SOME PRINCIPLES OF FOREST SITE-TYPE CLASSIFICATION

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The decision to establish a Soils and Sites Standing Committee at the meeting of the Canadian Institute of Forestry on October 28, 1950, at Sault Ste. Marie, Ontario was very remarkable. It indicated that thinking and action in regard to forest site-types will be better coordinated and put to practical use in the future. The time has come when the necessity of forest site classification is recognized by research workers as well as practical foresters.

First it may be well to clarify what we mean by forest site-type classification and on what it is to be based. There are so many different points of view and definitions that it is difficult to find one that adequately expresses the site-type.

No attempt will be made in this article to review completely different definitions or methods of site classification, but just briefly touch on them to recall them to mind and promote a greater interest in this subject.

The Society of American Foresters defines site as "an area, considered as to its ecological factors with reference to capacity to produce forests or other vegetation; the combination of biotic, climatic and soil conditions of an area".²

Climate and soil, these most important natural site factors, and vegetation interact on one another and make a tangled complex, sometimes joined by "artificial" or man caused factors such as forest utilization, forest fires, etc.

In practical forestry, where the maximum crop and perpetual production of the forest are the primary interests, such a complex is not very applicable in everyday work. Attempts have been made to find a simple and accurate unit of measurement, but there has been no general agreement on which is the most important and reliable factor. For the most part all known systems are based on climate, ground vegetation, soil, forest stands, or on more than one factor, choosing one of them as the main feature.

Climate, being the most independent and the least variable factor over a period of time, affects the soil and vegetation very much.

The method based on ground vegetation was devised by Professor Cajander in Finland and Ilvesalto made it useful in forest management. It is based only on ground flora at maturity of the stands, when ground vegetation reaches an equilibrium in relation to its environment. The method does not take account of the soil and forest stands. According to Cajander the same kind of soil may support widely varying forest types and one and the same forest type may appear on very different soils. The ground cover expresses the productivity and biological value of the habitat. Excluding swamps he grouped all forests in the large groups with the following types in each group named after the Latin names of the major plants:

¹ Department of Natural Resources, Prince Albert, Saskatchewan.

² Society of American Foresters, Forestry Terminology, 1950, Washington 6, D.C.

- (a) Dry forests with *Calluna* (C.T.) and *Vaccinium* (V.T.) type.
- (b) Medium moist forests with *Myrtillus* (M.T.) and *Oxalis-Myrtillus* (O.T.) type.
- (c) Moist or mixed forests with *Geranium* and *Sanicula* types (G.T.).

This type classification has been used for quite a number of years in practical forestry in Finland. The system has worked well in northern forests with shallow soil and with simple and relatively few forest types, but difficulties arise on deeper and more complicated soils with more tree species and forest types.

Can ground flora alone express and characterize fully the life and development of a forest or forest type? The rooting zone of the trees goes much deeper in the soil than the roots of the ground cover do and, for instance, there can be sandy soil in the upper layer and heavy clay in the bottom layer, that is, each vegetation association grows on quite different soils. By the way, stand composition and density influence the ground vegetation very much. The latter changes within a period of life of the stand and even with the season of the year. Very often it is not represented at all or destroyed by artificial disturbances such as fire, clear cutting, etc. The main part of the forest vegetation and the main object of our interest, the forest stand, seems to dominate the lesser vegetation, which itself is more dependent on the first than able to influence it. However, the value of ground vegetation can not be denied. It might be considered as a component in indication of sites and site qualities.

Professor V. T. Aaltonen has found a fair correlation between Cajander's forest types and soil texture in Finland.³ *Calluna* and *Vaccinium* types have been found mostly on sandy and gravelly *Myrtillus* and *Oxalis* types on morainic and *Geranium* types of fine textured and clay soils. The growth of the trees varies considerably within the same forest type according to the texture of the soil. These objections make us think that Cajander's type classification gives more silvicultural information and reliability when it is supplemented by soil studies.

In this connection another opinion of type classification arose, based essentially on soil. The idea prevails in measuring and correlating soil factors with the type. It originated in the first two decades of this century in Russia and this system had many followers in Europe and other countries.

Lately Dr. G. A. Hills in Canada has developed a method based on basic soil sites, described in terms of moisture regime, permeability of the soil materials and ecoclimate.⁴ This seems to be a promising approach, but all previous classifications based just on soil have plunged into geological and specific details of soils science and lost their value for practical forestry. No doubt, soil is one of the basic site factors, but we must remember that the interpreter and user of forest types will be a forester and his eyes will naturally be turned to the forest stands as a representative of the site.

The latter school deals with present stand using the relationship of height

³ V. T. Aaltonen, *Forest Soil Research in Finland*, Unasilva, Vol. IV, No. 3, 1950.

⁴ G. Angus Hills, *The Use of Aerial Photography in Mapping Soil Sites*, *The Forestry Chronicle*, 1950, Vol. 26, No. 1.

of the dominant and codominant trees at a reference age to determine site values. Here just the wood production is considered. It includes in one unit economically equivalent but biologically different stands, and partly for this reason it is not adaptable to a general type classification.

As one site factor turned out to be insufficient for site classification, the need naturally arose for a system based on more than one factor. The writer had the opportunity about ten years ago to work for a short time in forests where the latter kind of a system was practised. Supplemented and adapted for local circumstances by V. Eiche, this kind of classification was successfully used in forest management for five million acres of state and private forests in Latvia. Site classification and field data were collected parallel with the inventory work done at the same time. It took a great deal of field work because aerial photographs were not used in forestry at that time in European countries. Once completed in 1935, it turned out to be very useful in forest management. Thirteen permanent types were recognized. (See map).

The basic type description includes:

1. Description of forest stand and other vegetation communities in it as follows:

- (a) Stand composition by species, its structure, etc.
- (b) Site quality group and average volume per acre at the age of maturity.
- (c) Underbrush, its role in the present and in the stand expected in the future.
- (d) Seedling development, especially under the present mature stands.
- (e) Representative ground vegetation, dedicating more attention to the indicator plants.

2. Description of soil, giving:

- (a) A geological character in general lines of the area occupied by the type.
- (b) Topography (macro and micro).
- (c) Soil profile and thickness of the different horizons. Description of debris and humus layer. The reaction of the soil—pH.
- (d) Ground water level.

3. Possibilities of natural reproduction by climax species, considering:

- (a) Advance reproduction under the mature parent stand.
- (b) Subsequent reproduction after liquidation of the old stand.

4. The geneses of the type and its relationship with other types.

According to the climate, natural vegetation and other influences, soil can follow the improvement or degradation process from the productivity point of view. Leaching or podzolization is the best known process of degradation, common in humid climatic areas with more precipitation than evaporation. This natural exhaustion process is very slow but persistent. In a case of abundant precipitation, unfavourable drainage or topographical features in local areas, it reaches a waterlogged or flooded condition, resulting in a muskeg or swamp forest type. On the other hand, in an arid climate there is a deficiency of moisture and development of soil and vegetative cover results in shrubs and grasses, with not very much value at least in forestry. The action of man can greatly reduce or promote either one of these developments.

Origin and Development of
Forest Site – types in Latvia
(by V. Eiche)

Any change of a single factor or larger part of the complex affects the forest type and keeps it either improving or degrading. (See the forest type genesis scheme of Latvia).

Each rectangle represents a site-type and connecting arrows show the possibilities of development under local climatic conditions in that country.

The number of types will vary with the geographical regions, with the climate, soil, tree species, etc. It is desirable to keep the number of types as few as possible even if slight imperfections from the scientific point of view might result.

The classification system must be a practical one, including all possible variations but at the same time being not too finely differentiated. Provision must be made for eventual improvements or addition of new types. To meet the essential needs in forestry practice the following requirements could be set up for each type:

(a) Every type must have an economic aim, dependent on the species or stand composition, rotation age, improvement cuttings, etc.

(b) The type must express the productive capacity of the soil and durable relations between tree species and soil. In other words, establish the species natural to the site.

(c) It must show not only the present growing conditions but consider all possible improvements of the stand as well as soil in the future.

(d) To show the proper cutting practices silviculturally and economically appropriate to each site.

(e) In a broader line to trace out the reproduction, keeping climax associations in mind. It will lead to the reproduction of the most desirable and valuable species, and will reduce the number of years needed for successful reproduction of the stand.

(f) In addition to the above it is very desirable that the type be recognizable on aerial photographs. This demand did not occur twenty or fifty years ago when the first classification systems were evolved and aerial photography was just originating, but no forestry work is presumable without aerial photographs today. The cover type and topography as viewed on air photographs give some information of value. Certain types, such as swamps, outwash plains, etc., can be mapped on the photos with good accuracy.

How should the types be named? Well known local names are desirable but there an obstacle arises—it is not possible to compare such types from one country to another or even among the regions of a single country. For this reason Latinized nomenclature is recommended, or at least the latter should be mentioned following the local names. The most adaptable seems the nomenclature of two Latin names of:

(a) The name of the climax tree species which originally occupies the site.

(b) The name of indicator or major plant in ground vegetation, for instance:—Pinetum — Vacciniosum and Piceetum — Hylocomiosum. The first two words represent a dry pine site-type; the second two a spruce type.

The forest typology includes indirectly everything in forestry up to date. However, what a forester needs most besides his basic knowledge, is a pair

of searching eyes in the field and he will be able to read the needs and life of forests, as everyone can read a book knowing just the thirty sounds of the alphabet. Scientists as well as practical field workers can participate in this work and collect much information of value to our forests.

The Forest Inventory work is in full progress now from coast to coast in Canada. It is mostly the first general inventory and as such is and can be based mainly on aerial photographs. In this connection the present stands or cover types are the base for forest classification, volume and growth estimates, for planning forest utilization and protection. As forest stands are in uninterrupted natural development and under utilization, the overall picture of a forested area is fairly variable. For instance, mixedwood cover type can turn into softwoods in a period of less than twenty or thirty years and forest fires, cutting, etc., can radically change the cover types in unexpected ways in a period of only a few years. This renders the cover type inadequate as a base for long term planning and work practised in forestry. A natural forest classification in terms of site-types seems the way out and a more promising base for the present and much more so for the future forests. It matters little what method will be used as long as the aim is known. The practical work will show the most suitable method.