the task becomes and the more knowledge we need.

These considerations bring us to the heart of forestry, that it is essentially a managerial activity. It involves using—doing something with —a forest. "Use" commonly, but not necessarily, means the harvesting of various crops such as wood, forage, or wildlife. But an area managed primarily for protection of the water supply, or for wilderness values, or for scientific research is being used just as definitely and constructively in the broad sense of the term as is an area which is being managed for the production and utilization of sawlogs or pulpwood. The management of Mettler's Woods as a natural area constitutes a form of forestry, the products of which are esthetic enjoyment, spiritual uplift, and scientific knowledge.

Scientific knowledge is of course a *sine qua non* for effective forest management. Whatever product the forest manager is seeking, he must be thoroughly familiar with the characteristics of the plants, animals, and soils comprising the ecosystem and with their relations to one another. Such knowledge is provided by basic research in the biological and physical sciences. Its application is an art requiring a high degree of skill. There is often a wide gulf between knowing and doing, between basic science and applied science. The most brilliant investigator is not always the most skillful practitioner.

The engineering sciences are another field in which the practicing forester must have some competence. Property boundaries must be established, topographic maps must be made, permanent improvements must be constructed, aerial photographs must be interpreted. If timber is to be harvested, logging roads must be located and built, logging equipment must be selected and operated. Where recreation is an important use of the forest, picnic and camping grounds must be laid out, and adequate provision made for sanitation and for protection from fire.

Finally, economic considerations inevitably loom large in the forestry picture. Management practices that do not produce more income than outgo cannot be justified. The relation between costs and returns—present and future, tangible and intangible, private and public—is of vital importance. Either or both are often difficult to express in dollars and cents, but some value must be placed upon them. How much do eroded hillsides and fire-scarred landscapes cost? What are superb scenery and a pure water supply worth? Is the financial return lost by failure to log this forest more than offset by the inspiration and the scientific knowledge that will result from keeping it as a natural area?

Questions like these must be answered by the judgment of the community as to the relative values involved. We are accustomed to making such judgments with respect to city parks, public libraries, art galleries, schools, and churches. We must get used to making them with respect to forests and other natural resources. How the community can best obtain the values it decides it wants raises important questions of policy. Can unrestricted private ownership be relied upon to provide adequate, continuing supplies of timber; to preserve wilderness areas; to protect wildlife; to safeguard the water supply? Or is public ownership necessary? Or can private ownership achieve the desired results with public cooperation and control? In the case of Mettler's Woods, the answer has been found in public ownership by an educational institution.

All of this brings me back to my original thesis that forestry is a managerial activity involving science, art, and business. Like other forms of land management it uses sound technological practices to achieve certain desired economic and social ends. It rests on the triple foundation of the biological sciences, the physical and engineering sciences, and the social sciences.

The contribution which this forest can make to strengthening that foundation clearly lies in the field of the biological sciences, and more specifically in the science of ecology. This is partly because of the intrinsic importance of ecology, but even more because of the suitability of the area for studies in that particular subject. It is also inevitable that ecological research will extend into the closely related fields of physiology and genetics.

Since the production of forest crops, whether trees, forage, or wildlife, is guided so largely by ecological facts and principles, there appears to be a growing tendency to consider forestry as nothing more nor less than applied ecology. This is going too far. While it is unquestionably true that forestry applies ecology, it also applies pathology and entomol-

ogy and mathematics and engineering and economics. If one thinks only of timber production, it is entirely proper to regard ecology as one of the main foundations for silviculture, which is the art of reproducing and tending the timber crop. But silviculture is only one of the five fields in which the Society of American Foresters believes a forester must have adequate technical training to be recognized as professionally competent. The other fields are forest protection, forest management, forest utilization, and forest economics, which obviously go far beyond the bounds of ecology.

That the Hutcheson Forest maintained as a natural area can contribute substantially to our knowledge only in the silvicultural field in no way minimizes its value from the viewpoint of the forester. This is true in spite of the fact that a forester's activities are so often concerned with modifying natural conditions. Mother Nature if left to herself seldom produces maximum forest crops any more than she produces maximum agricultural crops. It is rather curious, when we are all so familiar with the drastic way in which farming interferes with natural processes, that we should not recognize the desirability of similar interference in the management of forest lands. No one recommends maintaining the "balance of nature" in the production of agricultural crops, yet such a balance is often held up as the goal to be sought in the management of wild lands.

Presumably the balance of nature is the condition established over a long period of time by natural forces operating without interferences by man. It is the climax stage in a successional series of communities. It is not a static condition, but rather one in which the community is in dynamic equilibrium with its physical habitat. Individual plants and animals come and go, but as long as there is no change in climate, or no catastrophe causes a reversion to an earlier stage, the composition of the community as a whole remains approximately the same.

Unfortunately, from some points of view, the climax stage in a natural succession of forest types is often not the one best adapted to man's utilitarian needs. Commonly the earlier stages in succession have greater economic or even greater recreational value. In the field of timber production, for example, white pine in New England, aspen in the Lake States, longleaf pine in the South, western white pine in the northern Rocky Mountains, and Douglas fir in the Pacific Northwest are valuable commercial species which the forest manager often wishes to perpetuate. Yet these are all temporary forest types, or in more technical terms "subclimaxes" or "disclimaxes".

In the field of wildlife management, deer in northern Michigan are far less abundant in an unbroken climax forest of northern hardwoods than in areas where numerous openings create an "edge effect" that provides a more favorable habitat. The reclamation of open fields by forests may completely eliminate such birds as the prairie chicken and the sharp-tailed grouse. In the realm of watershed management, recent studies in the Rocky Mountains have shown that the yield of water is less from dense stands of lodgepole pine than from forests in which holes or strips

have been cut to reduce transpiration and the interception of precipitation. These openings result in the maximum accumulation of snow, from which the bulk of the runoff is derived.

These examples of the value to man of transitional seral stages do not of course imply that he is never interested in the climax forest community. Northern hardwoods in the Northeastern and Lake States, ponderosa pine on dry sites throughout much of the West, and redwood in California are illustrations of climax forest types that the forest manager usually wishes to perpetuate. The important point is that whenever man interferes with natural processes, as by logging or hunting, he must know what results he seeks and how they can best be achieved. Among other things, this requires ecological knowledge of a high order and skill in its application, particularly when the objective is to maintain a temporary stage in the normal succession.

How can natural areas help to supply the needed knowledge when by definition they are to be reserved from commercial utilization? The answer is that in order to modify natural processes successfully we must first know what those processes are. Incidentally it may be well to point out that the Hutcheson Forest is not 100 per cent natural, since the clearing away of the surrounding forests, repeated man-caused fires, and the logging of windfalls after the 1950 hurricane have modified natural conditions in the tract. Furthermore, from now on, sufficient management will presumably be practiced to prevent serious damage to the forest by fire, insects, or disease. Compared with other areas in the region, however, the tract represents, and under the direction of Rutgers University will continue to represent, the closest approach to natural conditions which it is feasible to attain. Herein lies its greatest value.

In an undisturbed forest one can obtain much information not available elsewhere concerning the normal interrelations that exist between trees, shrubs, herbs, fungi, insects, birds, mammals, earthworms, nematodes, soil, and climate. Only in an undisturbed forest can one determine whether the present stand of oak and hickory is really a climax community or whether it will in time be replaced by a stand in which maple and beech are predominant. Yet such information is indispensable for the forest manager, particularly if his objective is, so to speak, to "buck" Nature. Man cannot conquer Nature in the sense that he ever changes natural laws. He can, however, alter materially and successfully the natural course of events if he knows what those laws are and governs his activities in accordance with them.

The need for wisdom in the management of forest lands is emphasized by the long life of the trees which are the dominant element in the community. Dean G. S. Allen of the Faculty of Forestry at the University of British Columbia recently expressed as follows the sobering responsibility which the forester must face: "What we do today and tomorrow will affect generations to come—favorably or unfavorably. We do not know enough yet to work in complete harmony with Nature, and so we will make mistakes. But mistakes can be minimized if we will be exceed-

ingly conservative in the biological sense and follow Nature as closely as we can". (Allen, 1955).

Dean Allen was speaking specifically of silviculture, or timber production, but thorough knowledge of natural processes is also necessary to obtain optimum returns in other fields such as watershed management and recreation. Generally speaking, the more we know the more liberties we can take in modifying the environment to meet man's needs. Much can be learned from controlled experiments in disturbed areas, which will of course continue to be widely used for research purposes. They are, however, not a substitute for undisturbed areas, where studies of natural processes will help us to direct our managerial activities along sound lines. That foresters recognize these truths is shown by the fact that for many years the Society of American Foresters has had a Committee on Natural Areas, and that that committee participated actively in the campaign to preserve these woods from destruction.

How does forest ecology differ from any other kind of ecology? If, as I stated earlier, the forest is the entire ecosystem, then forest ecology is all-inclusive in its study of environmental relations. There is no aspect of the inter-relations between the plants and animals in the forest and the environment in which they live, with which it is not concerned. Coming from a forester, this statement may sound immodest, but I believe that it is realistic.

No one would deny that in ecology as in other branches of biology we need specialists. The other speakers today have demonstrated unmistakably the services that can be rendered by plant ecologists and animal ecologists and soil ecologists. Some of these men will doubtless work in still more specialized fields such as moss ecology and insect ecology and mammal ecology. In these days when we are expanding the boundaries of knowledge so far that it is necessary for most scientists to know more and more about less and less, the specialists are indispensable. So too, I think, are the generalists, and in this particular field I believe that the logical generalist is the forest ecologist.

Management of a forest, whatever the goods or services on which emphasis is placed, has repercussions on the entire forest. We cannot utilize one part without having some effect on all the other parts. Ecology supplies the basic knowledge by which we can determine what those effects will be. It informs the manager as to what steps he can and cannot safely and successfully take. The task of the forest ecologist is to conduct studies that relate to the forest as a whole rather than to its individual parts, although inevitably with emphasis on trees as the dominating feature of the forest. If he does the task well, he will make full use of the findings of other ecologists and will automatically supply information that can be used by the forest manager to direct his activities along sound lines.

Just as forestry is a science, an art, and a business that deals with all the resources in a forest ecosystem, so does forest ecology deal with all

aspects of the inter-relations between the trees, other plants, animals, and environment that comprise the ecosystem. It is characterized both by its broad scope and by the utilitarian character of its ultimate objective. Although recognizing the indispensability of basic research, it is commonly less interested in knowledge as an end in itself than as a means to an end. That end is the continuous production and use of goods and services, among which wood and forest influences will doubtless continue to occupy a prominent position and hence to focus attention largely but not exclusively on the management of the trees in the forest. These considerations make it essential for a forest ecologist not only to have a firm grasp of the fundamental principles of ecology, but also to be familiar with the application of those principles in forest practice. He will be most useful if he is a well-trained scientist who understands the point of view and the problems of the manager.

Many men with these qualifications will in time, I hope, participate in the programs that will be developed at the Hutcheson Forest. Within the limitations imposed by its relatively small size and uniform conditions, it offers unusual opportunities for advancing our knowledge in ecology and related fields. It can thus be a major asset in placing one aspect of forest management in the hardwood region of New Jersey and adjacent states on a firmer foundation than would otherwise be possible.

I congratulate Rutgers University on the acquisition of so unique and so valuable a property. Foresters will follow with keenest interest the research that will be conducted there and will take advantage in their own activities of the results obtained.

LITERATURE CITED

Allen, G. S. 1955. Establishing the crop. Forestry Chronicle 31:31-34.