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Forecasts of Triad zoning scenarios on New Brunswick Crown License 1

Highlights

- Triad forest management is the allocation of a forest into three zones: one to provide primarily conservation values; one to provide primarily timber values; and one that places near equal emphasis on both.
- Projections for a 400,000 ha landbase in New Brunswick showed that, depending on forest condition, 100-year average harvest levels could be maintained when reserve area increased, so long as close to equal area was allocated to intensive management. Such increases in reserves and intensive management resulted in short-term harvest reductions and long-term harvest increases.
- Triad forest management affords the manager many allocation options to create different future forest conditions. Although each option will provide economic, social and ecological values of importance, inevitably, increased provision of some values will result in reductions of others.

Triad forest management

Seymour and Hunter (1992) defined a management strategy they termed Triad, where both reserves and intensively managed areas are nested in areas of extensive management. *Reserves* are normally considered areas free from timber harvesting, but the definition of extensive and intensive varies considerably. The *intensive zone* is often described as a zone where practices are implemented to create significantly higher timber yields than on other portions of the landbase. These areas may still provide non-timber values such as habitat, but the emphasis is on timber production. The *extensive zone* is the matrix within which the reserves and intensively managed area are placed. To be effective, this zone must be a source of timber on one hand, but be sufficiently different from the intensive zone on the other, so that it provides conditions that might not exist when the main objective is timber production.

An oft-cited claim about the Triad approach is that increased intensity of management for timber in a portion of the forest will allow establishment of increased reserve area without reductions in harvest levels. Following this, is the assumption that the ability to increase reserves *without* compromising timber production might lead to improved forest-level provision of social, economic and ecological values.

Study location and analysis

The 400,000 ha Upsalquitch Crown License 1 in northern New Brunswick was used as the study area (Figure 1). Remsoft's Woodstock forest planning model was used to forecast 36 scenarios where reserves and intensively managed area varied in 5% increments from 10-35%, and the rest of the forest was allocated to extensive management. Each scenario was evaluated in terms of several economic, social and ecological forest value indicators. However, in this research note we only report harvest volume and area treated by various silviculture systems. The objective of the analysis was to establish general relationships between performance of each forest value indicator and area allocated to reserves, intensive and extensive management areas. The salient questions were:

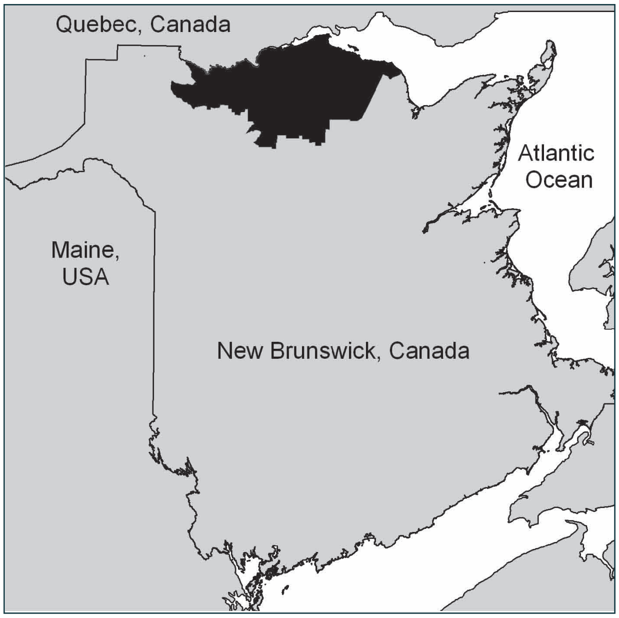


Figure 1. Location of New Brunswick Crown Timber License 1 (in black) within New Brunswick and eastern Canada.

- Under what allocation does each forest value indicator reach its maximum and minimum?
- To what changes in allocation is each forest value indicator most sensitive?

With intensive management, natural stands were forecast to be clearcut and planted to spruce species. Plantations were forecast to receive a herbicide treatment, to be commercially thinned at age 35 and to be clearcut at age 50. Under extensive management, all stands deemed eligible for non-clearcut harvesting (i.e. shelterwood, patch/strip and uneven-aged selection) were so treated. Both clearcut and non-clearcut treatments in the extensive zone were forecast to have 10-20% permanent retention, with the expectation that mature forest habitat would be partially or fully maintained. No harvest or silviculture treatments were forecast in the reserve zone.

Maintaining long-term cumulative harvest levels

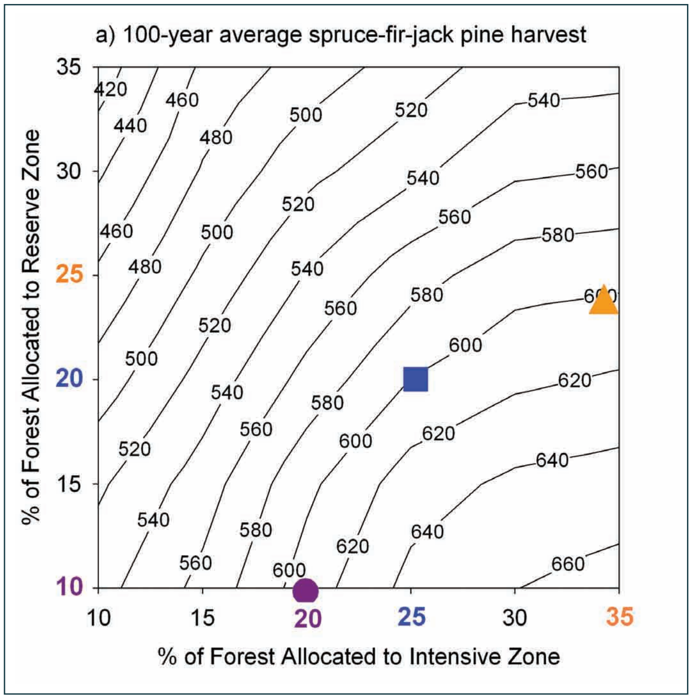
Figure 2a reveals the maximum, minimum and pattern of average harvest results under all forecast scenarios. When reserve area was held constant, the annual average harvest volume increased by approximately 25% as the intensively managed area increased from 10% to 35% (moving horizontally across Figure 2a). When the intensively managed area was held constant, average annual harvest volume decreased by about 20% as reserve area increased from 10% to 35% (moving vertically on Figure 2a).

An average annual harvest level could be maintained across scenarios that simultaneously increased reserves and intensively managed area (moving at a 45° angle on Figure 2a). As an example, if 600,000 m^3/yr was an annual average harvest target, it could be achieved using various reserve/intensive allocation combinations, including *10%/20%*, 20%/25%, and 25%/35% (Figure 2a). In these cases, harvest volume lost by allocating an extensively managed hectare to reserve was offset by an equal volume gained by allocating an extensively managed hectare to intensive management. This resulted from the harvest rate in the intensively managed area being approximately double that in the extensively managed area.

Much of the literature on the Triad approach reports this ability to increase reserves and maintain harvest levels. That potential exists on this landbase, but only for the cumulative, or 100-year average harvest level. The total volume produced over 100 years may be an important indicator, but perhaps more important is the timing of *when* that volume is available.

Triad allocation influenced timing of harvest availability

Although alternative scenarios produced similar average harvest levels (Figure 2a), the timing of when the volume was available for harvest differed. Reserves created in the short-term reduced operable



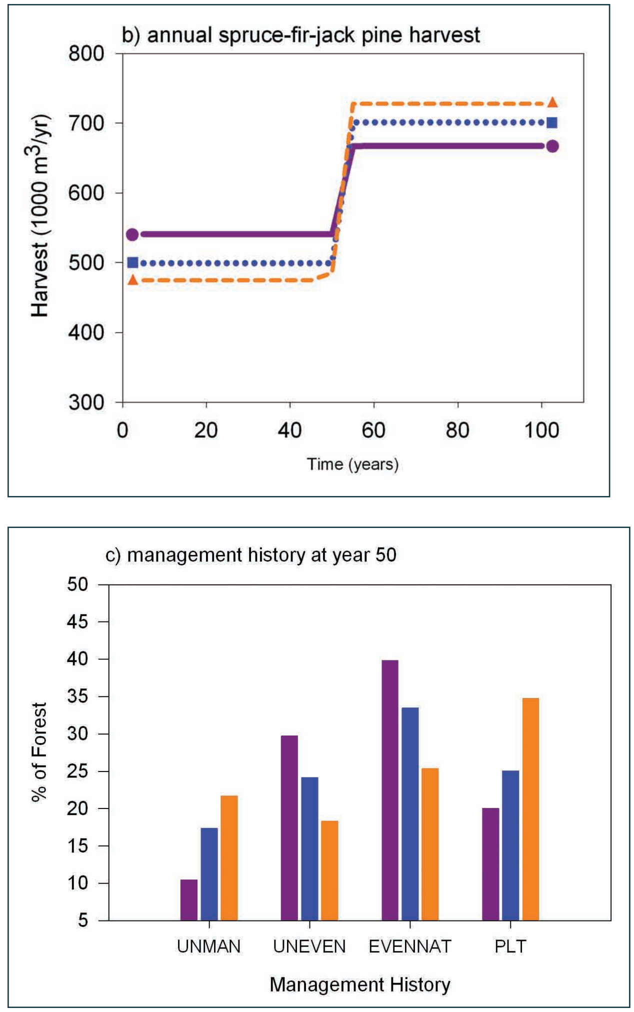


Figure 2. Comparison of three scenarios (*10% reserve/70% extensive/20% intensive*, 20% reserve/55% extensive/25% intensive, and 25% reserve/40% extensive/35% intensive) that each produce an annual average harvest of 600,000 m^3/yr. The graphs compare results in terms of 100-year annual average spruce-fir-jack pine harvest expressed in thousands of m^3 (a, above); spruce-fir-jack pine projected over a 100-year planning horizon (b, top right); and area in unmanipulated (UNMAN), uneven-aged management (UNEVEN), natural regeneration having been harvested by even-aged treatments (EVENNAT) and plantations (PLT) at year 50 (c, bottom right).

inventory in the short-term, whereas intensive management implemented in the short-term increased operable inventory in the long-term. As a result, increasing reserve area reduced short-term harvest levels (1-25 years), even with simultaneous increases in intensively managed area. When plantations became available after 40-50 years, the short-term reduction in harvest volume was usually regained, depending on area in plantations and area removed for reserves. An example of this effect is shown in Figure 2b. Although the *purple*, blue and orange scenarios all produce an annual average harvest of 600,000 m^3/yr, timing of harvest differed depending on the allocation of area to reserves and intensive management. Short-term harvest (1-50 years in future) was reduced by 13% when reserves went from *10%* to 25%, and long-term harvest (51-100 years in future) increased by 12% when intensive management went from *20%* to 35%.

The ability to implement the Triad approach without reductions in harvest levels depends on several factors, and will vary by forest and how the three zones are allocated. The following factors should be considered when assessing the potential short-term impacts of the Triad approach:

a) *The age-class structure*: if a "strong" allowable cut effect exists (i.e., the ability to increase the short-term harvest based on projected long-term productivity increases), intensive management may allow greater short-term increases in harvest volume and less impact of establishing reserves.

b) *The composition and configuration of reserves*: if area with low merchantable volume (young stands), or area already managed for conservation values that have low harvest rates are allocated to reserves, there may be less short-term negative impact.

c) *The transition to reserves*: if some very light harvesting was allowed in the forest to be allocated to reserves, merchantable inventory could be recovered, which would reduce the short-term negative impact of reserves, and might make allocating area to reserves more attractive.

Many options to create future forest conditions

Strategies that produce similar average harvest levels resulted in distinctly different forest conditions. The effect of allocation choices on the range of future forest conditions is revealed in Figure 2c using the same 3 scenarios as in Figures 2a and 2b. Under these three scenarios, after 50 years:

1) Area of unmanipulated forest increased to approximately the area allocated to reserves.
2) Area in plantations increased to the area allocated to intensive management.
3) The combined area of uneven-aged management and even-aged natural regeneration declined by an area equal to the increase in plantations and unmanipulated forest.

For example, the unmanipulated area at year 50 varied by 12% (from 10% under the *10% reserve* scenario to 22% under the 25% reserve scenario). This was accompanied by a 15% increase in plantation area (from *20% intensive* to 35% intensive), which reduced the combined uneven-aged management and even-aged natural regeneration area by 27% (70% to 43%) (Figure 2c).

These differences in future forest condition revealed that different Triad strategies could lead to the same end in some respects (e.g., harvest volume). However, in most cases those similarities were accompanied by very different outcomes in other respects, since such differences in future forest condition resulted in very different outcomes for other forest values (e.g. wood cost, snags/ha, carbon storage). Therefore, the desirability of any one scenario will depend on the importance the manager places on each value. The key to selecting the "right" Triad allocation for a given forest is that the manager must have a clear understanding of the values of interest, and an awareness of the relative importance placed on each.

Management Implications

- When a manager is considering the Triad approach, essential first questions to ask are: (1) how different is the approach from their status-quo management?; (2) what needs to change to implement a Triad approach?; and (3) will those changes improve the overall provision of social, economic and ecological forest values?
- The impacts associated with implementing the Triad approach will vary by forest, and benefits afforded in one forest may not be possible in another. Thorough analysis of possible alternatives, with clear descriptions of outcomes of each expressed in terms of social, economic and ecological values will help the forest users decide if implementing the Triad approach is superior to status-quo management.
- The reserve portion of the Triad approach has the potential, in some forest conditions, to reduce the short-term harvest level. To improve acceptability of the approach, managers should understand specific impacts in the forest they manage and be creative in ways to mitigate short-term negative impacts, while still providing values associated with that zone.
- Clear definitions of the management actions, resulting forest conditions and forest values associated with each zone should be communicated and discussed with forest users. If these definitions are clear, managers could have productive discussions with forest users about how much area should be allocated to each zone.

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