FOREST LAND CLASSIFICATION IN CANADA AND CURRENT PROJECTS AT THE NORTHERN FOREST RESEARCH CENTRE

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Silviculturists introduced soil science to Canadian forestry in a small way during the 1930's and 1940's. Early pioneers were W.E.D. Halliday (1937); J.S. Rowe, whose work culminated with the publication of *Forest Regions of Canada* (1972); and G.A. Hills (1952, 1960), whose extensive work over three decades earned him the title "father of forest site classification in Canada." The late George Brown, working in Ontario, also made early contributions.

A more organized approach to forest land classsification began in the early 1960's under the auspices of the Canada Land Inventory led by R.J. McCormack (1965, 1970). This cooperative project, which concentrated on the more southerly forests of Canada, stimulated forest soils work in provincial forestry and university agencies. The Canada Land Inventory also sparked attempts at developing integrated soil and vegetation classification. Leaders in the development of these ecological (biophysical) land classification systems were M. Jurdant (Quebec, 1977), S.C. Zoltai (Western and Northern Canada, 1973, 1974, 1975), E.T. Oswald and J.P. Senyk (Yukon, 1977), and P.N. Sprout *et al.* (British Columbia, 1966). Integrated ecological surveys are now in progress in British Columbia, Alberta, Manitoba, and the Northwest Territories. In addition, much forest soil information is being obtained by the federal and provincial soil survey agencies throughout Canada.

Early studies of organic soils (peat and muskeg) have been led by F.C. Pollett (Newfoundland, 1972), N.W. Radforth (New Brunswick, 1977), and J.K. Jeglum (Ontario, 1974). This work is now much expanded, as attested to by *Muskeg and the Northern Environment in Canada*, edited by Radforth and Brawner (1977).

Soil fertility studies are in progress by M.K. Mahendroppa (New Brunswick, 1969, 1972, 1973, 1976); K.A. Armson (Ontario, 1961, 1966, 1968); J.K. Foster and I.K. Morrison, nutrient cycling (Ontario, 1977); G.F. Weetman, nitrification (Quebec, 1971); and H.H. Krause (New Brunswick, 1970). Considerable work has been done in forest nurseries by H.S.D. Swan (Quebec, 1971) and I.K. Edwards (Alberta, 1977).

Numerous other forest soil projects include podzolization (A. Gonzales, Quebec, 1970, 1971, 1973), regeneration on northern soils (G.J. Frisque, Quebec, 1970), interpretations (N. Keser, British Columbia, 1976), and microbiological studies (J.A. Dangerfield, British Columbia, 1975, 1978; R.J. Fessenden, Ontario, 1968).

Thus, one may readily conclude that all workers in soils in Canada have encountered the forest at one time or other. The Northern Forest Research Centre, Edmonton, is responsible for one of the largest regions of Canada, including nonforested soils of northern Canada, and as such provides an example of current soils-related projects. These projects are listed below.

LAND CLASSIFICATION

1. *Ecological (biophysical) land classification of Banff and Jasper National Parks, Alberta.* This project is an integration of landforms, soils, vegetation, and wildlife into a comprehensive land classification system. The results are to be used in master planning of the national parks from site-specific developments to regional land use and conservation zoning.

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2. *Northern soils.* Soils, vegetation, permafrost, and their interrelationships are being investigated in various Arctic and Subarctic regions of the Northwest Territories. These studies, in cooperation with the Soil Survey of Canada, led to the development of the Cryosolic Order, which permits a rational description of northern soils. The significance of frost-induced microtopography in terms of subsurface ice accumulation and frost heaving is determined in relation to vegetation cover. These studies provide information on anticipated consequences of disturbance in different terrain and soils. By determining sensitivity of the terrain to disturbance, recommendations can be made to avoid or minimize damage to terrestrial ecosystems.

Current contributors:

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3. *Biogeoclimatic forest ecosystem classification in Alberta.* The biogeoclimatic ecosystem classification concept was developed by Dr. V.J. Krajina at the University of British Columbia (1965-1970). It considers all aspects of nature, such as climate, vegetation, soil, geological substratum, shape of the terrain, wildlife, and soil organisms.

The biogeoclimatic ecosystem classification of Alberta started in 1976 with the objective of developing a classification of forest ecosystems that will allow forest managers to improve site-specific management of forests in the province. Detailed study of forest ecosystems was undertaken in the northwestern part of the province in 1977; data and samples are currently being analyzed. In 1978 the northeastern part of the province is to be studied, and in 1979 southwestern Alberta. Completion of the project is scheduled for 1981.

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FOREST SOIL FERTILITY

1. *Forest nursery soils.* Silvicultural undertakings include advice to producers of bare root and container seedlings, determining nutrient requirements of coniferous seedlings in containers and conventional nurseries, studying the effects of soil amend-

ments and timing of fertilization on growth of conifer seedlings, greenhouse experiments on the effects of nitrogen source and spacing on growth of coniferous seedlings, movement of nutrients in nursery soils, and effects of salt water spills on forested and agricultural land.

Contributors:

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POLLUTION

1. *Heavy metals.* Studies on the effects of heavy metal pollutants on plant-soil relationships were begun in Thompson and Flin Flon, Manitoba in 1977. The present focus of research is on availability of metals to plants and the movement of metals in soil profiles. Future plans include the study of metals on the nutrient cycling properties of the forest litter layer.

   Contributors:

   Dr. S.S. Malhotra - Plant Biochemist, NFRC

   Dr. G. Hogan - Plant Physiologist, NFRC

   O.K. Fenn - Air Pollution Biology Technician, NFRC

2. *Air pollution impact.* The soils work dealing with the detection and assessment of air pollution impact on forests in the Athabasca Oil Sands Area has mainly concentrated on description and classification of specific upland biomonitoring plots, initiated in 1975. Some soil nutrient analyses have been completed in order to separate soil from atmospheric factors in pollutant concentration in vegetation samples. Future plans include long-term monitoring of soils and vegetation for air pollution impact.

   Contributors:

   Dr. S.S. Malhotra - Plant Biochemist, NFRC

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3. *Impact of pollutants on nutrient status.* The effects of atmospheric pollutants (SO_2 and other S compounds) and heavy metals on nutrient status of soils are being studied at Fort McMurray, Alberta and Flin Flon, Manitoba. In addition, the nutrient status and alteration brought about both by direct and indirect atmospheric pollutants on conifer growth (jack pine) is of major interest. Both soil and conifer nutrient compositional changes in response to atmospheric pollution are used to measure the intensity of effects.

   Fertilization of lodgepole pine (30-yr-old stands) on two major soil series and the effects of N, P, and S on both soil chemistry and stand growth continue to be a major responsibility.

   Contributors:

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SOIL SERVICE LABORATORY

This regional soil service laboratory was initiated in 1966 for analyses of soil, plant, and water samples. Samples are from various research programs in agricultural areas, shelterbelts, tree nurseries, and forests. About 17 000 analyses were performed on over 3000 samples during 1977-78.

The lab participates in an interlaboratory comparison of methods of soil and plant analysis conducted by the International

Union of Forestry Research Organizations and in analyzing reference samples for comparative data generation by the Canada Soil Survey Committee.

Contributors:

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FUTURE NATIONAL AND REGIONAL CONCERNS INVOLVING FOREST SOILS

1. Regeneration of approximately 20-24 million ha of forest land that has not regenerated.

2. Maintenance of nutrient levels, seedbed preparation, and moisture relationships in the face of increased utilization (whole tree concept and additional species).

3. Pollution problems from the long-term transportation of SO_2 and heavy metals.

4. Relating forest growth to soil characteristics so as to acquire better knowledge of the forest products, where they are located, and how the forest land should be managed.

5. Assessing land use impacts on northern soils containing permafrost and learning how to manage and preserve the stability of such soils.

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