TRIAD - A NEW VISION

by Dr. Graham Forbes

"The term *balanced forestry* (Seymour and Hunter 2009) recognizes "that there is no single right way to manage (or not manage) forests, and that thoughtful, cooperative design of forest landscapes can both conserve native biodiversity and sustain forest-based economies."

The Province of Nova Scotia is embarking on a new vision for forest management. This vision focuses on a paradigm shift for sustainable forest management, with an emphasis on using nature as the building block for decisions related to the maintenance of all values associated with the forest, including forest products, biodiversity, recreation, ecological services, and cultural values. The Lahey Report (2018), the result of a 2-year process including in-depth review of forestry practices and consideration of input and opinions from stakeholder and the general public, sets the foundation for this new vision. The following establishes the rationale and direction for future forest management practices on Crown Land in Nova Scotia.

A discussion of past practices will help put the new vision in context. Forest management in Nova Scotia has varied greatly over the last 100 years. Wilfred Creighton, who became Nova Scotia's first Provincial Forester in 1934, outlines the history of forestry in the province (Creighton 1988). Much of the timber harvesting in the 18th and 19th centuries focused on large pine and spruce trees, particularly those along waterways which facilitated the movement of large trees to shipyards and mills through log drives. Mention of wildlife was primarily in the context of hunted species, and rarely was the forest viewed as 'habitat' and its effect on game species populations.

By the 1950s, Crown land was still managed primarily for timber production but there was a move away from exploitative forestry, with a tendency to take the best trees (e.g. 'high-grading'), towards management and silvicultural practices that could produce a regular supply of timber. This era of "sustained yield", through the regulation of harvest rates and, by the 1970s, implementation of tree planting and stand tending maintained a suite of mills across Nova Scotia. The term 'habitat' had relevance primarily in terms of

game species populations. Fire was viewed as a destructive agent and was to be prevented at all cost. By the 1980's society demanded much more from the forests than timber and game species; society wanted the forest to provide recreational opportunities and wilderness, maple syrup and Christmas trees, and a host of other values. Concern about wildlife broadened beyond game species to include non-game species, like songbirds, mice and plants, and endangered species. By the 2000s, society expected even more from the forest. Adding to the expanding set of forest values is the provision of aesthetic viewscapes, spiritual opportunities, and ecological services such as clean air and water, but also the maintenance of all forms of life, from fungus to frogs to falcons. We must now consider the value of rotting wood as much as live wood, how best to create opportunities for mushroom and berry picking, and we need to do this across scales, from DNA to landscapes, and ideally, all packaged within a holistic framework like integrated resource management (Davis et al. 2001; Lindenmayer and Franklin 2002; Hunter and Schmiegelow 2011). Fire, insect outbreaks, and wind, although still an impact to production, are now also considered a way of seeing how forests are adapted to natural disturbance and as providing a blueprint for their management (Seymour et al. 2002). This evolution in forest management is not unique to Nova Scotia; similar trajectories occurred across North America, Australia, and Europe (Drengson and Taylor 1997; Kimmins 1997; Lindenmayer and Franklin 2002).

The expansion of forest management objectives, from a small set of consumptive products (timber and game species) to a complex set of multiple, often conflicting, values has posed a significant challenge to forest management. Adding to the challenge is the reality of a finite forest area from which to derive these values, notwithstanding minor shifts in land use between farmland and forest. The analogy often used is that the forest is a pie with slices; there can be many, or few, slices, but there is only one pie and it is fixed in size. The slices represent the expectations held by society and there can be conflict on how much of the forest is given to each value. Those with specific interests typically want a large portion of the forest dedicated to what they most value.

One response to these multiple and conflicting demands is to partition the forest into different zones so that all values are met, but not necessarily in each zone. In situations

where values cannot be simultaneously realized, it may be more efficient to avoid conflict by establishing one zone, for example, that emphasizes timber production, and another zone that emphasizes wilderness protection. This is not unlike zoning used in towns and cities to meet residential, commercial, and industrial requirements. The challenge in this approach is to define the right amount of area and the right locations for each zone so that the desired levels of all forest values are realized.

IMPLEMENTATION OF A TRIAD SYSTEM

One approach to zoning that has gained considerable support (MacLean et al. 2009; Messier et al. 2009; Cote et al. 2010; Ward and Erdle 2015) is termed “Triad” (Seymour and Hunter 1992), which recognizes three main zones in the forest landscape; production forest, protection forest, and the ecological matrix. The ecological matrix is the larger, dominant zone; the production forest and protected forest zones are embedded in this landscape and have primary goals of producing timber and conserving biodiversity, respectively.

The rationale for the Triad system is detailed in the Lahey Report (and Addendum; 2018) and is advocated therein because current forest management in Nova Scotia is seen as failing to adequately provide the values society holds for its forests. In simple terms, the protected zone conserves biodiversity and functioning of natural processes; the production zone provides the primary source of timber; and the ecological matrix produces a limited amount of timber, while maintaining important ecological stand conditions (e.g. snags and multiple age classes, and long-lived species) through low intensity, ecologically-appropriate harvest prescriptions.

Each zone is indispensable and of equal importance. Effective implementation of Triad zoning requires existence of all three zones in proportions adequate to meet objectives for all values. As stated in Lahey (p. 61; Addendum 2018) “foresters recognized that expanding the use of high-yield, commodity-production silviculture (via planting and early competition and density control) could, at least in the long run, offset any “loss” of timber productivity to forest reserves. Furthermore, it became apparent that this offset

could be achieved by a relatively small area in production forestry, roughly equal to that in reserves, thus leaving half or more of the entire forest landscape to be managed under less-intensive, ecologically based silvicultural systems…designed to conserve biodiversity as well as to produce some commodities". The importance of the interplay between protected and productive lands is not entirely new and was made years ago in Nova Scotia as the Colin Stewart Forest Forum promoted expanded production forestry as a means of mitigating loss of timber supply associated with the proposed increase in amount of protected areas (CSFF 2009).

The Role of Landscape Planning

Successful implementation of Triad zoning requires landscape-scale planning. Crown Land in Nova Scotia is not a solid block of land but is broken up into many parts, separated by ownership and their associated land use, such as cities, farms, and roads. Even within Crown Land, areas are zoned as protected or for resource production. Despite these obvious differences, these units still interact with each other; roads influence the movement of wildlife and timber products, the boundaries between farms and forest can be distinct or gradual, wind and water transport seeds for a few meters or many kilometers. And underlying these units are ecosystems that tie everything together. In order to be successful in meeting the expectations of Nova Scotians for Crown Land, the implementation of sustainable forest management requires thinking and acting across a range of years, and from individual stands up to the entire province.

Like many jurisdictions, Nova Scotia uses a hierarchical forest planning system at three levels: Strategic, Tactical, and Operational. Strategic level forest planning uses a long-term planning horizon (typically 100 years) and applies to a region or province in order balance economic, social and environmental values (Davis et al. 2001; Titler et al. 2001). Strategic goals are developed, and indicators are used as a means of monitoring success. Economic values include indicators for wood supply and wood products, such as future levels for sawlogs. Environmental values could include indicators for mature forest at the ecoregional scale and the area of forest by cover different types (e.g.,

hardwood vs. softwood) and social values could be tied to water quality protection by coordinating harvest levels with areas designated as municipal water supply.

Tactical level forest planning is a medium-term planning horizon (typically 20 years) that applies to the *landscape scale* and is the link between strategic goals and operational application because it ensures enough area of forest is identified and available. For example, strategic level planning sets the amount of wood potentially available whereas tactical planning identifies proposed activities and forest conditions over the medium-term. Indicators at this level are selected for all three values and tend to be more concerned or influenced by their location within the landscape (e.g., applying moose habitat prescriptions on the mainland only because moose are not endangered in Cape Breton). Forest management activities at this level are arranged on the landscape in 5-year management blocks that make tactical sense, considering things like road development and arrangement, forest age class, as well as environmental and social values. Nova Scotia Department of Lands and Forestry has produced several foundational documents (and indicators) to support tactical (landscape) level planning including: Ecological Landscape Classification, Ecological Landscape Analysis, Ecological Emphasis Index, and a Road index.

Operational level forest planning is undertaken at the individual site scale, such as forest stands, within 1-5-year periods. Operational plans include details on the method of harvest, treatment prescriptions, locations of harvest (including stream buffers and biodiversity features), seasonal concerns, and roads. Practices are reflected in statutes, regulations, and technical guidebooks (e.g., Forest Management Guides, Forest Ecosystem Classification, Forest Biodiversity Stewardship Guide, and Forest Wildlife Guidelines and Standards).

Within a Triad forest management system, the decision to apply the Triad, and the proportions of Crown Land in each zone begins at the strategic level where estimates for each of the 3 zones is first predicted, but not physically mapped. The tactical (landscape) component of Triad would include the physical mapping of each of the 3 zones; conservation, high production forest and the ecological matrix. The operational component further determines site level characteristics for areas found within the

ecological matrix and high production zones and includes the use of site level tools such as the Forest Management Guide, Pre-treatment Assessment, the Forestry Field Handbook and LiDar to design forest operations and silviculture interventions.

Current Situation in Nova Scotia

The Conservation zone is currently well-established in Nova Scotia, as protected forest currently accounts for 28-29% of Crown land, as measured by the amount of legislated protected areas. However, intensively managed forest (the intensive zone) is relatively small, accounting for approximately 6% of Crown land (as measured by the area in plantations). The remaining and dominant forest area is the ecological matrix, and in Nova Scotia, has historically been managed primarily “by single-aged silviculture and clearcutting, with little or no follow-up stand tending, (which) is incongruent with the multi-aged silvicultural systems required to practice ecological forestry”. This compromises maintenance of some ecological values and “appears to be yielding relatively low volumes of wood, thereby expanding the harvesting pressure everywhere on the working forest.” [p. 63 Lahey Addendum 2018].

THE NEW VISION FOR SUSTAINABLE FOREST MANAGEMENT IN NOVA SCOTIA

The Province of Nova Scotia envisions a forest that is productive and robust, and that meets the needs of Nova Scotians. The Triad model of forest management advocated by Lahey will be the vehicle to realize this vision on Crown forests. It will include designation, (including size and location) of three zones:

(1) a *High Production Forest* (HPF) zone will be designated and managed with intensive silvicultural practices that will increase the quantity of high value timber products;

(2) a *Conservation* zone will include legislated protected areas, in addition to other ecologically important and sensitive areas (i.e. Old Forests) not considered for timber production management, and will be core features in the protection of biodiversity and;

(3) an *Ecological matrix*, that will be managed for both timber production and biodiversity, through application of ecological forestry practices that create forests with older-lived forest species.

The ecological matrix will produce more biodiversity and eventually more forest products than it presently does. Some of these trees will become valuable sawlogs as the forest progresses from single-aged, short rotation forests to multi-aged, long rotation forests. Biodiversity will be increased because the creation of multi-aged forests containing longer-lived species will be more similar to forest conditions created from natural disturbance regimes typical to the province. A major tenet of the maintenance of biodiversity is that species are adapted to forest conditions resulting from the interaction of enduring features (e.g. soil, drainage, climate) and natural disturbance (Thom and Seidl 2016). Nova Scotia experiences a range of natural disturbance that vary in intensity and extent, from individual tree-fall gaps, to large stand-replacing hurricane wind events (Seymour et al. 2002; Taylor et al. 2017, 2019). The amount of clearcut in the ecological matrix will be considerably reduced from recent levels, coupled with an increase in various partial harvests to better reflect the frequency of different types of naturally occurring disturbance. Some clearcutting will be conducted only in accordance with the area and type of stands typically experiencing naturally occurring, stand-replacing disturbance events. Harvest prescriptions in the ecological matrix will be designed with a key focus on the number, type, and condition of trees retained after harvest. This deviates from the frequent current practice of basing prescriptions on what is to be removed, not necessarily what is retained.

The detailed components of implementing Triad have been developed in separate exercises, some of which are presented as reports. The Forest Management Guide directs the retention levels for each treated stand in the ecological matrix. The HPF document outlines the rationale for potential HPF sites on Crown land. Additional working groups have been formed to focus on other, equally important aspects of SFM, such as old-growth forest, species at risk, small-scale wood energy, outcome-based forestry, and environmental assessment.

Implementing the Triad model is a daunting and game-changing task but can ultimately be a successful model for other jurisdictions around the world if employed with a thoughtful, reasonable, and scientific based approach. All signs point to this currently being the path forward.

About the author:

Dr. Graham Forbes completed his BA (Biogeography) at York University, and completed both a Master's degree and PhD at the University of Waterloo on wildlife ecology.

He is a professor at the University of New Brunswick in the Faculty of Forestry and Environmental Management and Department of Biology where he teaches courses on: (1) Biodiversity & Ecosystem Management, (2) Mammalogy, (3) Wildlife Management, (4) Conservation Biology & (5) International Ecology Field Course

His research involves acquiring scientific information for use by resource managers in maintaining wildlife and biodiversity, focusing on mammals, birds, and herpetofauna. He works collaboratively with management agencies such as Parks Canada, provincial departments of natural resources and wildlife, and industry. He recently completed a 2-term appointment by the Federal Minister of Environment as the Co-Chair of the Terrestrial Mammal Sub-Committee for the Committee on the Status of Endangered Wildlife in Canada.

References

Colin Stewart Forest Forum Steering Committee. 2009. *Colin Stewart Forest Forum: Final Report*. 0-nsleg-edeposit.gov.ns.ca.legcat.gov.ns.ca/deposit/b10604285.pdf (April 2018).

Cote, P., R. Tittler, C. Messier, D.D. Kneeshaw, A. Fall, and M-J. Fortin. 2010. Comparing different forest zoning options for landscape-scale management of the boreal forest: Possible benefits of the TRIAD. Forest Ecology and Management 259(3): 418–27.

Creighton, W. 1988. Forestkeeping: A History of the Department of Lands and Forests in Nova Scotia 1926-1969. Province of Nova Scotia, Halifax. 155 pp.

Davis, L., N. Johnson, P. Bettinger, and T. Howard. 2001. Forest Management to Sustain Ecological, Economic, and Social Values. McGraw Hill, Boston. 804 pp.

D'Eon, R., J. Johnson, and A. Ferguson, 2000. Ecosystem Management of Forested Landscapes. UBC Press, Vancouver. 335 pp.

Drengson, A., and D. Taylor (eds.). 1997. Ecoforestry: The Art and Science of Sustainable Forest Use. New Society Publishers, B.C. 312 pp.

Hunter, M., and F. Schmiegelow 2011. Wildlife, Forests and Forestry: Principles of Managing Forests for Biological Diversity. Prentice Hall, Boston. 259 pp.

Johnson, N. J. Olson, and V. Sample (eds). 1993. Defining Sustainable Forestry. Island Press, Washington, DC. 328 pp.

Kimins, H. 1997. Balancing Act: Environmental Issues in Forestry. UBC Press, Vancouver. 305 pp.

Lindenmayer, D., and J. Franklin. 2002. Conserving Forest Biodiversity: A Comprehensive Multi-scaled Approach. Island Press, Boston. 372 pp.

MacLean, D.A., R.S. Seymour, M.K. Montigny, and C. Messier. 2009. Allocation of conservation efforts over the landscape: the TRIAD approach. *in* Setting Conservation Targets for Managed Forest Landscapes. M.A. Villard and B.G. Jonsson (eds.), 283–303. NY: Cambridge University Press.

Messier, C., R. Tittler, D.D. Kneeshaw, N. Gélinas, A. Paquette, K. Berninger, H. Rheault, P. Meek, and N. Beaulieu. 2009. TRIAD zoning in Quebec: Experiences and results after 5 years. The Forestry Chronicle 85(6): 885–96.

Seymour, R.S., and M.L. Hunter, Jr. 1992. New Forestry in Eastern Spruce-Fir Forests: Principles and Applications to Maine. Orono, ME: University of Maine.

Seymour, R., A. White, and P. deMaynadier. 2002. Natural disturbance regimes in northeastern North America – evaluating silvicultural systems using natural scales and frequencies. Forest Ecology and Management 155:357-367.

Taylor, A., D. MacLean, D. McPhee, E. Dracup, and K. Keys. 2017. Salvaging has minimal impact on vegetation regeneration10 years after severe windthrow. Forest Ecology and Management 406:19-27.

Taylor, A., E. Dracup, D. MacLean, Y. Boulangerc, and S. Endicott. 2019. Forest structure more important than topography in determining windthrow during Hurricane Juan in Canada's Acadian Forest. Forest Ecology and Management 434:255-263.

Thom, D., and R. Seidl. 2016. Natural disturbance impacts on ecosystem services and biodiversity in temperate and boreal forests. Biological Reviews 91:760-781.

Tittler, R. C. Messier and P. Burton. 2001. Hierarchal forest management planning and sustainable forest management in the boreal forest. Forestry Chronicle, 77(06): 998-1005.

Ward, C. and T. Erdle. 2015. Evaluation of forest management strategies based on Triad zoning. *The Forestry Chronicle* 91(1): 40–51.