Ecological Classification of Forest Land in Canada and Northwestern U.S.A.

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by M.M. Grandtner and F. Vaucamps
Laboratoire d'écologie forestière
Université Laval, Québec

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ABSTRACT

The authors discuss the floristic classification of forest vegetation, which is one type of classification based on an intrinsic characteristic of vegetation, its floristic composition. They stress its applications in Canada, distinguishing between the Finnish school of Cajander and the Zürich-Montpellier school of Braun-Blanquet. They also attempt to point out advantages and disadvantages of this classification and to show how it can be used as an index of the quality and productivity of a site. They finally discuss the potential of this method as a tool in forest management.

RESUMÉ

Les auteurs traitent de la classification floristique de la végétation forestière, basée sur l'une des caractéristiques intrinsèques de la végétation: sa composition floristique. Ils en exposent les applications qui en ont été faites au Canada, en distinguant les deux écoles de Cajander (école finlandaise) et de Braun-Blqnquet (école züricho-montpelliéraine). Ils tentent aussi de mettre en évidence les avantages et les inconvénients d'une telle classification, et de dégager le rôle que peut jouer la végétation comme indice de la qualité et de la productivité d'un site forestier. Ils se livrent, en dernier lieu, à une brève asquisse de l'avenir possible de cette méthode comme outil de l'aménagement forestier.

MAIN FLORISTIC CLASSIFICATIONS

Forest vegetation was mainly studied and classified by covertypes until 1930. The visits of some Finnish phytosociologists, Ilvessalo in 1929, Kujala and Cajander Jr. in the 1930's and Hustich in the 1940's resulted in the introduction and adoption in Canada of a method used in Finland since the beginning of this century for the study and classification of Finnish forests.

This phytosociological method is concerned mainly with forest typology; the method hypothesizes that forest types are characterized by indicators in the herbaceous stratum. The method applies quite well to the boreal forests of Canada, which are similar to forests in Finland.

This method was used by Ilvessalo in a study of Canadian forests published in 1929. Ab-Yberg suggested its general usage at a symposium of Quebec foresters in 1931. In the Province of Quebec, many authors have used this method: Bellefeuille (1931), Rousseau (1931), Provencher (1931), Sisam (1938), Heimburger (1941), Linteau (1955) and Lafond (1964), to name just a few. In British Columbia, the method was used by Spilsbury and Smith (1947), and by Illingworth and Arlidge (1960). More recently, Kabzems (1951), Kirby (1962), van Groenewoud (1965) and Mueller-Dombois (1964, 1965) have used lesser vegetation to classify the forest as a whole and Eis (1962) has stressed the importance of vegetation in forest classification.

However, due to specific characteristics of Canadian forests, some authors such as Hustich (1939) and Rousseau (1931, 1944) modified the method of Cajander by the addition of tree species. Furthermore, Hustich (1939), Heimburger (1941) and Linteau (1955) have added other components of the ecosystem such as relative humidity, soil data, and physiography.

On the other hand, when Linteau (1955) and Lafond (1964) studied more diverse boreal forests and other forests with a more complex composition, such as those of southern Quebec, they recognized the need for a method better suited to dealing with this complexity. They adopted the phytosociological method of the Zürich-Montpellier school, developed by Braun-Blanquet, as did many of their colleagues. This method includes a qualitative and quantitative study of all the strata and gives a more complete picture of the vegetation. It is then possible to determine taxonomic units of plant communities, based on the principle of characteristic species or characteristic groups of species. Moreover, phytosociological units defined on a floristic basis often correlate with types of soils for which morphology, water regime, physico-chemical properties and nutrient contents are very specific. This approach assumes that vegetation is best suited for providing a synthesis of overall environmental components. While using vegetation as the main criterion of classification, the method also makes use of other site factors as complements. This approach has been used in many vegetation studies in this country over the last thirty years. However, only one author, Dansereau (1943, 1972), uses the Braun-Blanquet method in its original form. Others have modified it slightly or completed it to meet the requirements of particular plant groups or particular problems, or else just as a matter of

personal preference. Damman (1967) introduced methodological modifications for the study of the boreal forest. Lafond, Grandtner, and their students from Laval University did the same thing in Quebec, as did Krajina and his students in British Columbia. At present, the Zürich-Montpellier method adapted to Canadian conditions seems to be the most satisfying and the most wide-spread phytosociological approach.

APPLICATIONS

Forest Typology

The pioneer in floristic classification applied to forest typology was Ab-Yberg. In 1931, he suggested a combined classification system for the forests of Quebec, based simultaneously on understory indicators and on cover classes. He defined four forest regions which became, according to Blake (1953), the basis for the forest classification of Halliday. His work was continued by many phytosociologists, mainly in Quebec but also in western provinces. Most of them defined their forest types on the basis of herbs and shrubs, whether associated with trees or not. This approach was used by Bellefeuille (1931) in the forests of the north shore of the St. Lawrence River and in the county of Chicoutimi and Saguenay, by Hatcher (1967) in the black spruce forests north of Baie-Comeau, and by Heimburger, Bellefeuille and Sisam in the Laurentian Mountains. It is also worth mentioning the classification of the forests of Labrador made by Hustich (1949, 1954), and the forest-type classification in the Abitibi county and on the north shore of the St. Lawrence River by Linteau (1955) and Lafond (1958). Although some authors attribute a prime role to lesser vegetation in site classification, they also consider other components, mainly soil composition and properties. Such was the case in Cormack's studies (1953) in the Rockies, studies that showed a correlation between vegetation and soil conditions and demonstrated, in 1956, that lesser vegetation was a more reliable criterion than tree species for differentiating stages of succession. Hare (1950) also related soil characteristics to vegetation in determining boreal forest types in Eastern Canada. Heimburger (1941) pointed out the strong correlation between distribution of types, landforms, and soil characteristics.

Since the late fifties, with the increasing number of studies on non-boreal forests, the Braun-Blanquet method has been used more widely. There have been studies on the classification of several types of forests, ranging from pure sugar maple stands to coniferous forests, all through the Province of Quebec. Similar studies have been carried out in this field in British Columbia, Newfoundland, Manitoba, Alberta and Saskatchewan.

Evaluation of Forest Resources

The applications of floristic classification in evaluating forest potential are numerous, since, besides fiber production, forests can be used in wildlife management, recreation, water conservation and environmental conservation in general. However, we should notice, and perhaps regret, that the effort so far has been mainly in the direction of evaluation of present and future fiber production. In this field, floristic classification has played an important role, forming the basis of research efforts. The pioneers in this field were Belleveuille and his colleagues of the thirties who argued that plant associations were a reliable index of production potential of a forest stand. Their followers, Lafond (1964), Linteau (1955), Damman (1964) and many others, in Quebec as well as in British Columbia and certain other provinces, have provided similar arguments on the usefulness of typology based on floristic classification for forest inventories and productivity studies. The best part of these studies was concerned with current fiber production. Some studies, such as those of Gagnon (1973), Grandtner (1972) and Dubé (1961), have shown that the phytosociological method applied to transition populations could forecast composition and quality of future populations.

Evaluation of forest potential other than fiber production has been left almost untouched. Floristic classification is already playing an essential role in pioneering studies of vertical stratification, estimates of tolerance to recreational activities, evolution potential, and elasticity of plant groups. These studies have been performed in the Forillon and the Mauricie National Parks. The method is also used in the study of ecosystems protection in these parks and in the IBP programme.

Forest Mapping

In addition, floristic classification can be used in photo interpretation and in mapping. For over twenty years, phytosociology has been a precious tool in photo interpretation for many researchers, namely Mueller-Dombois (1964) in Manitoba, Lacate (1966) in British Columbia, and Brown (1974) in the Temiscamingue area.

Phytosociology can, on the other hand, help directly in forest-type mapping. It was used along this line in British Columbia by Lacate and Arlidge (1966) for their maps of forest vegetation types based on lesser vegetation, and in Quebec by Gauthier (1968), Grandtner (1960, 1967), Ray (1958), and Marcotte (1974). Phytosociology was also instrumental in the elaboration of several small scale phytodynamic maps published in Quebec, such as those of the Lower St. Lawrence, the Gaspé Peninsula and the Magdalen Islands by Grandtner (1972), as well as large scale

mapping of the vegetation of the Magdalen Islands by Grandtner (1967), and of the county of Rivière-du-Loup by Blouin and Grandtner (1971).

Other Fields of Forestry

The method has proved useful in the domains of silviculture, exploitation, entomology, phytopathology, and in forming the basis for silvicultural treatments and logging. Hatcher (1967) studied competition between deciduous trees as well as between balsam fir and red spruce with this technique. He also compared stands of balsam fir growing at various sites in the Province of Quebec. Linteau (1955) pointed out that foresters working for various companies on the North Shore of the St. Lawrence make use of plant associations recognized by the Quebec forest service in their ten-year plans. Anctil (1956) and Damman (1964) have used the method for reforestation studies, after fire, logging, or other high-impact disturbance. Boulaine (1962), and Gèrardin (1967) used the phytosociological approach to study how a valuable stand - a sugar maple stand for instance - could be kept from being succeeded by beech. Finally, others like Ray (1958), Jurdant and Roberge (1965), and certain researchers in British Columbia use this classification as a basis for silvicultural prescriptions designed to increase the yield of various stands. From the entomological viewpoint, Laford (1958) studied the relations between forest associations and the increase in budworm populations, while van Groenewoud, in Saskatchewan, used plant community classification to study the occurrence of the root disease of white spruce.

CONCLUSION

Floristic classification seems to be widely used and to play an important role in a large spectrum of disciplines related to the work of foresters. However, the method is seldom used by itself in matters of forest typology and in evaluation of current or potential fiber production. It has the advantage of simplicity and ease of application by the forester, even if he had little knowledge of phytosociology applied either to boreal or more complex forests. It is a most versatile tool, well suited to various adaptations, including treatment by quantitative methods; it can be used anywhere in the world since it is internationally understood and recognized.

Even though up to now its use has been largely restricted to forest classification and evaluation of potential yield, it has been extended to the field of photo interpretation and mapping where it has proved very useful. Due to the historical evolution of forestry in Canada, during which time certain forest uses had received priority, phytosociology has been restricted to

these applications. In fields like silviculture, exploitation, and forest protection, phytosociology has not contributed to the prescription of specific treatments on a large scale, but rather to the orientation of research whose objectives are the development and testing of treatments.

Presently vegetation classification remains a good tool for foresters, when used together with a sound knowledge of other techniques. From the descriptive viewpoint, no extraordinarily new technique is to be expected since its methods seem to be restricted to subdividing, clustering, and ordering vegetation. However, new developments might arise in statistics, computer science, remote sensing, and data processing. Since floristic classification is based on a fundamental characteristic of vegetation, its composition, it is likely to remain a first quality tool for the forester as long as the forest remains an ecosystem dominanted by trees and their phytocenosis, and does not become a simple substratum still filled with air, but without a single lichen.

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