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MANAGEMENT OF BLACK SPRUCE DOMINATED VEGETATION TYPES OF NORTHWESTERN ONTARIO

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INTRODUCTION

Northwestern Ontario's Forest Ecosystem Classification (NWO FEC) was developed by the Canadian Forest Service – Ontario and the Ontario Ministry of Natural Resources to provide a framework for improved communication about forest ecosystems in northwestern Ontario (Sims et al. 1989). The NWO FEC recognizes 38 vegetation types (V-types) defined by the presence/absence or relative abundance of indicator species, as well as 22 soil types (S-types) defined principally on the basis of soil texture class, moisture regime, and depth to bedrock. Each V-type and S-type describes an average stand or soil condition.

Another technical note in this series (Kershaw and Sims 1994) describes 11 V-types in which black spruce (Picea mariana [Mill.] B.S.P.) is the dominant overstory species. The current note provides examples of management limitations and opportunities associated with these V-types. Additional details and other forest management interpretations are provided by Racey et al. (1989).

MANAGEMENT APPLICATIONS

The NWO FEC provides "modal" descriptions of V-types and S-types based upon the field description of a large number of forest plots. In developing this system a range of analyses and interpretations was conducted in order to better understand the common forest conditions. Table 1 summarizes general vegetation and soil characteristics of the 11 V-types discussed in this note.

An "ordination diagram" of the V-types (Fig. 1; cf. Sims et al. 1989 for a full explanation of its derivation) places all of the V-types within a two dimensional framework; general nutrient gradient (poor to rich) is indicated along the horizontal axis and moisture regime (wet to dry) is scaled along the vertical axis. The ordination can be used to help relate additional features to the variability of northwestern Ontario forest conditions. Figure 1 shows generalized classes of soil parent material (C horizon) texture overlayed onto the ordination.

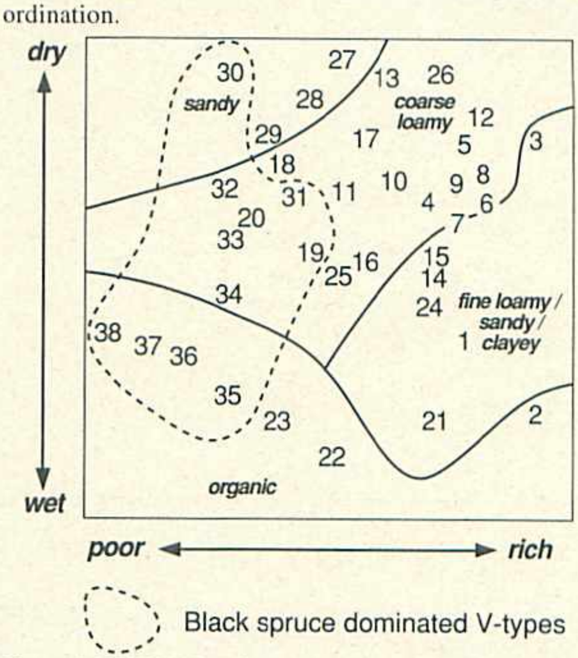

Figure 1. NWO FEC ordination, overlaid with the distribution of major soil texture (C horizon) classes. The 11 black spruce dominated V-types discussed in this note are indicated by the hatched line.

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Table 1. Dominant characteristics of 11 black spruce dominated V-types defined by the NWO FEC system. Soil moisture and depth classes are defined by Sims et al. (1989).

Dominant features	Dry upland black spruce/ jack pine			Upland black spruce/ feathermoss			Transition lowland black spruce/ *Sphagnum*			Black spruce wetland	
V-type	19	20	30	31	32	33	34	35	36	37	38
Tree layer											
Black spruce	x	x	o	x	x	x	x	x	x	x	x
Jack pine	o	o	o	x	x	o					
White birch	o	o									
Aspen	x										
Tall shrub	x			o	o			x			
Advanced black spruce growth	x	S	S	x	S	S	x	o	S	S	S
Balsam fir understory	x			x				x	S		
Alnus rugosa							x	x	o		
Alnus crispa		o		o	o	o					
Dwarf shrub	x	x		o			x	x	x		
Ericaceous spp.	x	x	x	x	x	x	x	x	x	x	x
Vaccinium spp.	o	o	x	o	o	o	o	o	o	o	o
Herb layer											
Herb rich	x			o				x	x		
Herb poor		x	x		o	o	o			x	x
Ground cover											
Feathermoss	x	x		x	x	x	x	x	x	x	o
Sphagnum		o					o	x	x	x	x
Lichen		o	x								
Soil moisture											
Dry		o	x		o	o					
Fresh	x	x	o	x	x	x					
Moist	x					o	x		x	o	
Wet							o	x	o	x	x
Soil depth											
Very shallow			x								
Moderately deep		x	o		o	o					
Deep	x	o		x	x	x	o		x		
Organic							x	x	x	x	x

Legend: x = dense or dominant condition, o = moderate, S = scattered clumps, blank spaces = low to absent.

The simple nomenclature used by the NWO FEC system provides a framework for the organization of existing information on common forest management practices. V-types may be grouped into larger, more generalized categories called Treatment Units (TUs). TUs are management oriented aggregations of defined soil and vegetation conditions that possess similar species composition, productivity, macroclimate, or ecological properties. They can easily be recognized in the field as broad landscape units that respond similarly to a given silvicultural treatment regime. A field guide (Racey et al. 1989) describes a wide range of forest management interpretations related to V-types and S-types.

Harvesting opportunities are typically limited to the winter season on V34 to V38 and moist phases of V19, V20, and V31 to V33. Moist to wet sites are more susceptible to rutting and compaction damage by heavy equipment. Careful selection of the types of machinery used on these V-types will help to minimize site damage. Winter harvesting is usually recommended for the very shallow, dry phase of V30. On these sites, excessive stoniness and shallow depth to bedrock may limit equipment choices as well as reforestation options. The dry phase of V19, V20, and V31 to V33 pose few limitations for equipment.

Expected competition is limited on the lowland black spruce/*Sphagnum* V-types 34 to 38. It is also limited on the dry V30. Moderate levels of competition following harvest are associated with the moist and dry phases of the upland black spruce/feathermoss V-types 19, 20, and 31 to 33. On fresh phases, high levels of competition following harvest are common and competition control is often recommended on these sites. The most common competitors on these V-types include trembling aspen *(Populus tremuloides* Michx.), *Calamagrostis canadensis* (Michx.) Beauv., *Alnus rugosa* (Du Roi) Spreng., and *A. crispa* (Ait.) Pursh (Buse and Bell 1992).

SUSCEPTIBILITY TO SPRUCE BUDWORM ATTACK

Key factors influencing a stand's susceptibility to infestation by spruce budworm *(Choristoneura fumiferana* Clem.) are its composition, age, and structure. Balsam fir *(Abies balsamea* [L.] Mill.) is a primary host for spruce budworm and typically suffers heavy mortality during infestations.

V19 generally has the highest balsam fir component and is normally at higher risk than the other black spruce dominated V-types (Fig. 2). With the exception of the herb-poor and poorly stocked V37 and V38, the remaining spruce V-types are ranked as moderately susceptible to spruce budworm attack. White spruce (*P. glauca* [Moench] Voss) and black

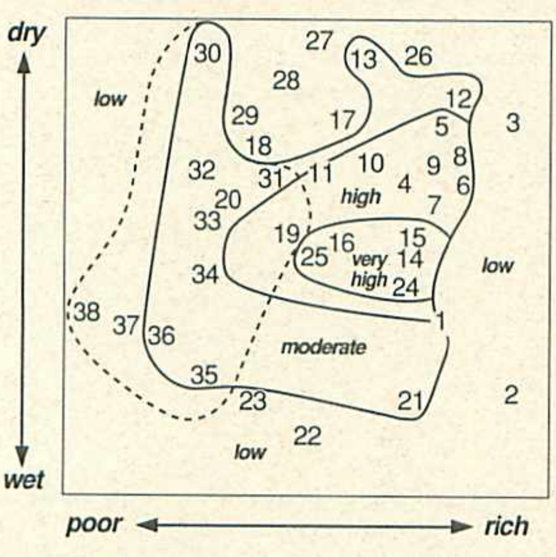

Figure 2. NWO FEC ordination (as in Fig. 1) overlaid with classes of susceptibility to spruce budworm (cf. Racey et al. 1989). The 11 black spruce dominated V-types are indicated by the hatched line.

spruce mortality is usually low to moderate, depending upon the intensity and duration of an infestation. Stands composed of trees with reduced vigour resulting from site-induced stress may be more vulnerable to mortality from budworm attack. Stands located on dry, well drained soils or on very wet, poorly drained soils, may be more vulnerable.

POTENTIAL FOR BLACK SPRUCE ADVANCE REGENERATION

Forest harvesting operations should be planned so as to minimize damage to black spruce advance regeneration, particularly on those V-types where such regeneration occurs in sufficient quantities to assist in the creation of a well-stocked future stand. V-types with the greatest potential for black spruce advance growth typically occur on wet, *Sphagnum* dominated organic soils (V34 to V38) (Wickware et al. 1990). Black spruce advance growth may also be common on conifer dominated, nutrient poor upland stands (in particular V20, V30, V32, and V33) on shallow soils with less than 20 cm of mineral soil over bedrock and a 5- to 20-cm organic surface horizon. Many of the mixedwood dominated V-types, with diverse and abundant herb and shrub components, have a lower potential for black spruce advance growth.

POTENTIAL FOR PRESCRIBED BURNING

Prescribed burning is the deliberate application of fire to meet forest management goals. These goals may include reduction of slash or wildfire hazard, disease control, site preparation, and wildlife habitat improvement. Fire may also cause an increase in soil temperature and pH. Fuel loading and wildfire potential of NWO FEC V-types are estimated by Stocks et al. (1990).

Black spruce dominated V-types on fresh to moist, fine textured, deep to moderately deep soils (V20, V31, V33, and V34) generally benefit from prescribed burning after harvest. This occurs because fire brings about an increase in soil nutrients and a decrease in vegetative competition, especially balsam fir (Stocks et al. 1990). On sites with over 40% advance growth stocking or where organic soils provide a suitable black spruce seedbed, prescribed burning is usually not recommended unless slash reduction is the primary objective. Prescribed fires are not recommended on V30 if they are likely to burn deep enough to remove the usually thin forest floor organic layer and expose the mineral soil and/or bedrock. This significantly decreases the water holding capacity and soil moisture content of the remaining soil and lowers long-term site productivity.

Prescribed burning opportunities are limited on the moist to wet V35 to V37, and it is not normally recommended for V38 (Racey et al. 1989). Under some circumstances, however, where other site preparation methods may compact the soil, cause rutting, or increase vegetative competition, prescribed burning on V35 to V38 may be the only viable option. Often, when prescribed fire is thought of for these sites it is associated with burning a large boreal forest clear-cut, but good results have occurred on smaller sites such as strip cuts. Proper ignition is required on these smaller burns to draw the fire and associated heat away so as to prevent damaging residual trees in the uncut strips.

CONCLUSIONS

The classification of black spruce dominated stands into one of 11 NWO FEC V-types assists forest managers and resource planners to better understand the ecology of a given stand. The NWO FEC provides a common, easy-to-use framework for naming and describing forest ecosystems that occur in northwestern Ontario.

The organization of a wide range of resource management interpretations in terms of NWO FEC units (V-types, S-types, TUs) has simplified the development of silvicultural and other management prescriptions for northwestern Ontario forests.

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