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FOREST ECOSYSTEM CLASSIFICATION IN ONTARIO'S CLAY BELT

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INTRODUCTION

The Clay Belt forest ecosystem classification project was a cooperative research and development study involving government and educational agencies. Its objectives were to: (i) develop an ecological classification of forest ecosystems with an emphasis on the commercial forest; (ii) provide an initial interpretation and evaluation of the ecosystem types for forest management purposes; and (iii) develop practical aids for identifying, recognizing, and mapping the ecosystem types both on the ground and on aerial photographs.

A field guide to forest ecosystem classification for the Clay Belt was published in 1983 (Jones et al. 1983). The guide described 23 vegetation types and 14 soil types for the Clay Belt. The soil and vegetation types were further integrated, with due consideration of practical operational constraints, to form 14 management-level classes suitable for developing silvicultural prescriptions. These 14 classes were termed operational groups (OGs) and were defined as landscape segments supporting mature forest, which have a known range of soil and vegetation features and probable responses to specific silvicultural prescriptions (Fig. 1).

Depending on the nature of the work, any or all of these basic classification units can be used for site description. For example, field staff doing precut inspections for the purpose of determining management alternatives might use the OGs; forest researchers might use the vegetation and soil types in their work.

MANAGEMENT CONSIDERATIONS FOR THE BLACK SPRUCE DOMINATED OPERATIONAL GROUPS AND VEGETATION TYPES

Because of the importance of the species, considerable emphasis is placed on the management of black spruce ecosystems in the Clay Belt. Integration of harvesting with regeneration planning and prescriptions is generally viewed as essential for successful management of black spruce ecosystems, since the harvest systems used determine to a great extent the regeneration alternatives available after logging.

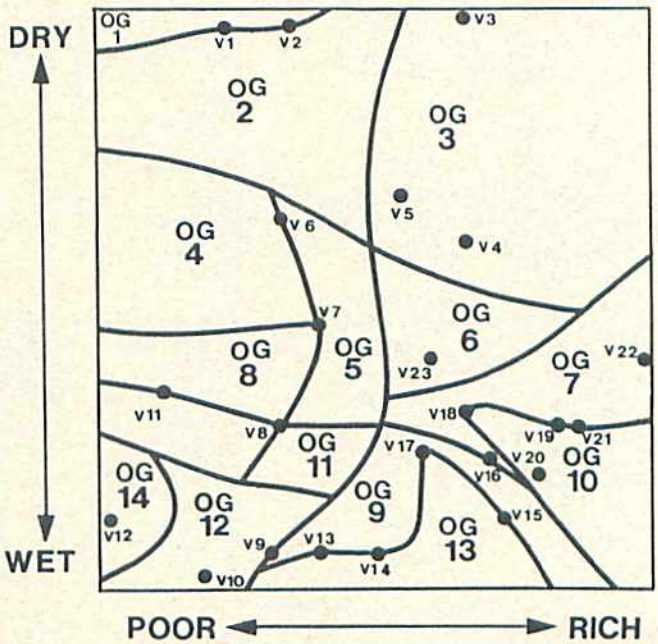

Figure 1. The operational groups included in the Forest Ecosystem Classification for northeastern Ontario.

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There are a number of operational considerations that determine the silvicultural alternatives available for management of a particular black spruce ecosystem. These include trafficability for equipment operations, availability of seedbeds for seed-dependent regeneration prescriptions, site fertility, abundance and distribution of black spruce advance growth for natural regeneration, and availability of food species and shelter for wildlife.

In turn, certain ecosystem elements that are inherent in the Clay Belt FEC system can be used to evaluate the potential suitability and limitations of a site for a particular prescription. Key elements include organic matter depth, humus form, soil texture, moisture regime, forest floor substrates, stand composition, and understorey plant species. Tables 1 and 2 summarize data for several key ecosystem elements of the black spruce dominated OGs and vegetation types, respectively.

USE OF THE FEC SYSTEM BY CLAY BELT FOREST MANAGERS

The Clay Belt FEC system has been incorporated into the silvicultural ground rules in most timber management plans in Ontario's Clay Belt. These rules describe the most commonly used management prescriptions by site type. In the ground rules, the OG descriptions serve as a framework for silvicultural prescriptions and help to integrate existing land resource information, including forest resource inventory

Table 1. Summary of key ecosystem elements for the black spruce dominated operational groups.

OG	Vegetation types[a]	Forest humus forms[a,b]	Depth of organic matter(cm)[a]	Soil texture[a]	Moisture regime[a]	Common forest cover types[c]	Mean % *Sphagnum* moss cover	Mean % feathermoss cover
1	V1[4] V7[3] V2[1] V11[1] V23[1]	FMor[6] HMor[4]	(1–10)[8] (>10)[2]	variable	(0–1)[8] (>1)[2]	rock, Pj, Pj–Sb	2	32
4	V6[6] V7[4]	FMor	(5–15)[8] (>15)[2]	sandy[8] CLoamy[2]	(2–5)[8] (<2)[2]	Sb, Sb–Pj, Pj	4	72
5	V7[5] V8[3] V6[2]	FMor	5–20	FLoamy[6] Clayey[4]	(3–6)[9] (<3)[1]	Sb, Sb–Pj, Pj	15	68
8	V8[8] V7[1] V11[1]	PMor	(20–30)[8] (>30)[2]	FLoamy[6] Clayey[3] (Sandy–CLoamy)[1]	5–6	Sb	49	37
11	V8[6] V11[4]	PMor	40–160+	organic	(7–8)[9] 6[1]	Sb	44	38
12	V9[7] V10[3]	PMor	40–160+	organic	(7–8)[9] 6[1]	Sb, Sb–Ce	59	19
13	V14[4] V13[3] V15[2] V17[1]	PMor	40–160+	organic	(7–8)[9] 6[1]	Sb, Sb–La–Ce, Ce–La	36	29
14	V12	PMor	120–160+	organic	8[9]7[1]	Sb,treed bog, treed fen	86	8

[a] Superscripts represent the proportion of samples and total ten in any one category.
[b] FMor = fibrimor, HMor = humimor, PMor = peatymor, CLoamy = coarse loamy, FLoamy = fine loamy.
[c] Pj = jack pine, Sb = black spruce, Ce = cedar, La = larch.

Table 2. Summary of key ecosystem elements for the black spruce dominated vegetation types.

Vegetation type number	Moisture regime range	Mean moisture regime	Mean organic depth (cm)	Range of organic depth (cm)	% sites on shallow soil (<1m)	Mean depth to carbonates (cm)	Mean % *Sphagnum* moss cover	Mean % feathermoss cover
1	0 – 1	0.3	6	3 – 9	75	none	1	28
6	0 – 5	2.5	9	3 – 13	14	129	4	71
7	2 – 6	4.0	14	7 – 30	5	97	5	74
8	3 – 7	5.5	34	9 – 92	0	95	45	41
9	6 – 8	7.3	107	40 – 290	0	151	58	17
10	6 – 8	7.0	84	37 – 132	0	151	62	25
11	5 – 8	7.0	79	5 – 160	7	146	44	36
12	7 – 8	7.8	156	120 – 177	0	179	86	8
13	6 – 8	7.1	84	9 – 160	0	120	53	26
14	5 – 8	7.1	90	7 – 160	0	151	19	42
17	4 – 6	5.3	28	10 – 79	0	48	4	65
18	2 – 5	3.5	10	3 – 20	0	42	0	32

(FRI) working groups, stand types, and soil inventories. Table 3 lists examples of a number of management considerations for the OGs.

RELATED BLACK SPRUCE RESEARCH

Research conducted under the Canadian Forest Service – Ontario's Black Spruce Ecosystem Program revealed relationships between the abundance and distribution of black spruce advance growth, and the FEC OGs and vegetation types (Groot 1984). Related research showed differences among the FEC OGs with regard to the effectiveness of different harvest methods in protecting advance growth and the site (Groot 1987). Research on black spruce direct seeding can also be related to the FEC by comparing seedbed distribution in the different OGs to determine the probability of success and the seeding rates needed.

Although the Clay Belt classification was not intended to address timber productivity, there has been considerable interest in this topic. A number of studies related to growth and yield have been conducted. Although these studies used different measurement criteria to evaluate productivity, the rankings for the OGs have proved to be similar (Table 4). This suggests that the Clay Belt site classification provides a reasonable approximation of timber productivity classes.

MANAGEMENT APPLICATIONS

The Forest Ecosystem Classification system for the Clay Belt was designed to address specific concerns of government and industry forest managers. Since the *Clay Belt Forest Ecosystem Classification Field Guide* was published, solutions to many of these problems have been found. The FEC has played an important role in this process by providing a useful framework for inventory, research, management interpretations, and prescriptions. Perhaps the most valuable contribution of the FEC system has been in providing a common framework for communication – a "site language", and today forest managers in the Clay Belt are "talking FEC".

Table 3. Summary of management considerations for the black spruce dominated FEC operational groups.

OG No.	Frost-free ground strength class	Suitability for careful logging to protect advance growth	Suitability for direct seeding black spruce	Moose habitat potential, early winter	Moose habitat potential, late winter
1	very good	low	low	low	low
4	moderate	medium	low	low	medium
5	moderate	medium	low	low	high
8	poor	high	high	low	high
11	very poor	high	high	low	medium
12	very poor	medium	medium	low	low
13	extremely poor	medium	medium	low	low
14	very poor	unmerchantable	unmerchantable	low	low

Table 4. Productivity rankings for the black spruce dominated operational groups based on different measurement techniques.

Measurement criterion	Productivity rankings by OG						
	Highest			---->		Lowest	
Mean annual increment of black spruce stands at age 90 (Ray 1985)	5	--	13	12	8	11	14
Black spruce site index at age 100 years (Ray 1985)	--	--	12	13	8	11	14
Black spruce 1-year seedling growth (Munson and Timmer 1986)	5	--	--	12	--	11	--
Black spruce mean unit needle nitrogen content (Timmer and Ray 1988)	5	4	8	13	12	11	14
Black spruce site index at age 100 years (Whynot and Penner 1990)	--	8	13	5	12	11	14
Black spruce foliar nitrogen content (Nieppola et al. 1993)	5	4	12	13	8	11	14

The principal applications of the Clay Belt FEC classification are as follows:

1. It provides a practical system for site recognition in the field that is easy to teach, learn, and use. It takes 1 or 2 minutes to allocate a field site to an operational group.

2. It is reliable and repeatable since it is based on a substantial data base and a comprehensive analysis.

3. It provides a meaningful framework to organize and build upon our present and future forest management experience. Since the system is applicable over the entire Clay Belt, management experience gained in other areas can be compared and transferred. For example, it can help in deciding the season and method of harvesting, potential for black spruce advance growth, regeneration method (natural, seeding, planting), and vegetation management options.

4. It provides consistency: through a common naming system for inventory, management interpretations, and planning and a framework for integrating and interpreting existing land resource inventories, such as the FRI and soils maps.

5. It provides a common system for site description, a framework for field-oriented research and development work, and facilitates transfer of research knowledge.

6. Habitat-potential maps are used to determine the applicability of timber management guidelines for the provision of moose habitat. (Ontario Ministry of Natural Resources 1986). It provides a "site language" to permit communication among foresters, biologists, field technicians, equipment operators, planners, and researchers; in fact, anyone involved in forestry work.

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