

The Natural Disturbance Model of Forest Harvesting: An Overview

Concept:

- Through natural selection the species inhabiting the boreal forest have developed adaptations for maintaining viability in the face of catastrophic disturbances such as fire.
- Based on the above observation, it has been hypothesized that that biodiversity can be maintained in the presence of industrial use if industrial practices are made to approximate natural disturbances. This hypothesis forms the basis of the Natural Disturbance Model (NDM) of forest harvesting.
- In practice, it is not the actual disturbance process that the NDM seeks to approximate, but the forest structure and pattern resulting from disturbance and subsequent forest regeneration. The operational goal is to maintain forest structure and pattern, along with ecological processes, within the typical range of natural variation.
- The assumption (and hope) is that the key to maintaining biodiversity is not necessarily the strict emulation of fire (or other disturbances) but the maintenance of habitat diversity, however that may be achieved.

NDM targets:

- The ability of forestry companies to replicate the forest structures and patterns produced by natural disturbances is dependent on how well these structures and patterns can be described.
- Because historical landscapes cannot be adequately characterized, using the current landscape for primary guidance is the only realistic option available.
- For companies to implement the NDM they must first develop a series of targets, appropriate for their management area, that can be incorporated into the planning process. To do this, key attributes that characterize forest structure and pattern are selected (see below), and estimates are made of their average level and range of variation under natural conditions. Economic and logistic constraints may influence the definition of the actual operational targets in some cases.

Attributes related to stand structure:

- Quantity and distribution of residual live trees after harvest
- Quantity and distribution of standing dead trees after harvest
- Quantity and distribution of downed woody material after harvest
- Soil nutrient levels
- Amount of disturbance and compaction of the forest floor

Attributes related to landscape pattern:

- Distribution of stand age (including the proportion of old-growth)
- Distribution of stand type (including the proportion of mixedwood stands)
- Distribution of stand size (including the proportion of large unfragmented stands)
- Patch shape and spatial arrangement of patches on the landscape

Implementation:

- Implementation of the NDM involves the integration of NDM targets into forest management planning. This generally involves changes in harvest planning procedures and in operational practices. The future landscape should resemble the reference landscape at all points in time and at no time should the value of structure or pattern attributes exceed the range of natural variation.
- The target distributions for size, shape, and spatial arrangement of forest stands can best be achieved by defining harvest blocks on the basis of existing stand boundaries.
- In order to maintain mixedwood stands the current dual land base system (coniferous and deciduous) must be abandoned and mixedwood management techniques need to be employed in place of clear-cut harvesting and plantation management.
- The maintenance of old-growth stands will require a change in the current policy of preferentially targeting older stands, and a reduction in the overall rate of harvest.

Sustained-yield management:

- The government of Alberta continues to use sustained-yield management (SYM) as its approach to forest management; the NDM has not yet been adopted.
- Under SYM the rate of harvest cannot exceed the rate of tree growth; however, there are no requirements for maintaining the ecological integrity of the system.
- Under SYM older age classes are preferentially targeted for harvest. The intent is to liquidate all age classes older than the optimal harvest age (generally ~ 80 years for aspen and ~110 years for spruce).
- Under SYM in Alberta the general approach is to clear-cut stands and then force regeneration to either pure spruce or aspen as quickly as possible (using plantation techniques for spruce). Mixedwood stands are lost from the system in the process, and non-merchantable vegetation is actively targeted for elimination. There are no targets for maintaining structural attributes on stands after harvest.
- Harvest blocks under SYM in Alberta are generally of uniform size and shape, and hence the natural variation in stand size and shape is lost over time. In particular, large contiguous patches, required by "interior" wildlife species, are lost from the system.
- The overall effect of SYM is to reduce habitat diversity by producing a forest that is younger and simpler than natural-origin forests. Reduced habitat diversity will in turn result in decreased species diversity.