Forest Site Classification in the Western and Northern Region

by

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Work on forest site relationships in the Western and Northern Region (Alberta, Saskatchewan, Manitoba and the Northwest Territories) is probably less plentiful in this region than in any other region of the country, due in part to the relatively recent (i.e. in the last 30 years) demand for large amounts of forest products. This review concentrates on studies relating forest productivity and composition to some aspects of the environment and does not dwell at length with studies that are mainly descriptive nor those focusing on broad scale inventories of forest resources, although it is recognized that such inventories and descriptive reports may often provide a focus for more detailed studies.

The review deals with the region by province, and identifies the focus of the study and classifying criteria considered such as climate, floristic composition, soil and physiographic properties, foliar characteristics and whether or not mapping was attempted. These classification categories are analogous to those used in the review by Rennie (1963). A thorough review of forest site classification activities in Canada prior to 1972 has been compiled by Burger (1972).

Alberta

Some of the earliest work in the western boreal forest was done by Brinkman (1931, 1936) in Alberta using lichens and mosses as site indicators. Smithers (1956) assessed site productivity in dense lodgepole pine stands in the Kananaskis Forest Experiment Station, Alberta, on the basis of physiography, moisture regime and parent material.

Heringa and Cormack (1953) related lodgepole pine site index to soil parent material, texture and vegetation cover in central Alberta. Horton and Lees (1961) described black spruce silvics and site relationships in the Alberta foothills. Similar studies relating height growth of dominant trees to landform, vegetation, and soils were conducted in southwestern Alberta by Jeffrey et al. (1968). A physiographic classification based upon aerial photo interpretation was the basis for assessing total volume production on land units of the St. Regis (Alberta) lease (Gimbarzevsky 1964). Duffy (1964) used multiple regression techniques to find relationships between site factors and growth of lodgepole pine in the Alberta foothills and in 1965 he developed a forest land classification for the Mixedwood section of central Alberta on the basis of differences in soil parent material and soil moisture status as they influence white spruce site index.

Several authors have attempted to use soil survey reports to evaluate site productivity. Crossley (1951) had only very limited success in interpreting soil productivity relationships in a soil-surveyed subalpine area of southwestern Alberta. Duffy (1962) was able to show differences in merchantable volume between two soil series in western Alberta and was optimistic about the utility of soil surveys for delineating areas for intensive management. Dumanski et al. (1973) used soil survey information to stratify productivity (periodic annual increment) differences between parent materials, soil map units and various physiographic and soil properties. Lesko and Lindsay (1973) classified 15 forest community types and related lodgepole pine and white spruce site index to soil map units and soil properties in west-central Alberta.

Corns (1983) similarly related forest community types and their site index and mean annual increment to several environmental factors and Corns and

Pluth (1984) expressed lodgepole pine and white spruce site index and mean annual increment as a function of several soil, vegetation and climate variables using stepwise multiple regression. Forest productivity stratified against reconnaissance soil survey soil associations was also tested. In recent years the provincial government has been conducting integrated resource inventories within Alberta's forests (e.g. Bentz et al. 1984). These inventories have evolved from earlier biogeoclimatic classifications (Kojima and Krumlik 1979).

Most recently, Corns and Annas[1] have developed a field guide to forest ecosystem classification and interpretations for 12 forest management concerns for a west-central Alberta study area.

In addition, many descriptive studies of the vegetation of Alberta have been conducted with varying amounts of soils data included. Reconnaisance soil surveys are available for much of the southern and central Alberta boreal forest.

Saskatchewan

A study by Losee (1942) that ranked the forest productivity of six physiographic classes was among the earliest site classification work in Saskatchewan. Rowe (1956) used understory plant species to quantify site moisture regime and mentioned his methods' potential for rating a site's nutrient or climatic regime. Jack pine site index was related to three site quality classes that were defined primarily on understory vegetation (Kabzems and Kirby 1956). Jameson (1965) similarly related jack pine height growth to

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[1] Corns, I.G.W. and R.M. Annas manuscript in preparation, Northern Forestry Centre, Edmonton.

site defined by soil pore pattern moisture regime, and inferred nutrient regime. Van Groenwoud (1965) distinguished three white spruce community types that had characteristic species composition, soil properties, pH regimes and tree height growth.

Site classification methodology for the estimation of potential productivity of large tracts of land mapped at small scale was developed by Zoltai et al. (1967) under the Canada Land Inventory land capability classification for forestry as reported by McCormack (1967). The recent published work by Kabzems et al. (1976) characterizes the predominant forest ecosystems of the Boreal Mixedwood ecoregion with respect to vegetation, parent materials, soils, productivity and some management concerns. Most recently, Liu (1984) used regression analysis to express productivity, expressed as MAI, as a function of soil texture and drainage, within the provincial forest inventory framework.

Other descriptive accounts of vegetation plus reconnaisance soil survey information is available for much of Saskatchewan's forests. In addition, a number of ecological land classification studies have been conducted as background to assessing wildlife habitat and impact from resource development as reported by Appleby (1979).

Manitoba

Site classification began in Manitoba with the work of Halliday (1935) who elucidated relationships between understory vegetation, parent material and tree growth of Populus, Picea glauca, P. mariana and Pinus banksiana in Riding Mountain National Park. His widely accepted "Forest classification for Canada" (Halliday 1937) delineated forest regions, later subdivided into forest sections by Rowe (1959, 1972). Local volume tables for

Picea glauca and Populus tremuloides were constructed by Jameson (1963) for several combinations of physiographic site type (texture and moisture regime) and cover type. Jameson (1964) constructed empirical yield tables for Picea mariana on four groups of physiographic sites in four forest sections in Manitoba and Saskatchewan. Understory vegetation, moisture and nutrient regime were related by Mueller-Dombois (1964) to site index, considerations for potential productivity, choice of species and method for reforestation, and potential for habitat amelioration by drainage in forests of southeastern Manitoba. Subsequently, Mueller-Dombois (1965) provided keys to mapping forest sites based upon landform, parent material, drainage and vegetation. A soil survey covering a 7700 km^2 area of southeastern Manitoba (Smith et al. 1964) was used to rate the productivity and regeneration of 13 tree species on 36 soil series.

The potential productivity of large tracts of land was mapped at 1:250,000 during the Canada Land Inventory land capability classification for forestry (Zoltai et al. 1967, McCormack 1967). More recently ecological land classification studies were completed at 1:125 000 scale with several pilot areas mapped at 1:6000 (Borys and Mills 1979).

Northwest Territories

Very little work has been concentrated on the evaluation of land for timber production in the Northwest Territories as commercially valuable timber occurs only in the southern Yukon and Mackenzie River valleys (Zoltai 1979). Most ecological land classification studies have been conducted as baseline data for resource extraction (mainly pipelines) and for National Parks. Zoltai (1979) has cited a number of these. Rubec et al. (1984) have mapped ecodistricts of northern Canada at 1:1 000 000 scale.

A study of forest types defined on the basis of topography, soils, and vegetation and their relation to tree height growth was conducted by Jeffrey (1964) for the Liard River area.

Summary

I have mentioned over 30 accounts of work where attempts have been made to relate forest growth to site. Is there a thread in common with these studies or is there evidence of an evolution in thinking in studies of site classification? Early studies tended to focus upon attributes of soils, physiography, vegetation or climate and it was unusual to find studies that considered all of these important site characteristics.

During the past 15 years especially, we have seen the development of site classifications and land mapping systems that are more holistic and hierarchical. There is an awareness of the need to stratify the sample population, particularly in regional studies, according to macroclimate and physiography before attempting to ascribe site and productivity differences to soil and vegetation properties. Soil and vegetation scientists across Canada including the Canada Committee on Ecological Land Classification have played an important role here and Canadians are in the forefront in the development of regional site classifications. Such studies, whether they are called biogeoclimatic, integrated resource inventory, forest ecosystem classification, or ecological land classification have certain similarities. I am not suggesting that the value of much of the earlier work is somehow made less valuable. Rather, by now putting these studies within a bioclimatic and physiographic framework, we can supplement our knowledge of particular ecoregions, ecosections and land units at larger scale and we may with a greater degree of confidence, further extrapolate the results of many of these high quality earlier studies.

Successful, future site classification efforts (particularly those of a regional nature) will integrate climate, physiography, soils, vegetation, and perhaps other ecosystem components. Such integration will be necessary to make the classification work cost effective and to serve as a framework for an ever increasing variety of interpretations being demanded including forest productivity, several silvicultural and land management concerns, wildlife habitat, recreation, and even engineering and road construction.

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SCALE

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