An Independent Review of Forest Practices in Nova Scotia

Executive Summary
Conclusions and Recommendations

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Executive Summary

Mandate, Ecological Forestry, and the Triad

My mandate was to make recommendations on forest practices that would, if implemented, balance environmental, social, and economic objectives, which I have interpreted to include values. My conclusion is that environmental, social, and economic values should be balanced by using forest practices that give priority to protecting and enhancing ecosystems and biodiversity.

In other words, I have concluded that protecting ecosystems and biodiversity should not be balanced against other objectives and values as if they were of equal weight or importance to those other objectives or values. Instead, protecting and enhancing ecosystems should be the objective (the outcome) of how we balance environmental, social, and economic objectives and values in practising forestry in Nova Scotia. A number of reasons are given for this conclusion, but the primary reason is that ecosystems and biodiversity are the foundation on which the other values, including the economic ones, ultimately depend.

The rest of my conclusions and associated recommendations relate to the measures that should be taken to achieve this objective, recognizing that it is an objective that can only be comprehensively achieved over time and with different approaches on Crown and private land. Some of these conclusions and recommendations are very specific. For example, I conclude, as others have, that the Nova Scotia Endangered Species Act must be fully and rigorously implemented in respect to forests on both Crown and private land – as it currently is not. I also recommend an open, transparent, collaborative, and inclusive review of the ecological efficacy and adequacy of existing regulations that limit harvesting within 20 metres of bodies of water and of others that require clearcutting to retain "wildlife clumps." As a third example, I recommend the adoption of new regulations generally prohibiting full-tree harvesting when combined with clearcutting, on both Crown and private land.

Other conclusions are of a general but more fundamental nature. The most important of these, key to the whole Report, is that forest practices in Nova Scotia should be guided by explicit and formal adoption of a new paradigm – called "ecological forestry" in the literature. Contrary to the forestry paradigm shaped by the Royal Commission on Forestry of 1984, which strongly emphasizes the growing of timber for mills, ecological forestry treats forests first and foremost as ecosystems. Ecological forestry is primarily concerned with the effects of forestry on ecological values such as water, soil, and habitat for all of the species that inhabit and constitute those ecosystems. In place of the philosophy of mitigation, it seeks to align forestry with ecological protection and biodiversity conservation by integrating ecological knowledge (including traditional knowledge), principles, and concepts into how forestry is conducted.

It is also important to stress what ecological forestry is not. It is not anti-forestry. It does not aim to protect the environment by eliminating or prohibiting commercial timber production.

Instead, it seeks to combine the imperative of protecting ecological systems and biodiversity with the social importance of sustaining a productive and profitable forestry industry.

Ecological forestry parallels the approach that representatives of the Confederacy of Mainland Mi'kmaq described as forestry based on "listening to the forests." It is an approach that gives priority to ecological protection (and enhancement) and biodiversity in determining how forest practices should balance environmental, social, and economic objectives and values, while at the same time recognizing the importance of each of these overlapping and intersecting categories of objectives and values.

Implementing ecological forestry calls for action both at the operational level of forestry and at landscape and provincial levels. It also requires approaches that reflect the different considerations applicable to the management of Crown versus private land.

At the operational scale – where decisions are made for particular stands of trees – ecological forestry means forestry that strives to emulate the natural processes that would affect those stands in the absence of forestry. In particular, forestry must seek to approximate the "disturbance regimes" that would naturally be determining the species composition and tree maturity of the forests in which forestry is being conducted. The underlying premise is that such forestry will moderate the negative consequences of commercial forest use because forests (as ecosystems) and forest-dwelling species have evolved to cope with those natural disturbance regimes.

In many of Nova Scotia's forests, forestry that emulates natural disturbance regimes would consist of partial or selection harvesting and modified or reduced-scale clearcutting. This is because much of the province's natural forest is composed mainly of multi-aged, mixed-species stands affected by disturbance regimes that generally affect individual trees within stands, as opposed to whole stands, at frequent intervals. Carefully done, partial or selection harvesting, including small-scale irregular shelterwood harvests, emulates that kind of disturbance regime, or pattern. In contrast, clearcutting at large scales does not, because it generally is applied to stands as a whole and because it promotes the regrowth of single-species, even-aged forests.

There are also forests in Nova Scotia subject to disturbance regimes that tend to affect whole stands at relatively frequent intervals and that result in even-aged forests of predominantly single species. In general, under an ecological forestry paradigm, clearcutting – depending on how it is done and the site-specific considerations – is acceptable in these forest conditions because it comes closer to approximating those kinds of disturbance regimes. It also gives effect to the importance that ecological forestry places on combining ecological protection with a thriving forestry industry.

It follows that the alternatives to clearcutting should generally be applied where the forest is of the mixed-species, multi-aged variety. It also follows that clearcutting is generally acceptable when applied to forests that are naturally like the forests produced by clearcutting, which are primarily softwood forests, as well as to forests planted and grown for harvesting by

clearcutting. This is only so, however, if the alternatives to clearcutting are fully developed and if clearcutting happens within an overall approach to forestry that is predominantly dedicated to maintaining and restoring multi-aged, mixed-species forests in which late successional species have the opportunity to grow and mature in accordance with the forest's natural condition. The importance of this overarching objective – and the forest resiliency it will foster – will become of increasing importance as the effects of climate change are increasingly felt.

At the landscape and provincial levels, I conclude that Nova Scotia should explicitly and officially adopt a triad model to the implementation of ecological forestry. This model recognizes that the goal – ecological well-being that supports a thriving forestry economy – cannot be achieved solely as the cumulative effect of operational decisions. It also requires the following three elements:

- Forests that are protected from all forestry (and many other kinds of human interference) by designation as parks, nature reserves or wilderness areas or through private conservation. These forests serve as a sanctuary for wildlife and as a base for the ecosystems and biodiversity that span across the broader landscape.
- Forests dedicated to high-production forestry, including through clearcutting, as well as high-production alternatives to clearcutting. These allow for the concentration of industry's activity and the minimization or avoidance of the impact it would otherwise have on the wider landscape.
- The management of the rest of the forest, or as much of it as possible, for a combination of ecological and production objectives, contributing both to ecological conservation and to commercial forestry. In general, this means forestry with a lighter touch and limited clearcutting.

In Nova Scotia, although the basic elements of the triad are in place, not enough is being done to deliberately manage our forests within a triad model. Each of the three legs of the triad requires development if ecological forestry is to be achieved on the landscape and provincial levels. In this Report, given my mandate to focus on forest practices, I emphasize actions that should – or can – be taken to strengthen the two legs of the triad that include forestry. In particular, I stress the importance of enhancing the productivity of forests dedicated to high-production forestry.

The question becomes how to implement ecological forestry and the triad at both operational and provincial levels given the following factors:

- That roughly 30 per cent of the forest is managed by the Crown and 70 per cent by private landowners, much of it by owners of small woodlots
- The irrelevancy of landownership to ecosystems and biodiversity
- The importance of private ownership of land and ownership of forests to Nova Scotians, especially in rural Nova Scotia
- The importance of the adequacy and predictability of wood supply to industry

My conclusion is that ecological forestry must be pursued on Crown and private lands with a combination of tools that are responsive to both the opportunities and limitations associated with each category of landholding. For Crown land, this means robust use of the Crown's direct authority over Crown land to require – on an ambitious timeframe – that forestry on it be conducted ecologically. For private lands, it means a comprehensive, multi-faceted, integrated, and collaborative strategy for encouraging and enabling private landowners, within broad parameters set by statute and regulation, to manage their lands in accordance with the concepts of ecological forestry within one (or more) of the legs of the triad.

Implementation on Crown Lands

In this context, the following are the primary conclusions and recommendations I have reached on implementing ecological forestry, including the triad, on Crown lands:

- Analysis of the existing system of ecosystem-based management applicable to Crown land suggests it is connected to an inadequate understanding of disturbance regimes and that, in many situations, it does not encourage, but limits and delays, adoption of multi-aged silviculture prescriptions and thereby delays the shift from clearcutting that is called for on Crown lands that are not in the high-production leg of the triad.
- The pre-treatment assessment process that largely determines the prescriptions applied within the current system of ecosystem-based management does not sufficiently take wildlife issues into account. The lack of attention to wildlife in the pre-treatment assessment process is not counterbalanced by reassurance that wildlife receives adequate attention in the Integrated Resource Management Process.
- Together, these conclusions raise doubts as to whether the current approach will produce the shift to ecosystem-based management of forestry on Crown land, including science-based reductions in the proportion of harvesting by clearcutting as is their stated objective, on a timely and meaningful basis.
- The ecosystem-based management system should be amended to remove the features that artificially favour even-aged silviculture in natural forests and to strengthen the support it provides for multi-aged silviculture prescriptions. This should be done through an open and transparent process that includes representatives from the Review team. The kind of amendments to be made, which are estimated to reduce clearcutting from 65 per cent of all harvesting on Crown land to 20-25 per cent, are outlined in the Report.
- Forestry operations on Crown land should continue to include high-production forestry; that is, forestry in the production leg of the triad, in plantations, and in suitable natural forests. It should, however, be subject to an accountability framework to achieve outcomes in areas such as soil productivity, water quality, wetlands, timber supply and quality, aesthetics, biological diversity, public accountability, economic aspects, social considerations, and forest health. To help ensure the productivity of this forestry, policies discouraging the controlled use of herbicides to encourage the growth of commercial species should be reconsidered.

- The Department of Natural Resources (DNR),[1] with Crown licensees, must take immediate and sustained action, including by conducting or commissioning appropriate scientific research, to respond to and address concerns about its current mapping of disturbance regimes and the impact of forestry on sensitive soils, bird populations, tourism, outdoor recreation activities, and protected areas.
- Current efforts for the protection and restoration of old forests are inadequate and must be strengthened by a number of integrated actions, including improved data collection, reconsideration and strengthening of targets in the Old Forest Policy, and implementation of old-forest restoration targets in addition to strengthened old-forest protection targets.
- The silviculture system for Crown land should be aligned with ecological forestry and the triad model. It should encompass a comprehensive range of prescription options, including production alternatives to clearcutting as currently conducted. It should include stronger accountability for achieving specified and expected outcomes.
- A legislated forestry management planning process for Crown lands should be instituted under which those given tenure on Crown land to conduct forestry operations would be required to prepare their forest management plans through a Class II environmental assessment or a forestry-specific assessment akin to a Class II environmental assessment conducted by an independent third party or panel.
- Conditional on the adoption of the proposed legislated forestry planning process, and other improvements in the functioning of DNR, the current system under which government officials approve each and every harvest should be replaced by one in which government focuses on policy, research, oversight, and leading by example, and in which licensees are held accountable for managing their operations in accordance with approved forest management plans, applicable laws and policies, and the paradigm of ecological forestry.

The Review team estimates that these measures could, in combination, reduce the wood taken from Crown land by between 10 and 20 per cent, although further analysis is needed to confirm that estimate. This will cause a significant challenge for industry to which there are no easy solutions. I conclude that, if government decides it must study the nature and scale of these impacts to determine if it will implement the changes I recommend for Crown land, the study should consider not only the economic impacts of what is proposed but also the ecological and social costs of the status quo and the long-term economic, social, and ecological benefits of what is proposed.

My recommendations for Crown land, if implemented, are likely to increase demand for wood from private land, including woodlot owners, a benefit for those who want to sell their wood. These recommendations will, however, create supply complications for mills and other buyers. A shift in harvesting to private land will also, at least in the short term, likely mean more clearcutting overall, since roughly 90 per cent of the harvesting that happens on private land is

[1] Now the Department of Lands and Forestry.

by clearcutting. My conclusion is that this is better than the status quo, where not enough ecological forestry is happening on Crown or private land, especially if concerted action is taken in parallel to bring more private land under active management that aligns with ecological forestry and the triad. In addition, I regard the alternative, of legislating ecological forestry on private land, as impractical, potentially counterproductive and distractive to what can be accomplished with concerted effort on Crown land.

Implementation on Private Lands

The following are the primary conclusions and recommendations I have reached on implementing ecological forestry, including the triad, on private lands:

- The management of Crown land should in substance become the model of ecological forestry for private land, including by implementation on Crown land of the ecosystem-based management system recommended in this Report.
- The efforts of woodlot owner membership-based organizations, including regionally organized woodlot service organizations, to support and promote effective and responsible forest management among their members should be strongly supported, on condition of a demonstrated commitment to a triad model of ecological forestry.
- Options for making greater use of and achieving higher value from the Association for Sustainable Forestry should be considered, developed, and implemented.
- Steps should be taken to ensure that private landowners have improved access to the tools, resources, and assistance that enable effective and responsible forest management, including the services of forest professionals, simplified versions of pre-treatment assessment tools, and improved access to data and technology resources used in the management of Crown lands.
- Work on growing and diversifying markets for a broader range of forest products, including local markets, should continue and receive greater emphasis. This should include sustained work on developing alternative markets, such as small-scale wood energy projects, for low-quality wood such as pulpwood.
- Options for creating the conditions that would enable owners of forest land to earn revenue for the carbon their land stores or sequesters should be actively considered and developed.
- The feasibility and value of a financing program for those who want to buy and manage woodlots in accordance with ecological forestry and the triad should be considered.
- The silviculture system for private land should be reviewed with a view to improvements that better align it with the goals and concepts of ecological forestry and the triad model, ensuring that it supports not only management for high-production forestry and for less-intensive forestry on private land but also a comprehensive range of silvicultural options. Improvements should also ensure that the system includes accountability not only for doing prescribed silviculture but for achieving the intended outcomes of the prescribed silviculture.

- Owners of private land classified as industrial should be subject to an accountability framework to achieve outcomes in their forestry-related activities in areas such as soil productivity, water quality, wetlands, timber supply and quality, aesthetics, biological diversity, public accountability, economic aspects, social consideration, and forest health.

Other Conclusions and Recommendations

This Report also includes conclusions and recommendations on a range of topics related to the implementation of ecological forestry, although they are not directly on forest practices as such. At the very beginning, it concludes that the condition of the forests – whether good, poor, improving, or declining, from ecological and resource perspectives – should be the guiding foundational consideration in discussions and decisions on forestry in Nova Scotia. To ensure that better and more-comprehensive information on the state of the forests is available in the future, I make a number of recommendations for improvement in the State of the Forest Reports periodically issued by the province and in information gathering, analysis, and sharing more generally.

I conclude that the Crown Lands Act should be amended to make it clear that the objectives of the management of those lands is broader than forestry and inclusive of all the values and objectives for which the management of public lands should be concerned in today's society.

The Report also emphasizes the critical need for the embrace of openness, transparency, collaboration, and accountability by DNR (now the Department of Lands and Forestry), including in the area of research and applying the results of research to policy and management. On research, this Report emphasizes the need for the department to become much more active in conducting and commissioning research, and in fostering innovation, including through collaboration with industry and peer-reviewed published scientists. More broadly, this Report stresses the crucial importance of decision making based on peer-reviewed science and the active conduct or stimulation of such research where it is lacking. In particular, it identifies the need for more (or continued) active research on topics such as natural disturbance regimes in Nova Scotia; soil sensitivity in the western region; post-harvest retention levels on Crown land; ecological efficacy and adequacy of riparian management (buffer) zones and of so-called "wildlife clumps"; linking pre-treatment assessments and decisions at the stand level to landscape-level characteristics and goals; the impact on and options for minimizing the impact of forestry on birds, soils, tourism, recreation and wilderness areas and other kinds of "protected areas"; improving the productivity of Nova Scotia's forests; and innovation in how forestry is conducted to align it with ecosystem protection and biodiversity.

Another topic considered is the crucial role that forestry professionals must play – and be equipped to play – if ecological forestry is to be achieved. I call for concerted and deliberate attention to the number, mix, diversity, and expertise of Nova Scotia's forestry professionals with a view to improving Nova Scotia's attractiveness as a place for promising and fulfilling

careers in forestry, particularly for those educated in ecological approaches to forestry. A related topic that is discussed is how available data and existing and new technology can be better deployed to enable forestry that is both ecological and economical on both Crown and private land.

Market Access

In accordance with my mandate, this Report also considers concerns raised by woodlot owners, particularly in the western region, about the availability of markets for their wood. I have concluded that the demand for wood from woodlots in that region reflects general and shifting market conditions, including the significant loss of regionally based demand for pulpwood, rather than the operation of the new organization called WestFor on western Crown lands. I recommend concerted action on developing alternative markets for low-quality wood, such as small-scale wood energy projects, as a way of strengthening demand for private wood in the region. I also endorse the proposed Mi'kmaq forestry initiative and licensing of a larger area to the existing community forest. Finally, I recommend a land use planning process for the western Crown lands to ensure wider participation in the process of deciding how the western Crown lands will be developed. The outcomes of this process will establish the context within which the legislated forest management planning process will unfold in the western region.

Monitoring, Evaluation, and Accountability

This Report recommends that the responsibility for monitoring and evaluating the implementation of this Report and its recommendations be given to an independent committee of technical experts, inclusive of members of the Review team. This committee should report regularly to the minister and to the public. It is recognized that achieving the goal – ecological forestry organized by a triad – may require additional or different measures from those recommended in this Report.

In addition, I recommend that goals about the implementation of ecological forestry and a triad model for both Crown and private land be added to the Environmental Goals and Sustainable Prosperity Act.

Final Word

Putting all of its conclusions and recommendations together, this Review concludes that we can have forest practices in Nova Scotia that combine ecological protection and biodiversity with productive and profitable forestry. It requires industry to recognize the need for significant change in how forestry is conducted – immediately and strongly – on the areas of Crown land that should be managed for a combination of ecological and production objectives – primarily with alternatives to clearcutting – and on private land in the longer term.

It also requires those with legitimate concerns about the status quo to recognize that change requires space on the forest landscape for high-production forestry, including clearcutting where it is ecologically acceptable and compatible with other activities and values.

A third requirement is getting past the stalemate created by the difficulties and challenges of implementing an approach that combines ecological and economic values in a province where so much of the forested land is privately owned.

We must see this as an opportunity that can, with determination and ingenuity, be leveraged to both improve the forests and expand access to the opportunities for growth and development that they offer in a province in which forested land is widely owned. Ultimately, these are the stakes: both the forests and the prosperity that depends on them.

1 Introduction

On August 30, 2017, I was appointed by the Hon. Margaret Miller, Nova Scotia's Minister of Natural Resources,[2] to undertake an independent review of aspects of forestry in Nova Scotia in two parts: of forest practices and of market access concerns raised by owners of forested land, particularly in the western region of the province. On both of these issues, my mandate was to "examine current practices, including strengths and weaknesses, and provide recommendations for improvement regarding how Nova Scotia balances long-term environmental, social, and economic interests in managing the province's forest." My original mandate was to complete the review by February 28, 2018. On February 21, Minister Miller agreed to an extension of two months, until April 30, 2018. Subsequently, finalization and release of the report was delayed by the identified value in having it legally reviewed.

I have, in accordance with my mandate, completed this Review with the assistance of a team of expert advisers. Their work has been of tremendous help to me. They are Dr Peter Duinker (professor, School for Resource and Environmental Studies, Dalhousie University); Mr Al Gorley, RPF (president, Triangle Resources Inc. and formerly assistant deputy minister, BC Ministry of Forests, and chair of BC's Forest Practices Board); Dr Malcolm Hunter (professor of wildlife ecology and Libra Professor of Conservation Biology, University of Maine); Dr Robert Seymour (professor emeritus and formerly Curtis Hutchins Professor of Forest Resources, Quantitative Silviculture, University of Maine); Mr Laird Van Damme, RPF (senior partner, KBM Resources Group, and external adjunct professor, Natural Resources Management, Lakehead University); Mr Chris Wedeles (partner, Arborvitae Environmental Services Ltd); and Dr Jeremy Williams, RPF (partner, Arborvitae Environmental Consulting Ltd).

Mr David Foster, a PhD student at Dalhousie University, has supported the team as research associate. Mr Tom Soehl of the Department of Natural Resources has been the Review's organizer and secretariat. The Review was also assisted by Mr Nathan Ayer, a graduate student at Dalhousie University, who was commissioned to write an overview of the history of forestry policy in Nova Scotia. The Mersey Tobeatic Research Institute wrote a report for this Review: *State of Nova Scotia Forest and Biodiversity Review*. It also hosted and provided a report on a one-day workshop for invited participants in discussions about forestry in Nova Scotia on options for creating continuing dialogue about forestry and forestry issues in Nova Scotia. Input

[2] In the final stages of the Review process, the name of the department responsible for forests and forestry was changed to Lands and Forestry. The Honorable Ian Rankin was appointed to be the minister for this renamed and reconfigured department.

was also requested and received from the Nova Scotia Forest Biodiversity Science Advisory Committee.[3]

Over the course of this Review, I have received oral input at approximately 80 meetings conducted between early December 2017 and the middle of April 2018.[4] More than 160 people participated in these meetings. Most meetings were also attended by Peter Duinker, David Foster, and Tom Soehl; a number were also attended by other members of the team of experts. In writing this report, I have reviewed the notes taken at these meetings. I have received and reviewed more than 250 written submissions. Members of the Review team have held follow-up discussions on specific topics with some of those who have otherwise contributed to the Review.

I have held two full weeks of meetings (and many individual discussions) with most of the members of the Review team: one in January and one in March. There has been continuous and ongoing dialogue and analytical collaboration among most of the members of the team, with periodic discussions with others, since early January. In March, I hosted a workshop – on the work of the Department of Natural Resources (DNR) on natural disturbance regimes and ecosystem-based forest management framework – for officials of the department and those who had criticized the work of the department in these respects. The workshop was also attended by members of the Review team and some members of the Nova Scotia Forest Biodiversity Science Advisory Committee. Individual members of the Review team have been taken on tours – of what were presented by tour organizers as illustrative harvest sites – organized by the department, forestry companies, and environmental advocates.

I have reviewed and taken into account the documents produced in the process that resulted in the natural resources strategy, called *The Path We Share: A Natural Resources Strategy for Nova Scotia 2011–2020*.[5] These documents included the report of Voluntary Planning on the views of Nova Scotians who participated in that organization's engagement with citizens on natural resources issues, including forestry; the reports of the members of the Forestry Panel of Expertise that advised the Steering Panel of the process – one by Donna Crossland and Bob Bancroft and one by Jon Porter; the report of the Steering Panel (Retired Chief Justice Constance Glube, Joe Marshall, and Allan Shaw); and the natural resources strategy and the progress reports on its implementation subsequently published by DNR. The Review also

[3] This committee is an advisory committee to the Department of Natural Resources. It is chaired by Dr Peter Bush of the department (and previously by the department's Dr Sherman Boates). It includes Dr Peter Duinker (Dalhousie), Dr Thom Erdle (UNB), Dr Graham Forbes (UNB) and Dr Tom Herman (Acadia).

[4] For a more detailed summary of the process of this Review, see David Foster, "Forest Practices Review," in the Addendum to this report.

[5] A summary of these documents and of the process by which the strategy was developed can be found in David Foster, "The Natural Resources Strategy," in the Addendum to this report.

reviewed and considered documents produced in the process called the Western Crown Lands Planning Process.

The Department of Natural Resources, under the leadership of Minister Miller, Deputy Minister Julie Towers, and executive director of renewable resources Jon Porter, has been incredibly supportive of this Review. Every request for information was promptly and fully answered. The department provided three days of extensive briefings at the beginning of the Review and further briefings to the team of experts when it gathered for the first time in January. The department was generous in helping the Review team conduct analysis that was critical to its work, including harvesting and market-related information and impacts on wood supply of possible changes in forest practices, particularly on Crown lands.[6]

Primarily through the knowledge of members of the Review team of the scientific and policy literature on issues considered in this Review, the Review consulted and took account of a large body of that literature.

This report begins with a brief and high-level overview of some of the leading themes of the oral and written submissions I have received. It then presents the conclusions I have reached, dealing first with forest practices, then with market access, and finally with some other issues that cut across and go beyond these two categories of issues. This section indicates the basis on which I have reached my conclusions, but it does not provide an exhaustive analysis of all the information I have received or considered on every issue on which I have reached conclusions. My conclusions should be read in conjunction with the information contained in the technical papers – written by members of the team of experts – found in the Addendum to this report.

This report then lists the specific recommendations I am proposing in accordance with the conclusions I have reached.

[6] While DNR personnel were fully responsive to requests for information by the Review team, this report is independently authored by the Review team and has not been approved by DNR officials.

2 Leading Themes of Verbal and Written Submissions

I received starkly different and dichotomous submissions from those who work for forestry companies or in forestry and those who define themselves as ecological or environmental critics of the forest industry and of clearcutting in particular. This is not to say there was not significant variation within these two groups of Review participants. There was. But viewed holistically, this variation was modest relative to the consistency of the submissions I received from those who made them mainly from either of these two perspectives. Therefore, it is consistent with the overall nature of the submissions I received to summarize them as coming primarily from these two largely oppositional perspectives.

Here are some of the leading themes in the submissions I received from those in industry:

1. The current balance between economic or environmental values and policy objectives is right or, if anything, too heavily weighted in favour of environmental concerns, values, and objectives.
2. Nova Scotia is an expensive place from which to compete in the forestry business, and competing is the name of the game. The cost of wood in Nova Scotia is a major part of the reason for its relative expensiveness as a jurisdiction. There is limited to no capacity to absorb the costs of further limitations or restrictions on harvesting that would make it more expensive to do business in Nova Scotia.
3. The availability of a stable (predictable) supply of wood is very important to the business climate for forestry in Nova Scotia and to the ability of the province to attract investment in its forest industry. This stability depends on the industry's harvesting activities on Crown land.
4. Existing forestry practices, including clearcutting, have negligible or no adverse ecological impact, and their impact is greatly overstated by those who are critical of those practices, leading to misunderstanding by the public.
5. The impacts of legitimate concern are being addressed by the industry as it currently operates.
6. Other causes of ecological damage or disturbance (such as clearing land for farming or road construction or subdivision development) are of far greater consequence to wildlife and ecological systems.
7. DNR's work on natural disturbance regimes and on ecodistricts and ecosystem-based forest management guides for forestry on Crown lands, including pre-treatment assessments, is well done, although it is (or is perhaps) being applied too prescriptively.
8. Clearcutting is the appropriate forestry treatment for much (or a lot) of the forests of Nova Scotia, particularly for softwood stands, including because of the risk of loss through blowdowns if certain species are permitted to become over-mature due to the Nova Scotia wind regime and its thin soils.
9. Rights of private property owners should be respected to allow landowner values to determine if forestry happens on private land and, if so, what kind of forestry.

10. DNR should not be micromanaging harvesting activities on Crown land but should instead be holding licensees accountable for forestry in accordance with law, policies, and forest management guidelines. The micromanagement reflects and increases the politicization of operational activities.

As the Review progressed, I heard more from industry about what industry has done and could do to better align forestry activities with ecological considerations. Directly and indirectly, I also heard quite a bit about the benefits of an outcomes-based approach to the regulation of forest practices. For example, I was asked to consider the outcomes that industry is required to meet under Maine's outcome-based forestry policy as an alternative to the rule-based approach taken by Maine's Forest Practices Act.

The leading themes in submissions from those who participated in the Review primarily to express concerns and call for change in forestry practices were along the following lines:

1. Some believe that DNR and the government broke faith with those who participated in the development of the natural resources strategy, in disregard of the science on clearcutting gathered and presented in that process – by failing to follow through on commitments contained in the strategy, including the commitment to reduce clearcutting to no more than 50 per cent of total harvest, and by communicating the dropping or weakening of those commitments by including a note in a progress report on the implementation of the strategy.
2. There is a perception that DNR is on the side of industry and pulp and paper mills in particular, or "industrial forestry" more generally, and there is concern that DNR will not do the right thing when it comes to forestry practices based on science and public opinion.
3. Some believe a lack of transparency in how DNR conducts itself in relation to the industry and its operations is a major problem and a major reason for distrust and lack of confidence in DNR.
4. Clearcutting, both in many of its specific applications and in its cumulative impact on a landscape level, is having a wide range of unacceptable adverse impacts on ecosystems, biodiversity, and in other areas, including the following:
    a. Impact on species at risk (SAR) or species of concern (including the lack of completion or implementation of species recovery plans required by legislation)
    b. Destruction of old-growth forests
    c. Proximity to protected areas and the impact of that proximity on the functionality of protected areas
    d. Proximity to and adverse impact on recreational and tourism activities or on forests or landscapes that have tourism potential
    e. Transitioning forests to (or keeping them in) an even-aged stage of development, contrary to their natural state as part of the Acadian forest
    f. Fragmentation of the forest landscape, including the adverse impact on connectivity between habitats for wildlife

g. Adverse impact on birds, including migratory birds and songbirds

h. Inconsistency of clearcutting, in many or most of its applications, with a true or complete understanding of natural disturbance regimes in Nova Scotia

i. Impact on sensitive and otherwise compromised soils, especially in western Nova Scotia

5. DNR science on natural disturbance regimes and ecosystem-based forestry is a fraud or, more positively, a commendable but deeply flawed effort that requires significant revision.

6. Whole-tree harvesting, or what may be more accurately called full-tree harvesting, should not be allowed.

7. Some say that harvesting trees for energy production, sometimes called biomass harvesting particularly when done for production of electricity, is a mistake that should be stopped because of the forestry practices it is associated with, and because it is a low-value use of trees (exacerbated by the chipping of high-value trees for biomass), and because burning trees is an inefficient source of energy for electricity that does not qualify as "green."

8. Many perceive that the harvesting of immature trees by clearcutting is widespread, indicating the indiscriminate nature of clearcutting and contributing to the degraded condition of the forests, the unsustainability of the mills, and the long-term damage that is being caused to the forests and to future opportunities in forestry.

9. Government has authority to regulate on private land and should be prepared to use that authority.

This summary of the submissions I received is not comprehensive. A content analysis of the submissions received by David Foster in the Addendum to this report provides a more comprehensive overview of the range and frequency with which issues were raised. Here, I would stress that in addition to the points raised above, I heard quite a bit about the disposition of the western Crown lands, largely acquired from Bowater. While some of these lands have become part of the province's network of protected areas and others remain in the state they were in when acquired, there is disagreement with DNR's decision to provide a licence to WestFor Management Inc. to allow mills that constitute WestFor to harvest on a significant portion of these former Bowater lands. I also heard from many about their dissatisfaction with market conditions for contractors and woodlot owners in the western part of the province. For the most part, these submissions claimed causation between DNR's grant of a licence to harvest Crown land and perceived market access issues. That said, many also spoke about the effect on woodlot owners of the distance of parts of the western region from potential buyers after the closure of the Bowater Mersey paper mill. I address these points further below, finding that the perception of cause and effect between licensing of harvesting on the western Crown lands and market conditions in western Nova Scotia are not consistent with the data.

The situation of woodlot owners was a major theme running through the Review. Much of the discussion was about options not only for improving market access for these producers but also

for better integrating them into forest management. I heard a lot about the demographic and economic considerations that influence woodlot owner decision making, such as the increase in the average age of woodlot owners, the growth in absentee ownership, and the role that selling wood plays in household economics, particularly for older owners. I heard a good deal about how the harvesting choices available to woodlot owners are influenced (some said dominated) by the scale of the equipment most contractors work with and the level of income that must be earned to finance the acquisition and operation of such equipment. Whatever the causes, I was told often that landowners claim to receive more for standing timber if they agree to clearcutting as a harvesting method than if they ask for partial harvesting.

There were a number of submissions on how to improve the choices available to woodlot owners and to encourage and support more of them to actively manage their land in accordance with good forest management practices. I heard very encouraging things about the progress and prospects of woodlot owner service associations, particularly from both the eastern and western ends of the province. Implementing lessons learned from a study group that recently travelled to Finland was raised a number of times. So were the prospects for earning and selling credits for carbon storage and sequestration for stewardship of forest lands. With a few notable exceptions, I did not receive concrete proposals for market restructuring along the lines of, for example, resurrecting collective bargaining or the creation of a marketing board system. There is a perception held by some that woodlot owners are not paid enough for their wood and that this is because there are too few buyers and too much access to Crown timber. As addressed in this report, these perceptions are not consistent with the data.

Another topic that was raised by a number of submissions was the perceived unavailability of Crown lands for forestry activity other than industrial harvesting for sawmills and pulp and paper mills. Maple sugar production and the production of finished products such as musical instruments, furniture, and kitchen utensils were among the alternative forestry industries that were said to be limited by the unavailability to them of access to Crown land or wood products from Crown land.

The Registered Buyers system of silvicultural credits – under which buyers of wood are required to carry out planting, regeneration, pre-commercial and commercial thinning, and other silvicultural options on private land – was raised often. Issues included the relative degree of emphasis on the different options and latitude that buyers have to harvest in one place and conduct silviculture in another.

3 Independent Reviewer's Conclusions

3.1 General Conclusions: Ecological Forestry and the Triad

1. Although this Review was framed as a review of forestry practices in general, it unfolded largely as a review of clearcutting. To the extent the Review was warranted by concerns about how forestry is conducted in Nova Scotia, it is therefore clear that the concern is primarily about clearcutting. This is unsurprising against the backdrop to the Review, which included the public's concern about clearcutting revealed by consultations on forestry conducted by Voluntary Planning in 2008–2009; the commitment government put in the natural resources strategy of 2011, following the advice of the Steering Panel that oversaw the strategy's development, to reduce clearcutting to no more than 50 per cent of harvesting within five years; the subsequent abandonment of that commitment without engagement with those who recommended and supported it; ongoing campaigns and media coverage of controversies about clearcutting; and the percentage of ongoing harvesting that uses clearcutting.

2. It was suggested to me that concerns about clearcutting are based on misinformation or misunderstanding or a simplistic distaste for the aesthetics of clearcutting. It is my conclusion that the concerns are largely legitimate science-based concerns about the ecological impacts that clearcutting has had and is continuing to have on the forests of Nova Scotia, on the ecosystems that are characterized by those forests, and on the capacity of the forests to provide ecological goods and services in the future, including wood for future forest industries. Moreover, in situations where clearcutting may otherwise be a valid forestry practice, the aesthetic dimension of clearcutting is a relevant consideration in determining both whether particular forests should be clearcut and the form or scale of clearcutting that should be applied.

3. At the same time, it is my conclusion that a viable forestry industry of significant scale depends on managing costs of production and that one of the tools industry can use to manage costs is clearcutting where it is ecologically defensible. Further, my conclusion is that forestry, including industrial-scale forestry that uses clearcutting in defined circumstances and subject to ecological limitations, can be part of improved ecological stewardship of Nova Scotia's forests. Two important qualifications are that this may be true only if industry embraces – and is pushed and supported to embrace – alternatives to current harvesting practices and if others accept the validity of space on the forest landscape for high-production forestry. With those qualifications in place, my conclusion that industrial forestry and ecological stewardship can be combined is directionally consistent with the conclusion of the Steering Panel for the Natural Resources Strategy: that clearcutting should be reduced to no more than 50 per cent of total harvest. Whether or not that was the right or a feasible proposed reduction, it indicates a recognition that some level of clearcutting is defensible or at least acceptable within an overall strategy that called for "A Natural Balance." In addition, such an approach can help to avoid (or minimize) reductions in clearcutting having counterproductive results by, for example, encouraging a geographic expansion of industrial forestry under which dispersed partial

cutting happens to yield the timber that could have been harvested in a more concentrated way with clearcutting.[7]

4. Despite a focus on clearcutting, this Review of forestry practices has of necessity become, subject to restraints of time and other resources, a broad review of many aspects of how forestry is conducted in Nova Scotia and of provincial forestry policy and of the management of Crown lands by the Department of Natural Resources (DNR). This is because clearcutting is central to how forestry is currently conducted in Nova Scotia. This is clear from the data, which show that in 2016 clearcutting accounted for 64 per cent of the harvesting on Crown lands and 89 per cent of the harvesting on private land: 80 per cent of the overall harvest. Many variables seem to account for this, including the character, location, and quality of Nova Scotia's forests and the higher cost of wood in Nova Scotia compared to other jurisdictions. The other factor, more intangible, is the extent to which clearcutting is more than a methodology; it's also a business model, a mindset, a professional culture and a public policy paradigm.[8] It is ingrained, perhaps because of the lasting influence of the thinking of the 1984 Royal Commission, in how the work of forestry is conceived, executed, authorized, funded, and regulated. One indication of this is the extent to which the debate about clearcutting takes place on the basis of an assumption shared by many on both sides of the debate: in Nova Scotia, industrial forestry and clearcutting are largely synonymous. Another indicator of this mindset are the arguments, presented by some who have been associated with forestry in Nova Scotia, that clearcutting is not only a necessary or acceptable but a universally preferable approach to forestry, solely on the basis of the value of even-age silviculture in growing certain species of trees and without acknowledgement of clearcutting's potential ecological consequences or its potential consequences for future forestry options.

5. For these and other reasons, I have concluded that I can only discharge my mandate to "provide recommendations for improvement regarding how Nova Scotia balances long-term environmental, social, and economic interests in managing the forests" by considering the issue of clearcutting in a wide frame of reference that engages with the broader issues that bear upon the prevalence and incidence of clearcutting in Nova Scotia. This includes consideration of the alternatives to clearcutting that are available to the industry and of the barriers (or of the enablers) that may be hindering (or could be assisting) the adoption of these alternatives. It also includes consideration of how and by whom forestry policy bearing on clearcutting and other forestry practices is made and implemented in Nova Scotia, and whether change is required within or to the mandate, structure, or functioning of DNR.

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[7] Even so, it has been estimated that bringing the percentage of harvesting by clearcutting down to 50% of harvesting could result in a 40% increase in the spatial footprint of harvesting.

[8] See Nathan Ayers, "Summary of Provincial Forest Policy from 1980 to 2017," in the Addendum, which conveys the broad outlines of this paradigm and the lasting pervasiveness of its hold on forestry policy and forestry in Nova Scotia.

6. My mandate calls for "recommendations for improvement regarding how Nova Scotia balances long-term environmental, social, and economic interests in managing the province's forests." Early on, I was warned about the dangers of an approach that aims at balancing interests that can be diametrically opposed to each other. Most specifically, I was warned against an approach that accepts economic values, as measured by jobs or taxes or stumpage revenues, as compensation for ecological damage. Some of what I was presented by industry invited me to follow this approach. For example, it was submitted that, because Nova Scotia forestry policy has (on this view) prioritized environmental concerns over the past 15 years, my recommendations should prioritize the economic competitiveness of the industry. Somewhat similarly, some of the presentations I heard from industry representatives emphasized that further constraints on their operations would render them uncompetitive and should therefore be rejected.

7. I have concluded that my approach should be to make recommendations that seek to balance environmental, social, and economic interests within a framework that gives priority to the protection and enhancement of ecosystems and biodiversity. The rationale for doing so can be understood as an environmental rationale: depending on how and where it is conducted and the spatial scale and rotational frequency with which it is conducted, clearcutting can have an adverse effect on the environment, ecosystems, and biodiversity. But the rationale for giving priority to ecosystems and biodiversity is not only environmental. It is also economic and social. It is economic because ecological well-being is foundational to the health of the forests in the long term and therefore to the long-term prospects for Nova Scotia's forestry industry. It is social because, as recognized by the One Nova Scotia Commission, the health of the forestry industry is crucial to the economy of Nova Scotia and therefore to the well-being of its citizens, families, and communities, especially in rural Nova Scotia, and to the fiscal capacity of Nova Scotia's government. Healthy forests are also important to other Nova Scotia industries, including tourism and, more generally, to the quality of life of all Nova Scotians. Healthy forests also provide recreational opportunities and opportunities for intellectual, emotional, and spiritual growth and development, all of which are economically and socially important. Moreover, healthy and thriving forests are good in and by themselves. They deserve reverence and protection. They contribute to the beauty of Nova Scotia and to the pride of place Nova Scotians can feel in their province.

8. My conclusion is that a shift in paradigm in the direction of what is called ecological forestry would be responsive to this broader understanding of the public interest, as well as to widespread public opinion, in relation to forests and forestry. It is a basis for public policy that is broader than the one that has been dominant since the Royal Commission of 1984. In my view, this broader interest should be fully embraced as the foundation for public policy on forestry and particularly on forest practices. Forestry should be expected to similarly embrace this broader articulation of the public interest and to figure out how to make it work, just as forestry was expected to embrace and operationalize the timber production paradigm of the Royal Commission.

9. I was told very different things about the current condition of Nova Scotia's forests and given contradictory explanations for why the forests were in the condition they are in. The

word “degraded” was used by some who regarded repeated and widespread clearcutting as the problem, while others said the woods of Nova Scotia were in good shape and that decades of careful forestry management by industry and government was the reason. For this Review, Professor Peter Duinker summarized his views in a paper on forest condition in the Addendum as follows: “In sum, largely as a consequence of four centuries of forest exploitation, the forests of Nova Scotia have (a) much greater domination by short-lived pioneer species, (b) lower standing stocks, (c) much greater domination by even-aged stands, and (d) distressing levels of species at risk, both tree species and others.”

10. It is clear to me that the question of whether the forests of the province are healthy, in distress, or somewhere in between is a complex one and that the answer probably differs from one part of the province to another. Much depends on how the attributes of a healthy forest are defined: there is a sharp divide between those who primarily invoke attributes of the natural forest and those who look at the question primarily from a timber production perspective. My conclusions on this critical question are as follows:

    a. Whether the forests are in good, poor, improving, or declining condition, including from ecological and resource perspectives, should be the guiding foundational question in discussions and decision making on forestry in Nova Scotia.

    b. Currently, although there is much useful information in the state of the forest reports compiled and published by DNR, these reports do not provide the kind of comprehensive information that is required to allow people to come to holistic conclusions and to put their personal observations and opinions and those of others on the condition of the forests into a broader context of objective data.

    c. Specifically, these reports need to aim for comprehensiveness on information that is useful in understanding the ecological condition of the forests, the forests as an economic resource, and the condition, functioning, and prospects of forest-related industries.

    d. Action must be taken to address the Province of Nova Scotia’s recognition and acknowledgement that it has only low to medium confidence in many of the datasets about the province’s ecosystems.

    e. The recommendation of the Mersey Tobeatic Research Institute found in the report it prepared for this Review – that Nova Scotia should “fully utilize Canada’s Sustainable Management Criteria and Indicators (2003) and collaboratively adapt them to a Nova Scotia context” – should be accepted and implemented. The metrics for understanding the condition of the forest and forestry in Nova Scotia that are tracked and reported in state of the forest reports should include all those recommended by the Mersey Tobeatic Research Institute.

    f. Measures should be taken to make information on the forests and forestry easier to access and to understand, including by profiling information on the most important metrics in a smaller document that focuses attention on those metrics.

    g. Forest conditions should be tracked and reported at the ecoregional or forest management-plan scale, or both, as well as on a provincial scale, including to support

the forestry management planning process for Crown lands recommended in this report.

11. Improvement of forest and forestry reporting should be done transparently and in collaboration with knowledgeable and interested parties, including industry, conservation organizations, landowners, academics, municipalities, and Mi'kmaq representatives. This will create opportunities for DNR to improve tracking and reporting (and therefore decision making), to increase trust and confidence in tracking and reporting, and to build collaborative relationships with and between interested constituencies. To enhance these benefits, consideration should be given to having forest reporting independently reviewed.

12. The age structure of the forests and the age (maturity) of trees being harvested are among the metrics of significant importance on which better and more-definitive information is needed. Data in the *State of the Forest Report 2016* suggest that the age of the forests is increasing across most age classifications and that the proportion of older forests is increasing. Direct observation and other data in contrast suggest that the forests of Nova Scotia are comparatively young and that, outside of protected areas, there is a very limited proportion of older trees, and that the population of trees between 50 and 120 years of age is relatively small. These observations align with other observations and data indicating that a high proportion of young, small trees is being harvested.

13. These are indications that the province's forests, or some of them, are in poor condition, whether they are viewed from an ecological or an economic resource perspective. Older trees and forest communities are critical to ecosystem integrity and biodiversity, as well as to aesthetic and recreational values. Harvesting smaller trees can be more expensive than harvesting older trees. Cutting trees before they reach commercial potential can be a loss of economic value, including silvicultural investments. Dependency on harvesting young trees also raises questions on the sustainability of the current level of harvesting and concerns that there may be a shortage of timber in the near future, even if steps are taken now to increase the average age structure and the productivity of Nova Scotia's forests in the longer term.

14. To align forestry with the priority to be given to ecological protection, it should be guided by an overall approach to forestry (a paradigm) that has been called "ecological forestry." As explained by Professor Malcolm Hunter and Mr Chris Wedeles in their paper in the Addendum on ecological forestry, it "requires (1) conceptualizing forests as ecosystems and (2) being concerned about the effects of forestry on various ecological values such as water, soil, and habitat for an array of species." This approach to forestry, now with at least 25 years of scientific and professional backing, seeks to align forestry with ecological considerations and with ecological protection and well-being by integrating ecological knowledge, including traditional knowledge, and ecological principles and concepts into how forestry is conducted.[9] It is an approach to forestry consistent with the development and implementation of an ecosystems-based approach to forestry on Crown lands by DNR,

[9] See also Robert Seymour, "Balanced Forestry and the Triad" in the Addendum.

which is still a work in progress. It is also an approach consistent with the philosophy and objectives of Nova Scotia's Environmental Goals and Sustainable Prosperity Act.

15. The aim of ecological forestry is not to protect the environment by eliminating or prohibiting forestry. Rather, it seeks to balance the dual societal mandate of protecting ecological systems and biodiversity and sustaining a productive and profitable forestry industry. The paradigm's underlying assumption, as outlined by Hunter and Wedeles, is that if forestry practices can approximate natural processes, many of the negative consequences of these practices can be moderated because forests and forest-dwelling species have evolved to cope with the natural processes that ecological forestry emulates. This is the stated objective of DNR's ecosystem-based approach to managing forestry on Crown lands. "Listening to the forest" is how this approach was vividly described by representatives of the Confederacy of Mainland Mi'kmaq who met with me.

16. For much of Nova Scotia, a healthy and productive forest that is capable of supporting biodiversity is a multi-aged, mixed-species forest in which late-successional species have the opportunity to grow and mature in accordance with the forest's natural condition. The objective of forest practices in Nova Scotia should generally be to maintain such forest conditions where they exist and to contribute to their restoration where they have ceased to exist or have been compromised, to the extent practicable. The objectives of public policy affecting forestry practices should be the same.

17. The importance of maintaining and where possible restoring a healthy mixed multi-aged forest of diverse species is likely to increase as the climate changes. In their paper on ecological concerns about forestry written for this Review, Professor Hunter and Chris Wedeles write, "In general, Acadian forests have higher levels of plant species diversity than boreal forests, and more diverse ecosystems are likely to be more resilient and stable."[10] In addition, mentioning balsam fir, they point out that climate change magnifies concerns about borealization "because boreal tree species are predicted to be particularly vulnerable to the effects of climate change." In short, a mixed-species, multi-aged forest is one better able to adapt and adjust to climate change. Economically, it will be a forest more likely to include species of trees of commercial value that will do well under climate change while others recede from the landscape.

18. As a method of harvesting, clearcutting is at odds in many of its potential applications with the objective of maintaining a multi-aged forest over much of the landscape of Nova Scotia because, by objective or effect, it creates or perpetuates even-aged forests of single or few early successional species.[11]

19. The natural processes of particular importance are the succession dynamics and the disturbance regimes – such as fire, wind, disease, or insects – that would, or do, affect the

[10] See also the comments on the likely impact of climate change provided to the Review by the Nova Scotia Forest Biodiversity Science Advisory Committee, Appendix F in the Addendum.

[11] For further discussion, see Robert Seymour, Chris Wedeles, and Laird Van Damme, "Clearcutting," in the Addendum.

forests in the absence of forestry and other human manipulation. These disturbance regimes vary across Nova Scotia from those that tend to cause stand-replacing disturbances at relatively frequent intervals to those that tend to cause only partial (smaller) disturbances at the stand level at more infrequent intervals.

20. Leaving aside other and more-specific ecological considerations, single- or even-aged silviculture implemented by clearcutting generally emulates frequent stand-replacing disturbances, whereas partial harvesting alternatives generally emulate partial disturbances. While this means there are areas of Nova Scotia's forests on which clearcutting should not occur from an ecological perspective, it also means there are areas of Nova Scotia's natural forests on which clearcutting is an ecologically appropriate method of harvesting as long as attention to leaving legacies of the stand-replacing disturbances is reflected in how it is done. In other words, there are forests in Nova Scotia that would tend to be single-species and even-aged forests in their natural state, though there is debate about their prevalence. In such forests, clearcutting with retention can generally be expected to be in some alignment with the forest's ecological characteristics.

21. It should, however, be recognized that clearcutting generally causes greater disturbance of the forests to which it is applied than would the natural disturbances (such as fire) it emulates. This gap can be mitigated by limiting the scale at which clearcutting is conducted and by meaningful overstory retention. Currently, the Wildlife Habitat and Watercourses Protection Regulations call for "wildlife clumps" that result in retention of roughly four trees per hectare. Studies show these clumps have some ecological value. Higher levels of retention would, however, have higher ecological value while also doing more to improve the aesthetics of harvesting.

22. There is debate as to the extent and location of forests subject to frequent stand-replacing disturbances in Nova Scotia.[12] The mapping completed by DNR suggests that roughly 40 per cent of Nova Scotia's forests are subject to frequent stand-replacing disturbance regimes. Critiques of this mapping have, however, raised serious concerns that it overstates the prevalence of such stand-replacing disturbance patterns, perhaps significantly. Until these concerns are transparently acknowledged and addressed by DNR, with peer-reviewed science, caution should be applied in using DNR's mapping as justification for a level of clearcutting that assumes that frequent stand-replacing disturbance patterns apply to roughly 40 per cent of Nova Scotia forests.

23. In addition to being limited to forest vegetation types with which it is generally compatible, clearcutting should also be limited by site- or stand-specific considerations that apply across the landscape, or that would make its ecological impact unacceptable in a specific context.[13] For example, it should not be applied in stands where it would destroy or impair

[12] In addition to the emphasis placed on this issue by some of those concerned about current forestry practices, it was one of the issues flagged for the Review by the Nova Scotia Forest Biodiversity Science Advisory Committee: see Appendix F of the Addendum.

[13] See Robert Seymour, Chris Wedeles, and Laird van Damme, "Clearcutting," in the Addendum.

the habitat of a species at risk or where it would result in the destruction of old-growth forests. Depending on research currently being conducted in the Pockwock Watershed, it may have to be restricted within a protected watershed. These are other circumstances in which clearcutting should not happen:

a. In natural stands that are governed by gap dynamic and infrequent stand initiating regimes
b. In young stands that are still exhibiting rapid growth in volume and/or value
c. In forests with high recreational or social value
d. Where ecological values are likely to be impaired at a landscape level
e. In areas characterized by sensitive or thin soils (where there is a higher risk of acidification or erosion) or on steep slopes
f. In situations that may cause harm to aquatic values through processes such as erosion and siltation of runoff of surface water
g. In municipal watersheds (subject to research under way in the Pockwock Watershed)14 or when a high proportion of any watershed area has already been clearcut or otherwise disturbed
h. Adjacent to the boundaries of parks, nature reserves, wilderness areas, or other protected areas

24. There is, in addition, a further ecological consideration arguing for limits on the extent of clearcutting above and beyond limits that reflect the conditions of specific sites or stands. This is the consideration that ecological well-being needs protection at the landscape level and not only for the ecologically important aspects of particular sites, such as habitat for species at risk.[15] Indeed, the latter require not only protection from specific interference but also the proper functioning of the wider ecosystem in which they are situated. The same is true of protected areas – wilderness areas, parks, and other kinds of nature reserves: their ability to serve their conservation function depends on the integrity of the wider ecosystems in which they are located. The broader rationale for this concern at the landscape level is more directly the importance of the wider landscape for all wildlife. These considerations are summarized by Hunter and Wedeles in their paper on Ecological Considerations Related to Forestry, as follows:

> Society has long been concerned with the welfare of wildlife species, especially those that are in jeopardy of extinction or that are highly valued, such as game species, but conserving biodiversity means that all species merit some level of attention. That said, with a single ecosystem comprising hundreds or thousands

[14] The research being conducted in Pockwock is relevant to understanding the impact of clearcutting within both protected and municipal watersheds due to the fact that some but not all of the protected area is also a municipal watershed.

[15] See also Input from Nova Scotia Forest Biodiversity Science Advisory Committee, Appendix F in the Addendum.

> of species, it is not feasible to address species one by one. The practical response to this dilemma is a two-pronged approach to conservation that starts with focusing on conserving ecosystems (often called the coarse-filter approach [Hunter 1991]) and goes on to address those individual species that are not adequately conserved by ecosystem conservation (i.e., a fine-filter approach targeting species that fall through the pores of a coarse filter). The attention to SAR and nesting birds described above is a good example. The most straightforward way to conserve entire ecosystems for their biodiversity values is to designate them as protected areas in which most activities except non-motorized recreation are restricted. Moreover, many elements of biodiversity might be conserved in concert with careful, sustainable use of natural resources undertaken in ways that are consistent with natural ecological processes. This is a key role for ecological forestry …

25. The extent of the limitation this should place on clearcutting is uncertain and debated. It is an area in which research in Nova Scotia is needed and should be undertaken. The uncertainty and debate do not, however, justify the conclusion that landscape-level issues are irrelevant or unimportant in better aligning clearcutting with ecological considerations.

26. Clearcutting is an acceptable forestry practice where conducted in alignment with succession dynamics and natural disturbance regimes and used in accordance with an overall approach to forestry that is attentive to the interests of others who may be impacted by clearcutting, such as those of recreational users of the forests, neighbouring landowners, and those in the tourism industry. The ability of industry to use clearcutting where it is ecologically acceptable and attentive to the interests of others is important to industry's viability and therefore to the significant number of direct and indirect jobs that depend on the industry. In simple terms, clearcutting can be considered

    a. in vegetation types that are naturally subject to frequent stand-replacing disturbance regimes (subject to appropriate retention)

    b. in stands in which shade-intolerant, early successional species are to be perpetuated

    c. as part of well-considered restoration activities intended to address degraded conditions caused by anthropogenic influences (e.g., poor regeneration, infestation by alien species)

    d. in extraordinary circumstances, such as salvage cutting after intense natural disturbance

    e. to create areas for plantations managed intensively to provide long-term stable sources of industrial fibre, especially within an overall triad approach to the implementation of ecological forestry

27. The stated rationale for clearcutting within the economics of Nova Scotia's current forest industry is that it is a comparatively inexpensive timber harvesting method.[16] The context for the importance of this factor is that mills in Nova Scotia pay more for wood from both Crown and private land than their competitors do – in some cases, significantly more. The harvesting-cost advantages of clearcutting are said to be accentuated by the extent of the investment by the Nova Scotia industry in equipment that is geared to clearcut harvesting. It should be noted, however, that peer-reviewed literature indicates that piece size, not harvesting method, can be the most important factor in harvesting cost. From this perspective, it could be the small size of the trees being harvested in Nova Scotia that accounts for high harvesting costs. If this is so, the sustainable long-term solution is to grow bigger trees, not to continue to rely on clearcutting to harvest small trees, especially if the effect of this would be to perpetuate and expand the prevalence of a forest of small trees. This suggests that economic viability in the longer term requires aggressive measures now to ensure a suitable supply of bigger trees for harvesting in the future.

28. There are silvicultural alternatives to clearcutting that can mitigate the increase in harvesting expense associated with reduced reliance on conventional clearcutting.[17] These alternatives reduce the ecological concerns with harvesting that are associated with clearcutting. They are more consistent with making uneven-aged (i.e., multi-aged) forests a core objective of forest practices. Some of them, such as the so-called "string of pearls" approach, are being used in Nova Scotia. Others that may hold more promise, such as irregular shelterwood silviculture, are not being used as widely, although they are being used with success in comparable jurisdictions of eastern North America. While they can increase harvesting cost relative to conventional clearcutting, they are also less expensive than partial or selection harvesting methods implemented by removing scattered single trees – which, if carelessly done, can also result in high-grading. In the longer term, alternative methods would contribute to healthy forests and the availability of larger trees and potentially a reduction in harvesting cost as compared to continued clearcutting of forests of small trees.

29. The economic impact of implementing limits on the use and extent of clearcutting can also be mitigated over time by proactive identification of areas of forests that will be managed for high-production forestry, usually called plantations. Many such plantations already exist in Nova Scotia, both on Crown and private land: they account for 9.4 per cent of the forest land base of Nova Scotia, which is nearly 14 per cent of the "working forest" land base after removing forests restricted from harvesting. On Crown lands, 18 per cent of all working forest land is in plantations. The purpose of such plantations is to create forests of desired commercial trees that can be harvested in the most efficient way, including by clearcutting. The ecological advantage of this approach is that it reduces both the pressure

[16] The associated rationale also stated is that partial harvesting alternatives increase the vulnerability of trees left standing to blowdowns, which result in loss of the opportunity to harvest those trees at a subsequent harvesting.

[17] Discussed in Robert Seymour, "Balanced Forestry and the Triad," in the Addendum.

to *conduct* intensive forestry on natural forests and the pressure to *allow* that kind of forestry to happen on natural forests.

30. Such an approach would be consistent with the *triad* model of ecological forestry, the basic elements of which are already in place in Nova Scotia, albeit somewhat unofficially and to varying degrees.[18] Under this approach, aligning forestry with ecological well-being involves categorizing forests as being either predominantly for conserving ecological integrity, predominantly for producing timber, or for a balanced combination of conservation and production objectives, all for the overall objective of aligning forestry with ecological protection. In Nova Scotia, one branch of the existing de facto triad is the protected areas and other legally protected forests, including privately conserved forests, in which timber harvesting is prohibited. The high-production branch of the triad includes the plantations mentioned above, some of which are on Crown land, and the other land that owners decide to manage using high-production methods. The third branch of the triad, yet to be clearly denoted as such, is the wider landscape or matrix on which both protection and production objectives are applicable and where forestry would generally be of a low-intensity nature to ensure consistency with broader biodiversity conservation objectives.

31. For the triad model to be successful, all three of its elements must be taken seriously. Nova Scotia has most clearly taken the protection leg of the triad seriously, having almost reached its goal of having 13 per cent of the province reserved as protected areas, perhaps because of the support wilderness conservation received from the Environmental Goals and Sustainable Prosperity Act. The work to be done on this leg of the triad is, however, unfinished. Canada's commitment to protecting at least 17 per cent of its land and fresh water, and the ecological rationale within a triad framework for protecting lands representing more than 13 per cent of Nova Scotia, should include ongoing development of the province's network of wilderness areas, nature reserves, parks, and privately conserved lands.

32. The other legs of the triad have not been as clearly embraced or developed. The production forestry leg of the triad refers to that part of the landscape where timber production is the primary objective. It includes but is not limited to plantations. It encompasses any part of the working forest centred on timber production dominated by short rotation, even-aged conifer stands, primarily spruces and balsam fir, with aggressive treatments to grow quality logs for sawmills as rapidly as possible.

33. Despite the heavy reliance on clearcutting in Nova Scotia, it is not as clear that this leg of the triad is clearly identified or managed in Nova Scotia to yield high production.[19] Without this leg of the triad, the result will be – and perhaps has been – industry contraction, more pressure to continue high-intensity forestry on the component of the natural forest that should be reserved for balanced or less-intensive forestry, or some uncertain combination

[18] Robert Seymour, "Balanced Forestry and the Triad," in the Addendum.

[19] Robert Seymour, "Balanced Forestry and the Triad," in the Addendum.

of both of these outcomes. Further, unless this leg of the triad is developed, its weakness will continue to provide a rationale for both opposition to the development of the triad's protection leg and for resistance to limiting the application of intensive forestry practices, including clearcutting, to the wider forest landscape.

34. On plantations, high-production forestry entails not only planting but early competition and density control measures, including the use of herbicides. It will also require adequate investment in other kinds of silviculture and measures to ensure its effective deployment. The treatments, in addition to vegetation management using registered herbicides, may include any from this list: (a) clearcutting, (b) site preparation using mechanical scarification, (c) planting, (d) pre-commercial thinning, (e) commercial thinning, and (f) soil amendments to assure continued soil fertility.

35. The third leg of the triad is the wider landscape matrix in which conservation and forestry objectives are blended. It is also not clearly identified or managed as such in Nova Scotia. It would encompass the rest of the forest landscape not dedicated to either conservation or to high-production objectives. Under the triad, timber production is one of the activities that occurs on this landscape (excluding inoperable lands and other excluded sites such as old forest), but generally with practices, such as partial or irregular shelterwood harvesting, that have a lower ecological impact than conventional clearcutting. In this branch of the triad, forest management is expected to be dominated by practices that perpetuate multi-aged forest conditions. This does not mean forestry that makes negligible contribution to the needs of the forest products industry: high rates and qualities of timber production can, in many cases, also be realized in situations where stands are multi-aged and managed under partial and shelterwood systems, including the irregular shelterwood approach that represents exemplary ecological forestry. In addition, some clearcutting can occur in this part of the triad, based on applicable disturbance patterns and stand-specific conditions.

36. The spatial characteristics of sites allocated to each of the three levels of legs of the triad varies. Protected areas need to be large and connected enough to provide ecological functionality. In contrast, the spatial distribution of sites dedicated to ecological forestry and production forestry does not need the same aggregated patterning. Sites for production forestry will be interspersed across the landscape and selected based on site conditions, including land productivity, proximity to processing facilities, and the choices made by landowners. Ideally, to the extent practicable, high-production forestry sites will be located where there is also alignment with successional dynamics and disturbance patterns and where growing conditions are optimal. Areas where ecological forestry would be practised would form a matrix surrounding protected areas and high-production areas. Their function in the triad is to provide a substantial degree of ecosystem integrity across the landscape, connectivity between protected areas, and forest products.

37. There are four significant complications in fully implementing the triad in Nova Scotia, also discussed by Dr Robert Seymour in his paper in the Addendum to this report on balanced forestry and the triad. The first is the expected opposition to continuing or developing high-production forestry on Crown land, especially when combined with use of herbicides. I discuss the rationale for doing so below. Here, I simply say that, given the serious

challenges of implementing the triad on private land, the triad cannot be meaningfully achieved on a provincial scale without some high-production forestry on Crown land. The corresponding ecological benefit of the approach proposed in this report is much stronger assurance of multi-aged management on the rest of the working forest on Crown land.

38. The second – and related – complication is the proportion of the forest that is privately owned and, more specifically, by many owners. The issue is the number of decision makers who must opt to manage their woodlands under the triad model for the model to be achieved on a provincial scale. Leaving aside the protection leg of the triad, this presents difficulty for both of the legs in which forest operations occur. Implementing the triad requires owners who will embrace and act upon the underlying premise of ecological forestry – that forestry practices should emulate natural processes – where this calls for restrictions on clearcutting. But it also requires owners engaged in high-production forestry to minimize pressure for wider application of high-production methods and to contribute to meeting the supply needs of industry.

39. A third and related complication in implementing the triad is the challenge of maintaining a stable and predictable supply of needed wood products when more of it must come from a relatively fragmented supply network. In this report, I make some recommendations to address these complications. I do so acknowledging that addressing these issues will be very difficult and take concerted effort over many years applying a range of measures: the identification of the centrality of these issues to forestry policy in Nova Scotia goes back at least until the Royal Commission of 1984.[20]

40. The fourth complication is also a related one, though it is of broader origin and consequence. It is that Nova Scotia forests, including those being managed for industrial production, generally do not appear to be very productive from a resource development perspective.[21] For example, their productivity is considerably below that of the forests of Maine, a jurisdiction with a similar forest, to an extent that is not fully explained by biophysical differences. This is ironic, given the number of submissions I heard from industry about the problems Maine is said to have encountered in imposing limits on clearcutting. My conclusion is that the low productivity of Nova Scotia forests stems from the fact that much of the forest is not really managed at all, due either to landowner choice or to the lack of opportunity or incentive available to landowners. Further, too much of the forest that is managed is not being managed well, under the apparent influence of a combination of silvicultural theories or practices and related public policy choices that are yielding low rather than high productivity.

41. The importance of this to the implementation of the triad model is that low forest productivity increases the wood-supply and harvesting-cost challenges created for industry by ecologically based limits on clearcutting within the landscape matrix leg of the triad. It does this by limiting the wood that can be obtained from the high-production leg of the

[20] Nathan Ayer, "Summary of Forest Policy from 1980 to 2017," in the Addendum.

[21] Robert Seymour, "Balanced Forestry and the Triad," in the Addendum.

triad to offset the reduction in supply available from the wider landscape. The seriousness of this is that actions to increase forest productivity will only yield benefits over decades. Implementing restrictions on clearcutting on the part of the landscape matrix that is on Crown land, as this report recommends, will therefore create significant transition challenges for industry that are connected to but distinct from the issues of expanding the supply available from private lands.

42. Overcoming, or managing through, these complications to the triad's implementation in Nova Scotia will not be easy. What is clear is that they will not be overcome if they are avoided. They must be confronted and addressed. Unless they are, Nova Scotia will continue to face the choice between a much smaller forest industry and an industry that continues to apply high-production practices to a much wider proportion of the landscape, including to forests on Crown lands that are ecologically ill suited for such forestry.[22]

43. I received submissions in favour of clearcutting that either assumed (or asserted) that the alternative was the partial-harvest high-grading of the era before clearcutting became the dominant mode of harvesting. If this were true, it would indeed be a serious concern with my proposals to limit clearcutting on the matrix portion of the landscape on Crown land. It is beyond doubt that high-grading does (and did) lead to forest degradation. It is, however, also clear that degradation also happens when clearcutting is applied on short rotations to forests that should not under a natural disturbance regime framework be clearcut in the first place. For this Review, Professor Duinker makes this point by writing, "Timber harvests, both long past (due to high-grading) and recent (due to clearcutting), have left a legacy of impoverished forests".[23] The crucial point is that the high-grading of the 1950s and before is *not* the alternative to the current regime of clearcutting.

44. The same submissions often argued for clearcutting saying it took full advantage of the capacity of Nova Scotia's forest to regenerate without planting, an important competitive advantage for Nova Scotia's industry. I accept this to be the case but understand it to be true of some Nova Scotia forests types more than others. It is in any event an unacceptable rationale from an ecological perspective for clearcutting forests that are not subject to a frequent stand-replacing natural disturbance regime. Finally, as noted above, comparative forest productivity data suggest that the province's forests are not, for example, as productive of those of Maine, where the forests are very similar, to an extent that may not be fully accounted for by biophysical differences, important as these are. This may indicate an overreliance in Nova Scotia on the natural regeneration capacity of Nova Scotia forests. It could show that this silviculture philosophy is being applied to forests that do not fit the theory. It could show, by the same token, that there is not enough planting in Nova Scotia. It could also show that regeneration is not being adequately managed even where there is

[22] The point here is that rigorous application of ecologically justified limitations on clearcutting on Crown land, such as those recommended in this report, will result in a timber supply problem for industry until long-term improvements in forest productivity are realized on lands (whether Crown or private) managed for intensive forestry production.

[23] Peter Duinker, "Condition of Nova Scotia's Forests," in the Addendum.

high potential for regeneration. Whatever the reason, or combination of reasons, this low productivity is not only an economic problem but an ecological one: as stated above, it creates an economic imperative for application of high-production forestry techniques to more of the forest than would otherwise be necessary.

3.2 Conclusions on Implementing the Ecological Forestry Triad on Crown Lands

45. For more than a decade, the Department of Natural Resources has been developing a model of ecological forestry for Crown lands, called ecosystem-based management. At the same time, it has been incrementally bringing its management of Crown lands under this system, primarily through its oversight of licensees. The amount of high-quality work that has been devoted to this project indicates that the department accepts that Crown lands should be managed in accordance with the ecological forestry paradigm. In principle at least, this represents a shift from the paradigm recommended by the Royal Commission of 1984, which defined the purpose of forestry on Crown land as largely to produce fibre for pulp mills through even-aged silviculture.[24] On the other hand, various aspects of how this shift in paradigm is being developed and implemented raises questions about whether the shift is genuine or substantively consistent with principles of ecological forestry.

46. The department's ecosystem-based management system is built on the report, discussed above, that maps Nova Scotia's natural disturbance regimes. It now includes a comprehensive classification of Nova Scotia's distinct forest ecosystems, which categorizes forest land by vegetation type, soil type, and ecosite, resulting in the identification of 110 vegetation types within 14 "forest groups." Each vegetation type is linked to its characteristic natural disturbance regime, which is in turn linked to detailed soils and ecosite characterizations. This provides a conceptually strong foundation for making ecologically sensitive harvesting and silviculture decisions.

47. DNR's system now also includes the *Forest Management Guide*, which identifies a long list of silvicultural treatments and provides a series of prescriptive decision trees (organized by major forest groups) that prescribing foresters working on Crown land are required to use to choose the treatments they will apply to particular stands. They do so by following a pre-treatment assessment process that requires measurement of a range of variables, including overstory vegetation, regeneration, soil type, windthrow hazard, and special ecological features, if present. Soon to be completed is a landscape planning pilot project to identify and develop options for linking prescriptions made at the stand level and broader landscape-level forest management objectives, such as increasing the percentage of forest in old-growth stands.[25]

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[24] Nathan Ayer, "Summary of Forest Policy in Nova Scotia," in the Addendum.

[25] The importance of this pilot project, and of the objective of being able to link stand-level prescriptions to landscape-level objectives, is recognized and emphasized both by the Review team (see Hunter and Wedeles, "Ecological Forestry," in the Addendum) and by Nova Scotia's Forest Biodiversity Science Advisory Committee (see Appendix F in the Addendum). Its importance (and urgency) is also implied by Hunter and Wedeles, "Ecological Considerations Related to Forestry," in the Addendum.

48. Administratively, each prescription is subject to DNR approval. This is done through the department's Integrated Resource Management (IRM) process, which brings together DNR foresters and biologists, among other specialists. Approved "blocks" are posted on the "harvest viewer," which allows members of the public to view the proposed harvest and to submit questions or concerns to DNR. These are typically referred by DNR to the licensee for response. The department conducts audits to satisfy itself of the accuracy and completeness of the data and analysis that go into pre-treatment assessments. It conducts random field inspections to satisfy itself that silviculture treatments are conducted as approved.

49. In principle, this framework creates a strong foundation for conducting forestry on an ecological basis: it is an innovative system that reflects positively on the knowledge and professionalism of the DNR employees who developed it. Its underlying rationale is to match silviculture to natural disturbance regimes at the ecosystem level. Its stated objective is to "prescribe uneven-aged management and non-clearcut harvesting methods when appropriate as a first choice," and to "favour natural regeneration harvest methods where possible within stand and site limitations." Developing such a framework has been and continues to be a resource-intensive project that gives Nova Scotia a unique set of tools for operationalizing ecological forestry in an Acadian forest context.

50. It is, however, disconcerting that the framework remains a work in progress roughly 10 years after its development began. Throughout those years, the percentage of harvesting on Crown lands that is conducted by clearcutting has decreased only modestly. For example, it decreased only from 67 per cent in 2006 to 63 per cent in 2016. The point of departure for the framework continues to be the highly criticized natural disturbance mapping that may significantly overstate the prevalence of frequent stand-replacing disturbance regimes. There is a lack of clarity as to how the framework interacts with the IRM process, which is understandably described by critics as a "black box process." This raises questions, especially in light of the proportion of clearcut harvesting that continues, as to what values are actually being applied in that process.

51. Analysis of the framework, particularly of the Forest Management Guide and decision keys, suggests that it does not encourage but limits multi-aged silvicultural prescriptions. The following is a list of examples written by Dr Robert Seymour of the Review team:

    a. The first node in many keys is whether or not the stand is "over-mature." This pejorative term is a relic of a past era when efficient, economically driven timber management sought to create forest structures devoid of biologically old trees, and is no longer used in scientific literature or textbooks. Table 4 of the Guide (page 15) attempts to define over-maturity using tree ages that are often only one-third or less the lifespan of the species. For example, if a hemlock forest is over age 100, it is deemed "over-mature" and unsuitable for multi-aged silviculture, and is instead sent to the "Regenerate" key, where complete overstory removal is prescribed once advance

regeneration is present. Such a complete disturbance in a biologically young (hemlock lives to age 400–500) hemlock forest would be virtually unprecedented in nature. [26]

b. The concept of tree and stand maturity clearly does belong in any silvicultural decision guide, but the various definitions of maturity (ecological, biophysical, economic) should be clearly distinguished, defined, and applied more appropriately.

c. In virtually all the forest groups, complete overstory removal is prescribed once advance regeneration stocking is adequate (typically 70%). If the only goal is good regeneration, then this practice suffices, but even the necessity for advance regeneration is overridden where windthrow hazard is high. Options to retain immature growing stock trees, rare species, or large legacies are not addressed.

d. In the forest types where multi-aged silviculture is considered, *high windthrow hazard* or *deficient stocking of Acceptable Growing Stock (AGS) trees* triggers a regeneration treatment as above. In strict ecological terms, where the goal is to maintain or restore the long-lived intermediate or tolerant (LIT) stand component, these factors are largely irrelevant. Both decision variables thus appear to have strong economic underpinnings. Residual trees that are subsequently blown down or broken off are viewed as "wasted wood" rather than valuable biological legacies and habitat structures. Also, from an ecological standpoint, there is nothing wrong with carrying substantial stocking in Unacceptable Growing Stock, which is strictly a timber-driven criterion based on suitability of trees for sawlogs.

e. When considering early successional forest types (e.g., Intolerant Hardwoods such as aspen and paper birch), the criteria for *stocking of LITs required to follow a restoration pathway* is far too stringent and would only infrequently be met. Principles of conservation biology applied to silviculture strongly suggest that all LITs be left, *especially in cases where such LITs have become rare*. Whether they are AGS, vigorous, have low windthrow risk, and meet other traditional timber-based criteria is irrelevant.

f. The precautionary principle dictates that we should never kill the last of anything that will occupy a given ecosite. A limited review of nine recent harvest plans revealed several cases where small components of eastern white pine, red spruce, sugar maple, yellow birch, and red oak documented in the pre-treatment assessment were prescribed for clearcutting because the dominant stand components were shorter-lived balsam fir, white birch, and black spruce. These prescriptions will ensure that the LITs will likely never again reach the main canopy, furthering the dominance of off-site, shade-intolerant pioneer tree species where they are ill adapted (the process sometimes characterized as borealization of the Acadian forest).

g. The pre-treatment assessment and prescription process do not appear to employ the excellent, synthetic concept of *ecosite* that is well developed in the Forest Ecosystem Classification manual, even though all the information needed to do so (Vegetation

[26] Robert Seymour, Ecological Based Silviculture on Crown Lands: Review of DNR's Forest Management Guide, in the Addendum.

Type, Soil Type, Ecoregion) is collected. This is particularly relevant to item (d) above regarding restoration of forest composition and structure that has been degraded ecologically from excessive past disturbance, usually clearcut harvesting. For example, all Intolerant Hardwood vegetation types – nominal candidates for restoration – occupy ecosites that can be found in later-successional vegetation types, suggesting that these could routinely become restoration targets mandated in any prescriptions for such conditions.

52. A different kind of deficiency with DNR's ecosystems-based forestry framework is that the pre-treatment assessment process does not take wildlife issues into account. In their paper for this Review, "Ecological Considerations Related to Forestry," Professor Hunter and Mr Wedeles put it this way: "A shortfall of the system is that the data collected are not used to (1) predict impacts on wildlife, (2) consider wildlife-based concerns in silvicultural prescriptions, (3) identify ameliorative measures."

53. The issue of the role that wildlife concerns played in DNR decision making on harvesting came up elsewhere in the Review. For example, several people referenced – and the Review team noted – the conclusion of the Auditor General that the department has completed few of the recovery plans and created few of the recovery teams that it is supposed to have in place for species at risk under the Endangered Species Act. The East Coast Environmental Law Association presented a written brief that dealt extensively with the department's record under this legislation. It points out that although the act contemplates regulations protecting core habitat for species at risk, "There are 46 species listed as threatened or endangered … but there are no regulations respecting core habitat."[27]

54. The lack of attention to wildlife in the ecosystem-based management (EBM) process is not counterbalanced by reassurance that wildlife issues are independently injected into the IRM process. DNR wildlife biologists expressed a desire to the Review for a greater and more preventive opportunity to comment and have input on timber harvesting plans and, more generally, for greater opportunity to better align harvesting with wildlife conservation considerations and objectives, including but going beyond those directly associated with species at risk.

55. These points raise doubts about whether the department's approach to ecosystem-based forestry will produce the intended shift toward ecological forestry on a timely and meaningful basis, including science-based reductions in the proportion of clearcut harvesting. They raise concern for some that delaying that shift while appearing to be working toward it may be the objective of the department, or of some within it. One possibility is that some of the policy impetus for a robust ecological framework dissipated once the department moved away from the commitment to make clearcutting no more than 50 per cent of harvesting within five years. Another possibility, not mutually exclusive,

[27] This issue is also profiled in Input from the Nova Scotia Forest Biodiversity Science Advisory Committee, Appendix F in the Addendum.

is that the move to EBM competes with DNR's wood supply obligations to forestry companies and that the latter may be the more important factor in the IRM process.

56. My conclusion is that the EBM framework DNR has created should be amended to remove the features that artificially favour even-aged silviculture in natural forests and to strengthen the support it provides for multi-aged silviculture prescriptions. This should be done through an open and transparent process that includes an advisory group with membership from industry, technical and academic experts, and representatives of forestry policy stakeholders. This advisory group should include representation from the Review team. The changes that should be made are described in detail in the paper entitled "Ecological Based Silviculture on Crown Lands: Review of DNR's Forest Management Guide," written for this Review by Dr Robert Seymour, which can be found in the Addendum to this report. The critical changes to be made are these:

    a. Drawing on work from other nearby jurisdictions, revamp the Forest Management Guide to describe and emphasize a wider range of ecologically based silvicultural systems, especially irregular shelterwood, that result in at least two age classes after harvesting to improve management of growing stock, conserve biological diversity, better manage light and regeneration, retain and enhance stand structures, and improve aesthetics of harvested sites. Eliminate complete overstory removals from all keys and replace with a requirement for retention of residual trees in all (former) single-aged prescriptions. To the extent that such systems increase harvesting costs, ensure that such practices qualify for silviculture funding via the Registry of Buyers and the Association for Sustainable Forestry programs.

    b. To maintain or enhance diversity in age and structure, incorporate guiding principles in the Forest Management Guide that prescriptions should never (i) reduce the age or vertical diversity of the pre-harvest stand, (ii) release or regenerate commercial tree species that are shorter-lived or more early successional than the present overstory, or(iii) simplify species composition by harvesting minor components of LIT species in a complete overstory removal.

    c. Replace the present requirement for "wildlife clumps" with far more rigorous retention requirements (in the range of 5–30 per cent of the pre-harvest stocking, depending on site conditions), including requirements that such retention be dispersed throughout the harvest block, not just aggregated into small clumps, which offer little benefit.

    d. To facilitate the field application of the above, revamp the pre-treatment assessment protocols to require more assessment of stand structure and wildlife habitat features, and to formally measure and assess potential for post-harvest retention.

    e. Thoroughly revamp definitions of tree and stand maturity (Table 3 in the Forest Management Guide) to better reflect ecological factors such as longevity, successional status, potential for growth responses at older ages, and potential to reach large size, balanced with traditional timber concepts of maturity.

    f. Maintain the emphasis on shelterwood regeneration methods, but relax the strict requirements for short regeneration periods to better accommodate the necessity for

decades-long recruitment of later-successional species and their ability to grow well under partial overstory shade.

57. These changes are intended for application on what DNR calls the "working forest" on Crown lands that are part of the matrix forests in a landscape triad that are largely managed using natural regeneration under an ecological framework. They are not meant to apply to areas where plantation forestry is conducted on Crown lands as a contribution to the intensive production forestry leg of the triad. It may also be appropriate to exclude other parts of Crown land being appropriately utilized for high-production forestry from their application. Instead, these areas of Crown land should be managed under an outcomes-based accountability regime such as the one I recommend below.

58. My conclusion is that forestry operations on Crown land should continue to include high-production forestry, provided that it is conducted in accordance with the principle of ecological forestry implemented via a triad model. At a minimum, this is necessary to ensure that both industry and Nova Scotians realize the value of decades of silvicultural investments that have been made to grow merchantable trees for commercial forestry on Crown lands. More broadly, a continuing presence of high-production forestry on Crown land recognizes the important role that wood from Crown land plays in providing Nova Scotia's forest industry with supply stability in a province in which a high percentage of forest land is owned by many independent private owners. Continuing the contribution of Crown land to high-production forestry, particularly with plantations, can also minimize pressure to conduct ecologically damaging harvesting both on Crown land and on private land. It may be essential to effective implementation of the triad approach to ecological forestry in Nova Scotia. For these reasons, opportunities for expanding high-production forestry on Crown lands should be explored, provided that this can be done through application of silvicultural methods consistent with ecological forestry on a landscape scale and without clearcutting where clearcutting should not occur.[28]

59. High-production forestry on Crown land should, however, be subject to a more-robust accountability framework for its effective management than is currently in place – accountability that is responsive to the characteristics of, and rationale for, high-production forestry. My conclusion is that those licensed to conduct forestry on Crown land should, in respect of the high-production elements of their activities, be required by DNR to achieve outcomes – in areas such as soil productivity, water quality and wetlands, timber supply and quality, aesthetic impacts, biological diversity, public accountability, economic aspects, social consideration, and forest health – such as required under the State of Maine's Outcome-Based Forestry Policy. This outcomes-based regime should be subject to compliance with otherwise applicable laws and regulations, such as the Endangered Species Act and the Wildlife Habitat and Watercourse Protection Regulations.

[28] This conclusion is closely related to the conclusion below that a Forest Utilization Licence Agreement should be subject to a class II environmental assessment or to a review process that is equivalent to and serves the same functions as such an assessment.

60. My conclusion is that licensees on Crown land should have the option on plantations identified for high-production forestry of using herbicides, in accordance with applicable regulations, to maximize yields of desired commercial species. This is to ensure that production forestry is in fact high-production forestry. It is also to limit the amount of forest land needed in high-production forestry to ensure that Nova Scotia's forestry products sector has an adequate supply of timber. Overall, my conclusion is that constrained use of herbicides (typically occurring once per stand during a rotation of between 40 and 80 years) within the high-production branch of the triad represents minimal and acceptable risk within the ecological forestry paradigm, as compared to the alternative of a higher amount of intensive forestry being conducted on the wider landscape, whether on Crown land or on private land. It will also minimize the diversion of pre-commercial thinning activities, which is currently happening, from improving stocking and density of naturally regenerating stands (where it is called for) to salvaging failing plantations (where it should not be required). Although I recognize the concerns that many have about the use of herbicides, I accept the conclusion of Dr Robert Seymour, based on a recent exhaustive review of the literature, which found a general lack of evidence of significant deleterious effect to humans, terrestrial and aquatic fauna, and environmental quality from the use of herbicides in forestry.[29]

61. To enable the option of using herbicides, DNR should reverse its policy of excluding this silvicultural option from public funding for silviculture on Crown lands.

62. The system of silviculture spending and oversight on Crown lands needs improvements in six respects:

    a. In addition to providing funding for partial and selective cutting, it should provide funding for a broader range of silvicultural options to protect and promote uneven-aged management, including substantial increases in pre-commercial thinning, cleaning, and irregular shelterwood harvesting.

    b. It should include silvicultural practices that can improve the yield obtained from high-production forestry, including planting and the use of herbicides to discourage competing species.

    c. There should be stronger accountability for the effectiveness of silviculture applied to Crown lands, including independent auditing of outcomes achieved relative to forest management plans, including in the effectiveness of silviculture for high-production forestry.

    d. Silviculture planning should be a major focus of the legislated forest management planning process for Crown lands recommended later in this report.

    e. It should provide greater transparency and accountability for management of silviculture trust accounts.

[29] Robert Seymour, "Herbicides," in the Addendum.

f. As part of a wider review of the multiple systems under which silviculture happens, it should be reviewed to ensure its alignment with ecosystem-based forestry on Crown land and the implementation of the ecological triad on the wider landscape.[30]

63. Under the combination of managerial and regulatory changes discussed in the preceding paragraphs, clearcutting could be reduced to perhaps 20–25 per cent (from 65%) of all harvesting on Crown land. Roughly 10–15 per cent of this would be clearcutting to establish and maintain high-yield plantations, while an additional 5–10 per cent would be final regeneration harvests in frequently disturbed ecosystems. The accuracy of these estimates will depend on (a) how much of the land is found to be within frequently disturbed regimes in a revised natural disturbance map for the province, and (b) exactly how the proposed changes to the ecosystem-based framework are implemented. Where clearcutting happens, retention would not be required in plantations, except in accordance with the Wildlife Habitat and Watercourse Protection Regulations. Harvests in natural forests would require more retention than currently required by those regulations. Most of the rest of the working forest on Crown land would be managed using repeated partial harvests under multi-aged silviculture systems that maintain continuous forest cover. Overall, more than half of the forests on Crown land now treated by clearcutting would be harvested by other methods, and over half the remaining clearcuts would have a reduced ecological impact.

64. The Review team estimates that this represents a short-term reduction in wood harvest from Crown land of approximately 10–20 per cent, with the loss being distributed unevenly across regions, depending primarily on the character of the forests on Crown land from region to region. Greater harvesting from sites of high-production forestry on Crown lands is not a short-term option for addressing this reduction in wood from Crown lands; harvests from those areas are already included in the wood supply model that shows a 10–20 per cent reduction in wood from Crown lands due to implementation of the revised EBM system. Similarly, higher harvesting from private-land plantations is also not an option in the short term: they are already projected in the wood supply model to be harvested as well. This leaves increased harvesting on other private land, including woodlots, where the proportion of harvesting by clearcutting is already over 80 per cent. Nova Scotia's sustainable harvest level, which is above actual harvest, suggests the trees are there. The issue will be whether they are available to industry on economic terms.

65. I have considered three other forestry practice issues relating to Crown land: full-tree harvesting, often called whole-tree harvesting; the width of the special management zones (i.e., riparian buffers) that are required to be left between harvest operations and bodies of water by the Wildlife Habitat and Watercourse Protection Regulations; and the so-called "wildlife clumps" required by the same regulations.

66. Currently, full-tree harvesting is not allowed by policy on Crown land, but there is no legislative prohibition of it on Crown or private land. I have concluded that such harvesting,

[30] Options for achieving these and other improvements to the system are discussed in Laird Van Damme and Peter Duinker, "Silviculture Reporting, Progress, and Accountability," in the Addendum.

when it is combined with clearcutting, as it typically is, generally makes the ecological damage caused by clearcutting sufficiently adverse as to make it unacceptable on private or Crown land. As pointed out by Peter Duinker, Laird Van Damme, and Jeremy Williams in their paper for this Review on the topic, the main concerns are erosion and the removal of nutrients from the soil and the impact of this on soil fertility, "a major concern in Nova Scotia." Another supporting consideration is the potential exacerbation of climate change on the impacts of full-tree harvesting combined with clearcutting, also noted by Duinker, Van Damme, and Williams. I therefore have also concluded that full-tree clearcutting should, possibly subject to limited exceptions, be prohibited or generally prohibited by regulations under the Forests Act that would, like the Wildlife Habitat and Watercourse Protection Regulations, also apply to Crown land. The exception that may be warranted is where full-tree clearcutting is used to conduct salvage harvesting. If that exception is to be created, regulations should specify the quantity and quality of limbs, chips, and other debris to be left on the harvested site.

67. Currently, riparian buffer zones applicable on Crown lands are those set by the Wildlife Habitat and Watercourse Protection Regulations. The regulations require a fixed riparian buffer zone of 20 metres, subject to watercourse width and slope-based variations. Twenty metres is a relatively narrow riparian zone compared to those applied in other jurisdictions and relative to what the literature would indicate is generally needed to ensure effectiveness. This is particularly so, considering that harvesting is allowed in the riparian zone in Nova Scotia but not in some other jurisdictions. On the other hand, Nova Scotia's narrower riparian zone requirements apply to smaller watercourses than in other jurisdictions.

68. I have concluded that the adequacy of the watercourse protection provisions currently prescribed in the Wildlife Habitat and Watercourse Protection Regulations should be independently studied.[31] The regulations should be amended in accordance with the outcomes of this study. One of the issues to be considered is whether a wider buffer is needed to ensure effectiveness in particular conditions. Another highly relevant variable is the method of harvesting: generally, a wider riparian zone may be called for next to clearcutting with minimal retention than next to other kinds of harvest. One obvious option would be a general increase of the riparian zone required next to all watercourses. An alternative is to require different zones next to watercourses of different classes. Another option to consider is a tiered system in which the restrictiveness of the riparian zone increases with proximity to the watercourse. For example, in a review that increased the width of riparian zones overall, a no-harvest zone could apply immediately adjacent to the waterbody, and a partial-harvest-only zone could apply farther away from the watercourse, with its width depending on the severity of the abutting harvest. For example, the regulation could be amended to include the following elements, taken from the paper on special management zones written for this Review by Professor Malcolm Hunter and Laird Van Damme:

[31] Malcolm Hunter and Laird Van Damme, "The Shores of Watercourses (Riparian Areas)," in the Addendum.

- Special management zones next to watercourses adjacent to clearcuts could be either 30 m where the watercourse is so narrow that the forest canopy is unbroken above it or 40 m where the watercourse is wider.
- The machine exclusion zone could be a no-cut zone, providing an area to retain large old trees and snags next to water.
- On a case by case basis, wider special management zones (up to 100 m) could be considered on larger lakes and rivers to account for recreational and aesthetic issues or wherever other considerations, such as habitat for species at risk, require much wider special management zones.

69. Currently, the Wildlife Habitat and Watercourse Protection Regulations require "wildlife clumps" to be retained in areas harvested by clearcutting. Some research has shown that these clumps, contrary to the skepticism of some, may have some ecological value. They will, however, probably have less ecological value than the levels of retention proposed for Crown lands to be governed by the revised ecosystem-based management framework. These are recommended to be in the range of 5–30 per cent of pre-harvest stocking, depending on site conditions, with requirements for retention to be dispersed throughout the harvest block. These retention levels will also do more for the aesthetics of harvesting than the currently required wildlife clumps. With those changes in retention levels adopted, consideration should be given to whether the wildlife clumps required under the Wildlife Habitat and Watercourse Protection Regulations should continue to apply to Crown land managed under the amended ecosystem-based system.

70. The wildlife clumps requirement would continue to apply to high-production forestry conducted on Crown land. This requirement should, however, be independently reviewed to better determine its efficacy and adequacy in achieving its intended wildlife protection purpose. The research that has been done, while helpful, is not sufficient to conclude that the requirement is efficacious. The wildlife habitat provisions of the Wildlife Habitat and Watercourse Protection Regulations should be amended in accordance with the outcomes of this Review.

71. DNR, with Crown licensees, must take immediate and sustained action – including by conducting or commissioning appropriate scientific research, engaging interested parties in collaborative problem-solving forums, and adopting precautionary measures – to respond to concerns about the potential adverse impact of Crown land forestry on

    a. sensitive soils, particularly on Crown lands in the western region[32]
    b. bird populations[33]
    c. tourism operations and developmental plans

[32] DNR scientists have done the leading work on this issue, and the department needs to act on and build on that work.

[33] I learned in this Review that Nova Scotia has some of the highest densities of forest-dwelling songbirds in Canada, particularly in its coniferous forests. Keeping it so should be a policy priority.

d. outdoor recreation activities, including established trails

e. Protected Areas

72. During the course of this Review, there was considerable discussion and much coverage in the media of clearcuts of areas said to be or to include old-growth forests. Defining what is and what is not an old-growth forest is difficult. But it is clear that, however defined, there is currently little of it in Nova Scotia's forests outside of ecological reserves: as little as 0.9 per cent of the wider forest, according to the most recent State of the Forest Report. In my view, it is also clear that DNR "targets" for the protection and restoration of old-growth forest conditions outside of those reserves are not ambitious enough. Steps that together would go a long way to improving the abundance and conservation of old forests in Nova Scotia, as developed for this Review by Professor Duinker (see his paper, "Old Forests," in the Addendum), include the following:

a. Implementation of ecological forestry, with emphasis on long-rotation stand development and multi-aged stand structures.

b. Accelerated and improved data collection on the existence of old forests across all unprotected Crown lands. This could include improvements to the pre-treatment assessment process, targeted field assessments, and advanced applications of spatial modelling (GIS) and data capture technology such as LiDAR.

c. Reconsideration of the area-proportion targets in the Old Growth Policy, as well as potential inclusion of other tree species in the climax group (e.g., red oak, red maple). This will require a targeted research program that, like other DNR initiatives, should become an inclusive process with participation of a suitable range of scholars and experts from various walks of life.

d. Addition of old-forest restoration targets alongside the old-forest protection targets in the policy.

e. Development of a silvicultural manual for old-forest restoration.

3.3 Conclusions on the Legislative and Planning Framework for Crown Lands

73. More than an improved ecosystem-based management process and improved regulations (or policy) on specific forestry practices is needed to ensure that forestry on Crown land becomes the model of ecological forestry that DNR says it should be. Measures are required to make sure that the necessary change of paradigm is embraced from top to bottom within DNR as well as by those who are licensed to conduct forestry on Crown lands. These measures should include changes in the legislative and institutional context in which the management of forestry on Crown land occurs, to ensure that ecological forestry, including a strong ecosystem-based prescription process, truly determines how forestry is governed by DNR and conducted by licensees.

74. These changes should include

a. ensuring, as an immediate priority, that the Endangered Species Act is fully implemented on Crown land, including by the completion of recovery plans that

identify and make provision for protection of core habitat for species at risk located on Crown lands.

b. amending the Crown Lands Act to ensure that its stated purposes encompass and give equal weight to the full range of the values (and uses) relevant to the management of Crown land, thereby eliminating the preference the act's current statement of purpose gives to timber production objectives.

c. establishing a legislated forestry management planning process for Crown lands under which those given tenure to conduct forestry on Crown land (for example, under a forest utilization license agreement [FULA]) would be required to complete their forest management plan through a Class II environmental assessment under the Environment Act or a process akin to a Class II environmental assessment conducted by an independent third party (or panel) appointed by the Minister of Natural Resources or jointly by the Minister of Natural Resources the Minister of Environment.

d. writing a goal (or goals) for the implementation of ecological forestry on Crown land into the Environmental Goals and Sustainable Prosperity Act, currently under review.

75. The rationale for the conclusion that the Endangered Species Act should be robustly implemented on Crown land should be self-evident. In addition to the obvious fact that the law of Nova Scotia requires recovery plans and teams to be created, its purpose is to protect species at greatest risk of disappearance from Nova Scotia's forests. It cannot do that if it is not strongly implemented and enforced on Crown as well as private land. Indeed, the Crown's capacity to effectively enforce it on private land – where it must be as equally effective as on Crown land to achieve the act's objectives – depends on its credibility in having implemented the law fully on its own land.

76. The rationale for the proposed amendments to the Crown Lands Act derives from the fact that this statute is the source of authority for DNR officials who manage Crown land and, specifically, for the licensing of forestry on Crown land. Currently, it defines its purposes in a way that conveys a powerful message that Crown land should be managed for forestry.[34] Changing the governing legislation to make it clear that Crown land should be managed for multiple objectives, including but not limited to forestry, will not by itself ensure that it is managed accordingly. But it will help to ensure that Crown land is managed for a wider array of values, and it will make it clear that managing Crown lands solely or primarily for forestry or without sufficient regard for other values, interests, and objectives is wrong.

77. The rationale for requiring "FULA holders" to complete a legislatively mandated forest management plan through a Class II environmental assessment – or a process akin to that kind of environmental assessment – is multi-faceted. It is explained in greater detail in the paper on environmental assessment and forestry by Professor Peter Duinker, found in the Addendum to this report. Such a process will fill a gap in the management system for

[34] In this Review, the other objectives referenced in submissions included landscape aesthetics, outdoors (and wilderness) recreation, maple syrup production, tourism, craft forest industries, alternative forest industries, and biodiversity, wildlife, and nature conservation.

forestry on Crown land with a process like the one followed in some other provinces. It will ensure that the public has an opportunity to have input at a level and scale where the decisions are made that will guide many harvesting decisions over a wide landscape and over multiple years. It will bring important elements of independence, transparency, and participation to a process that is now seen to be compromised by the double mandate of DNR, the self-interest of forestry companies, and a high level of opaqueness. Further, it will help to ensure that ecological forestry principles, concepts, and methods are incorporated into the plans that guide licensees in their harvesting planning and activities and in their operational decision making at the stand level.

78. A legislated forestry management process conducted as a Class II environmental assessment – or in a comparable process under an independent third party (or panel) – has the potential to accomplish a range of objectives:

    a. It will bring transparency to the management of Crown land for forestry production and provide the public with a meaningful opportunity to contribute to Crown land management at a strategic level of decision making.

    b. It will help to ensure that forestry is conducted on Crown lands in ways that are compatible with the full range of values applicable to the management of public lands, with the activities of other users of Crown lands, and with activities taking place on neighbouring lands.

    c. It will help to embed the principles and values of ecosystem-based forestry (or of ecological forestry) into the plans that will then inform operational planning and harvesting decisions.

    d. It will bring a significant measure of institutional independence from DNR to the planning of forestry on Crown land.

    e. It will create opportunities for stronger and continuing relationships between operators and their stakeholders and mechanisms for ongoing dialogue with those stakeholders through the process of a plan's ongoing implementation.

    f. It will facilitate and enable customized application of the principles of ecosystem-based forestry to account for relevant regional differences.

    g. If done properly, with openness and transparency and based on strong science, it will reduce the pressure for intense scrutiny by DNR or the public of individualized harvesting decisions.

79. My conclusion is that the current system under which DNR approves each and every harvest conducted on Crown land is problematic for the following reasons:

    a. It means that the limited resources of the department are disproportionally invested in operational work instead of in developing the policy framework for ecological forestry, analyzing and conducting research on policy and scientific questions, conducting oversight of forestry operations on Crown lands, and supporting the forestry management activities of forestry businesses and landowners.

b. It compromises the ability of DNR to hold licensees accountable by implicating the department in the industry decisions and actions that warrant accountability.

c. It diminishes the responsibility of licensees, and of their professional advisers, for stewardship of the public resources they are authorized to manage, develop, and utilize.

d. It creates a relationship of partnership between DNR and licensees (operators), which is contrary to DNR's accountability to ensure that Crown lands are managed in the public interest for multiple values and objectives, thereby contributing to the perception that DNR manages Crown land – and is managed – for the benefit of the forestry industry.

e. It causes understandable confusion and uncertainty on the part of the public, DNR, and industry about who is responsible for what in decision making and operational activity on Crown lands.

f. It politicizes the management of DNR, the management of Crown lands, and the conduct of forestry business in Nova Scotia.

g. It increases the cost of doing business in forestry in Nova Scotia and otherwise detracts from the attractiveness of Nova Scotia as location for investment in forestry.

h. It is not working in addressing public concerns about how forestry is managed and conducted on Crown lands, or in improving how forestry is conducted on Crown lands.

80. An alternative outcomes-focused system – under which DNR's responsibility for the forestry aspect of its management of Crown lands is focused on policy, science, licensing, the approval of land use management plans, regulation, and enforcement – should be developed and implemented. This system should include measures to ensure full and effective implementation of the Endangered Species Act on Crown lands; adoption and implementation of amendments to the Crown Lands Act designed to ensure that the conduct of forestry on Crown lands is compatible with the full range of values and objectives that should apply to the management of all Crown lands; and legislative establishment of a forestry planning process conducted as or like a Class II environmental assessment under the control of an independent third party as a condition of obtaining permission to conduct forestry on Crown lands.

81. It is, however, reasonably clear that a new and less-managerial system in which DNR is extricated from the operational aspects of forestry operations will be acceptable only if DNR, the industry, and forestry professionals demonstrate commitment to an approach to forestry on Crown lands that is consistent with modern principles of ecological forestry.

82. DNR must have a comprehensive and rigorous monitoring, oversight, and accountability system in place before removing itself from harvest-level decision making on Crown lands. This system should fully address the recommendations made by the Auditor General in his 2015 report on his review of DNR's activities in Forest Management and Protection.

83. The Environmental Goals and Sustainable Prosperity Act (EGSPA) is currently being reviewed for updating and revision. The shift in paradigm toward a triad model of ecological forestry on Crown lands is of fundamental relevance and importance to the

social, economic, and environmental philosophy of sustainable prosperity embedded in EGSPA. It therefore follows that EGSPA should specify a goal or goals relative to the implementation on Crown lands of the triad model of ecological forestry. Like many of the other goals in EGSPA, these should be aspirational and focused on outcomes rather than on all of the detailed steps that could or must be taken to achieve those outcomes.

3.4 Conclusions on Impact on Wood Supply and Harvesting Costs

84. Industry urged me to cost my recommendations, particularly to understand their potential consequences for harvesting costs or losses of wood supply. The suggestion from some was that I should not make recommendations without knowing what they would cost the industry. Even though I agree with the importance of understanding the costs associated with alternative approaches to the management or regulation of forestry practices, this is not a proposition I accept, any more than I would accept the proposition that I should not make recommendations beneficial to the industry (as I have) without knowing exactly what their ecological costs or cost to others, like the tourism industry, would be.

85. On wood supply, the Review team conducted a preliminary analysis of the impact that proposed changes for DNR's ecosystem-based system of management would have on wood supply.[35] That analysis suggests a short-term reduction in wood harvest from Crown land of between 10 and 20 per cent. It also suggests that the reduction cannot be addressed in the short term by shifting production either to high-production sites on Crown land, including plantations, or to plantations on private land. More broadly, the analysis indicates that the reduction can be addressed by increased harvesting on other private lands, given that the sustainable harvest level (as estimated by DNR) is currently above actual harvest levels. The issue will be its economic availability and the cost of procurement and of harvesting. Further scenarios should be run, particularly to determine the impact on wood supply from Crown land of different levels of required retention on Crown land; that is, within the proposed 5–30 per cent range.

86. Otherwise, the Review team did not have the opportunity to complete the kind of analysis of my recommendations that industry urged me to complete. If such an analysis is part of the consideration of my recommendations, it should look at benefits as well as costs and it should look at both broadly, including ecological and social considerations as well as economic ones and consider all three in the long as well as the short term. These should be compared to the costs and benefits of current forest practices, again taking ecological and social as well as economic outcomes into account for both the short and the longer term. The analysis should be completed openly and transparently. This will not only ensure its credibility but help to avoid a flawed analysis. It will, for example, prevent the kind of discrepancy that occurred in the past when DNR commissioned a review of the cost to industry of the goal of reducing clearcutting to 50 per cent or less of harvesting in five years; instead of analyzing the impact of a reduction in the percentage of harvesting done

[35] Described in Robert Seymour, "Ecological Based Silviculture on Crown Lands: Review of DNR's Forest Management Guide," in the Addendum.

by clearcutting, it analyzed the impact of a 50 per cent reduction in the volume of harvesting, a very different thing. Openness and transparency will also help to ensure that the analysis is conducted on the basis of fair, defensible, known, and openly stated assumptions.

87. Specifically, if there is to be a cost analysis of recommendations that limit or reduce clearcutting on Crown land outside of plantations, there should be a parallel analysis of the socio-economic and ecological costs of current harvesting practices on those Crown lands. For the reasons given in the preceding paragraph, this analysis should be conducted openly and transparently. This will ensure that there is clarity and accountability for the tradeoffs being made among economic, social, and environmental factors in decisions based on a costs/benefits analysis of my recommendations.

88. An acceptable alternative would be to simply get on with the implementation of the recommendations contained in this report, dedicating the analytical capacity that would otherwise go to this kind of cost/benefit analysis to the work of identifying, designing, and testing options for making the change to ecological forestry that is right for Nova Scotia. On this approach, one of the areas of focus should be options for mitigating the impact on the forest industry of implementing changes in how forestry is practised in Nova Scotia, particularly on Crown lands, other than delaying the implementation of those changes.

3.5 Conclusions on Achieving Ecological Forestry and the Triad on Private Lands

89. On forestry practices on private land, I have reached three fundamental conclusions:

    a. First, the considerations leading to the conclusion that forestry practices on Crown land should be guided by ecological forestry also apply to private land.

    b. Second, decision making on the forestry practices that are followed on private land should generally be left to the owners of the land.

    c. Third, government, industry, and foresters must more actively and seriously seek to encourage, enable, and support private landowners to manage their forested land in accordance with the principles of an ecological forestry triad paradigm.

90. The objectives of an ecological forestry paradigm cannot be fully achieved solely by their application to the management of Crown lands. Provincially owned lands represent only 33.4 per cent of the lands in Nova Scotia and have no necessary locational relationship either to features of ecological importance or to the conditions that are best for growing trees for the forest industry. In fact, Crown land tends to be less-fertile land: it was the land that was not granted for settlement because it was less attractive for agriculture.

91. A high proportion of the harvesting that happens every year happens on privately held land. Currently, more than 70 per cent of wood harvested is harvested on private land. Within an ecological forestry paradigm, this means that a roughly equal proportion of the accommodation between ecological protection and harvesting that the paradigm calls for, including the high-production branch of the triad, must happen on private land.

92. As indicated above, the concerns driving this Review are concerns about clearcutting. The reality is that a higher proportion of harvesting on private land is by clearcutting than is the

case on Crown land, where some modest progress has been made in reducing the percentage of harvesting by clearcutting. While approximately 65 per cent of harvesting on Crown land is by clearcutting, the percentage of harvesting on private land that is by clearcutting is much higher, close to 90 per cent. Overall, nearly 80 per cent of the harvesting currently by clearcutting is on private land. Many of the clearcuts that happen on private land must therefore be among those causing an adverse public reaction.

93. Having concluded that there are certain circumstances in which clearcutting should not happen for ecological reasons, such as in old-growth forests, or that measures should be taken to protect birds during nesting season, I have difficulty concluding that we should care less about old-growth forest when it is cut on private land or less about birds that are affected when they make their nests on private land. The difference in ownership of the land is something of indifference to the old-growth forests or to the birds and to the ecosystems that are either enhanced or diminished depending on whether or not the old growth is harvested or the nests destroyed.

94. The forests on private land are obviously important to the implementation of ecological forestry through adoption of the triad model of forestry at a provincial scale. Clearly, the ecosystems that ecological forestry seeks to protect and where possible to enhance cut across the boundary between public and private land.[36] The forests on private land, just as much as those on Crown land, contribute to the ecological services that are critical to the overall health of the forests and that the forests provide to wider ecosystems that include but extend beyond the forests. Indeed, given the proportion of forested land that is privately owned and the limited amount of Crown land in significant parts of the province, decision making by private owners of forested land may be of greater importance to many ecosystems and overall biodiversity than the decision making that takes place on Crown land. This seems most likely in the central region, where Crown land is most limited and the proportion of timber production that happens on private land is higher than in the two other regions. There and elsewhere, management of private land seems highly important to landscape-level ecological concerns, including for wildlife requiring geographically expansive habitats.

95. Similarly, private land has a critical role to play in the high-production forestry branch of the triad model, given how much harvesting already happens on private land. Its role will become more important as implementation of a more-demanding ecosystem-based approach to forestry on Crown land limits production on Crown land.

96. Therefore, I conclude that the objective of provincial forestry policy should be to achieve widespread participation in ecological forestry – and the associated forestry practices – by the owners of privately owned forests, recognizing that landowners can participate in any of the three branches of the triad, or in a combination of them, by

[36] See Input from Nova Scotia Forest Biodiversity Science Advisory Committee, Appendix F in the Addendum.

a. adding some or all of their forested land to the land that is privately conserved in Nova Scotia under the Conservation Easements Act, thereby permanently taking it out of timber production.

b. managing their forested land in accordance with the stewardship principles – and associated forestry practices such as partial harvesting – that would apply to lands that are part of the ecological matrix in which a balance between conservation and harvesting objectives is expected to prevail.

c. managing their forested land in accordance with the forestry practices that are used to conduct high-production forestry, adhering to the limits and constraints on clearcutting that apply even in the high-production branch of the triad in an ecological forestry paradigm.

97. The ecosystem-based management system that DNR uses to manage forestry on Crown land does not apply to private land. There is also no equivalent of Maine's outcomes-based model of regulation applicable to private land in Nova Scotia. The question arises as to whether one or both of these models of forest practices management should be made applicable to private land by regulation or some other means, or whether clearcutting and other forestry practices should be otherwise regulated on private land.

98. It is clear, contrary to the opinions of some, that the provincial government has the legislative authority to regulate forestry on private land, provided the regulation is authorized by statute. The Endangered Species Act applies to private as well as public land and currently gives the Minister of Natural Resources regulatory authority and responsibility over private land. It gives the Governor in Council the authority to make regulations protecting critical habitat, whether it is on private or Crown land. The Forests Act applies to private as well as Crown land and gives significant regulation-making authority to the Governor in Council. That authority has been used to make the Wildlife Habitat and Watercourse Protection Regulations, which currently apply to private as well as Crown lands. This regulation-making authority could be lawfully (i.e., constitutionally) broadened by legislative amendment.

99. This said, my conclusion is that, with some exceptions, the management of forestry on private land should be left to landowners. The primary reason is that a recommendation to broadly regulate forestry on private land should in my view be considered only after a broadly consultative process focused on the issue of whether and how forestry on private land, and thus the property rights of landowners, should be regulated. I was not mandated to conduct, and have not conducted, that kind of consultative process.

100. I also agree with those who in their submissions expressed the view that many, and probably the majority, of those who own forested land believe that they should be able to decide the kind of forestry, if any, that happens on their land. This is supported by the public consultations that Voluntary Planning conducted on natural resources, including forestry, in 2008–2009: the right of landowners to decide whether and how to participate in forestry was one of the strong themes to emerge from those consultations.

101. I agree also with those who advised me that proposing new regulations for private land would be counterproductive: it would generate a fierce debate about the legitimacy and rationale for encroachment on rights of owners that would divert attention from the forestry practices improvements needed on Crown land and generate landowner opposition to the more important goal, which is shifting forestry on private as well as Crown land toward ecological forestry.

102. Three other considerations reinforce my conclusion that I should not recommend a regulatory approach to implementing ecological forestry on private land:

    a. The current environment is one in which woodlot owners, particularly in the western part of the province, perceive difficulty in selling their wood. Now may not be the right time to adopt new regulations that, by restricting private-land harvesting options, could make it difficult for them to sell their wood.

    b. The decision of landowners, particularly of woodlot owners, to have their land clearcut is often made in response to a range of factors that are outside their control. These factors are capable of compelling owners to agree to clearcutting even when it is contrary to their values. It is not obvious that it would be effective or fair to respond to the difficulty that landowners face in this regard by putting regulatory limitations on them.

    c. It is not clear to me what kind of regulations I could recommend to improve forestry practices on private land, particularly on woodlots, given (i) the diversity of their circumstances, (ii) the desirability of landowners to contribute to any of the three legs of the triad, and (iii) the extent of the transition forestry will be undergoing as a revised ecosystem-based management framework is implemented on Crown land.

103. The first exception to my conclusion not to recommend additional regulation of forestry on private land relates to the enforcement of an existing law: the Endangered Species Act. In my view, it is equally important that the Endangered Species Act be as effectively implemented on private land as on Crown land. There are difficulties and complications in doing so, which makes it harder to effectively implement the legislation on private land. These difficulties and complications have to be confronted, not used as an excuse for minimizing efforts to make the act operational on private land.

104. The second exception to my conclusion not to recommend additional regulation of forestry on private land relates to riparian management zones. I conclude that the rationale for reconsidering the riparian buffer zones required by the Wildlife Habitat and Watercourse Protection Regulations applies as much to forestry on private land as it does to forestry on Crown land. The decision to regulate riparian management zones for forestry on private lands has already been made. The ecological reason for doing so – the common public interest in protecting bodies of water and the ecosystems and aquatic and terrestrial life that depend upon them – would apply as much to changes in the regulation to improve

their effectiveness as it did to the original decision to make the regulations applicable to private land in the first place.[37]

105. The next exception relates to the wildlife clumps requirement in the Wildlife Habitat and Watercourse Protection Regulations. These should continue to apply to forestry on private land, just as they should continue to apply to high-production forestry conducted on Crown land. Their efficacy and adequacy should, however, be independently reviewed, as explained above. The requirements of the regulations on retention for wildlife protection purposes should be amended in accordance with this Review.

106. Similarly, the rationale for prohibiting full-tree harvesting when combined with clearcutting as a forestry practice is sufficiently strong to make a prohibition to that effect applicable to private as well as to Crown land. The basis of this conclusion is that such harvesting, particularly on the scale at which it is typically applied, makes the ecological damage caused by clearcutting so significantly adverse as to make it unacceptable on private or Crown land. As noted above in the discussion of this issue in relation to Crown land, the regulation to prohibit full-tree harvesting when combined with clearcutting could provide for limited exceptions, such as in salvage cuts.

107. The final exception to my conclusion not to recommend additional regulation for forestry on private land relates to industrial forested land: land owned by owners of wood processing facilities, most of whom are licensed to conduct forestry on Crown land or who are buyers of wood from Crown land. There is a rationale for requiring such landowners to show they are responsible managers of their own lands and to thereby contribute to the broader goal of aligning forestry in Nova Scotia with the triad model of ecological forestry. In that context, I have concluded that a regulation should be made under the Forests Act requiring owners of lands classified as industrial to manage their lands to achieve outcomes – in areas such as soil productivity, water quality and wetlands, timber supply and quality, aesthetic impacts, biological diversity, public accountability, economic aspects, social consideration, and forest health – such as are required under the State of Maine's Outcome-Based Forest Policy. This outcomes-based regime should be subject to compliance with otherwise applicable laws and regulations, such as the Endangered Species Act and the Wildlife Habitat and Watercourse Protection Regulations.

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[37] It was mentioned by a number of those making submissions to the review that there was inconsistency and unfairness in the inapplicability of the watercourse protection provisions of the Wildlife Habitat and Watercourse Protection Regulations to those who cleared forested land for land development purposes. The recommendation for a review that could result in a widening of the riparian management zones for forestry can be expected to bring the inapplicability of the regulations to development activity that results in permanent loss of forests to the fore. The applicability of forestry-related regulations to land development activities is probably outside my mandate to make recommendations on forestry practices: land clearance for development may not, strictly speaking, be a forestry practice. It does, however, involve a forestry element, and its impact on watercourses may be similar or in some circumstances greater. In my view, serious consideration should therefore be given to making the watercourse protection provisions of the Wildlife Habitat and Watercourse Protection Regulations (or a variant thereof) applicable to the clearance of forested land for development where land clearing is not otherwise subject to comparable regulation at the municipal level.

108. Otherwise, subject to the later discussion of the regulations that govern silviculture on private land, I am not recommending any changes to the regulation that applies to forestry on private land. One option for additional regulation frequently discussed was a regulation requiring landowners to have a pre-treatment assessment completed by a forestry professional in order to sell to a registered buyer. The objective behind this idea is to ensure that owners have the opportunity to make a more-informed decision between their options, particularly between the alternatives of partial cutting and clearcutting. Concerns about the burden this would place on landowners could be mitigated by connecting the requirement to a simplified version of the pre-treatment assessment process that applies on Crown land and also by encouraging more owners to belong to regional service organization or one of the other kinds of associations that provide services to woodlot owners. I have concluded, however, that such a regulation should not be adopted at this time. I have not been convinced that it would target the variables most responsible for determining the choices landowners make. I am also concerned about its feasibility, given the number of foresters in the province and the demands the profession will face implementing the revised ecosystem-based approach on Crown land. This option should, however, be considered in the review of the private-land silviculture system that I recommend below.

109. As an alternative to a general regulatory approach for bringing more of private land into the triad system, a comprehensive, multi-faceted, and integrated strategy should be developed for encouraging and enabling private landowners, particularly woodlot owners, to engage in forestry management in accordance with a triad model of ecological forestry. The objective should be a level of participation in active forestry management by private landowners in Nova Scotia's system of ecological forestry that is on a par with the level of landowner participation observed in Finland's system of even-aged management forestry by the Nova Scotia delegation that recently made a study tour to that country.

110. Foundational to this approach, DNR should accentuate its efforts to model ecological forestry practices for private landowners – and those who buy wood from them – by making its ecosystem-based management system more restrictive of clearcutting and more enabling of multi-aged management, as recommended by this Review, and by more generally moving clearly to develop and effectively implement the triad model of ecological forestry on Crown land.

111. DNR should continue to strongly support the efforts of woodlot owner membership-based organizations, including regionally based woodlot service organizations, to support and promote effective and responsible forestry management among their members. The condition and accountability for this support should be demonstrated organizational commitment to a triad model of ecological forestry.

112. Through the membership-based organizations referenced in the previous paragraph, or independently of them, DNR should work to ensure that private landowners have better access to the tools, information, and assistance to engage in effective and responsible forest management, such as forest professionals trained to work with landowners in the principles and methods of ecological forestry; simplified versions of the pre-treatment

assessment tools applicable on Crown lands; and improved access to the data and technology resources, including guidance from DNR's network of permanent sample plots and from LiDAR technology analysis, that can facilitate better decision making and more-effective forest management on private lands.[38]

113. The feasibility and utility of a lending program for those who want to buy woodlots to manage them in accordance with the triad model of ecological forestry should be considered. The idea, as proposed to this Review, is a forestry counterpart for the loan boards that already exist for agriculture and fisheries. The rationale would be to facilitate the transfer, on market terms of ownership, of woodlots into the hands of those interested in their value as working woodlots. In addition to bringing a younger generation of owners with a stewardship mentality into the vocation of woodlot ownership, such a program would give an additional alternative to asset liquidation to some members of an aging generation of woodlot owners.

114. Options for making greater use and achieving higher value for private landowners from the credibility and capabilities of the Association for Sustainable Forestry, in respect of its role in silviculture and more broadly, should be considered and developed.

115. Work on growing and diversifying markets for a broader range of forest products, including local markets, should continue and receive greater emphasis.

116. Options for creating conditions enabling owners of forested land to earn revenue for the carbon their land stores or sequesters should be actively considered. These opportunities are greater for those who manage their lands in ways that increase the carbon that their forests store or sequester. In general, these are landowners who manage to retain and promote the growth of multi-aged stands that include older and larger trees in alignment with the concept of ecological forestry. Currently, these revenue opportunities may be limited by the decision of Nova Scotia to establish its own carbon credit market instead of joining one of the larger markets that include multiple and larger jurisdictions. Given the importance of the forestry sector to Nova Scotia, the important role private landowners play in that sector, and the importance to landowners of revenue for ecological forestry management, I have reached the following conclusions:

    a. The extent to which Nova Scotia's decision to establish its own carbon credits market limits the revenue opportunity available to owners of forested land in Nova Scotia should be determined by an independent study funded by government.

    b. Working with the Departments of Environment and Energy and other relevant departments, as well as with interested stakeholders, DNR should develop or oversee the development of a framework for maximizing the access of Nova Scotia landowners, including woodlot owners, to carbon credit trading opportunities in and beyond Nova Scotia.

[38] The options for this approach are discussed at greater length by Laird van Damme, "The Impact of Emerging Technology on Forestry Practices," in the Addendum.

117. The existing system under which buyers of wood are responsible for silviculture on private land should be reviewed in light of the following salient facts:[39]

a. The system, for a variety of reasons, is complex:

- It attempts to reflect and accommodate the distinct considerations pertinent to different categories of private land ownership (industrial lands, large landowners, and woodlot owners), diverse forest utilization objectives, diverse ecosystems and tree species associations, dynamic market conditions, and differing viewpoints on silvicultural philosophies and methodologies.
- It involves complicated formulas and the use of credits and dollars, which are sometimes but not always considered equivalent.
- The result is that each adjustment in the applicable rules as to the proportion of each kind of silviculture that is to happen or as to the proportion of silviculture that categories of land holdings are to receive, shifts resources available for other kinds of silviculture or for silviculture in other categories of landholding.40
- While the amount of silviculture obligation that buyers are responsible for in each category depends on the volume of timber purchased in the previous year, many sites require treatment years, even decades, after harvest, making it difficult to optimize investments for long-term objectives.41
- Multiple organizations are involved: Registered Buyers (e.g., purchasers of primary forest products), DNR, landholder associations, and the Association of Sustainable Forestry.
- Changes to accommodate new or changing objectives have been made incrementally, adding to the system's complexity while creating internal tensions and conflicts in the system's operation; for example, increased emphasis on partial harvesting has reduced credits available for other kinds of silviculture.
- The system has also evolved to achieve outcomes that are related to harvest approach rather than operations that are conventionally considered silviculture.
- The system is poorly aligned with the provincial direction to reduce clearcutting.

b. Nova Scotia's silviculture system for private land is unique in Canada, possibly the world, insofar as the industry bears a substantial responsibility to carry out silviculture on private lands that it doesn't own, in proportion to the amount of wood purchased

[39] The discussion in this paragraph and the following paragraph draws on the following Addendum papers: Laird van Damme and Jeremy Williams, "Funding Silviculture in Nova Scotia"; Laird Van Damme and Peter Duinker, "Silviculture Reporting, Progress and Accountability"; and Robert Seymour, "Balanced Forestry and the Triad."

[40] This is because the annual amount of buying determines the extent of the silviculture obligation that each buyer is responsible for (and that buyers collectively are responsible for) in the following year.

[41] This may not be a problem if harvest levels remain stable. But if harvest levels drop, there may be a shortfall of credits to complete follow-up treatments on the larger areas that were harvested in earlier years.

on an annual basis from private landowners. In no other province do forest companies take such a significant role in undertaking silviculture on other people's land. This reflects the difference in the high percentage of forested land owned privately in Nova Scotia as compared to the high percentage that is publicly owned in other provinces. Comparisons with private-land forestry management in other provinces are therefore difficult and should be made with caution, encompassing not only the differences in how silviculture on private land is handled but how those differences relate to the broader differences between industries that operate primarily on public lands and Nova Scotia's industry.

c. The system was created in consultation with the forest industry and landowner associations, and has been formalized by government in regulation.

d. Nova Scotia's system provides a level of transparency and accountability regarding private-land forest activity that may be unmatched in other provinces. Detailed reports are provided on silviculture activities in the different forest ownership categories, standards exist, and DNR has a system for compliance monitoring for completed activities.

e. There are a number of issues with the current system, including the following:
   - There is a general perception that the system is too opaque/complex.
   - Data from the Registry of Buyers indicate that industrial landowners complete substantially more silviculture on a per-hectare basis than other kinds of landowners (substantially more than required under the credit system).[42]
   - Data from the Registry also show that limited work is currently done to establish intensive plantations on private land.[43]
   - While there is admirable transparency and accountability for how silviculture is done – and for ensuring it is carried out – there is less of both for what it accomplishes, i.e. for its effectiveness.

f. The range of views the Review heard about the Registry of Buyers system, include the following:
   - Some in industry have suggested that constraints such as the reservation of 75 per cent of credits for small and medium-sized non-industrial landowners should be removed and that returns would be improved by allowing more investment for

[42] Industrial land comprises 12 per cent of provincial land, and in 2016 accounted for 34 per cent of all silviculture credits completed. This suggests that significantly more timber could be produced on private land if other landowners made – and were able to make – similar levels of investment.

[43] In 2016, 3,000 hectares of regular plantations were established, compared to 80 hectares of intensive plantations. This raises concerns about the implementation of the triad model, which relies on intensive plantations to offset lower yields on ecologically managed stands. Industrial landowners are most likely to lead in developing high-yielding plantations, and it is unclear why this does not appear to be the case.

large (non-industrial) landowners (better lands, economies of scale, and a tendency to be more interested in increasing wood production).

- Some smaller landowners expressed concerns that Registered Buyers have broad discretion over where they complete silviculture, and that, while the applicable regulations require silviculture to be conducted on the category of landholding from which harvesting occurred, there are no assurances that a registered buyer will conduct silviculture on the land of particular sellers.
- Some of have argued that where the demand for silviculture exceeds the available credits (i.e., the credits that buyers have accumulated according to how much wood has been purchased in the previous year), silviculture conducted under the system should target the most productive sites that will yield the highest returns (which does not necessarily occur under the current system).
- Others have suggested that the Registered Buyers have too much control over silviculture and would favour more work being administered by the arms-length Association for Sustainable Forestry.

g. Silviculture rates and some of the credit values have not been recently updated and may need updating.

h. It is difficult to assess the effectiveness of the investments being made and of the work being completed, particularly in light of data suggesting that managed forests in Nova Scotia have relatively lower productivity than might be reasonably expected.

i. Implementation of the triad system, including intensive plantations and other areas of production forest and a stronger emphasis on ecosystem-based management on the majority of the working forest on Crown land, could raise questions about the capacity of the system to

- support a transition to treatments that are consistent with the triad, in particular a greater emphasis on intensive plantations in forest production areas and a greater emphasis on uneven-aged management practices.
- more generally adapt as the triad regime is implemented. For example, could it adapt to the substantial drop in the need for silviculture treatments in stands managed under an uneven-aged management regime?

j. The system is not well designed to address partial harvesting. On the one hand, partial harvesting generates credit obligations (because wood goes to Registered Buyers). On the other hand, it uses up credits (because certain partial harvesting qualifies as an eligible silviculture treatment). This leads to the concern that as higher levels of partial harvesting occur, the balance of credits available for other silviculture activities, such as intensive plantations or pre-commercial thinning, may be displaced. Also, some point

to the fact that as stand conditions improve, partial harvesting may become economically competitive (as it has in other jurisdictions).[44]

118. Taking these and other relevant considerations into account, DNR should, in collaboration with Registered Buyers, private landholder groups, silviculture contractors, and others, initiate a broad review of the private-land silviculture system. The public policy rationale for this review is that in a province where so much of the forest is on privately owned land, silviculture on private land is a matter of a critical importance to forestry and to public values and interests in relation to forest management. The scope of the review should address, but not be limited to, the following issues:

    a. Supporting the implementation of the triad model of forestry on private land and, in particular, providing the appropriate enablers and incentives to support both intensive plantations and forests managed for a combination of conservation and production objectives. This should include, when planning silviculture activities, mechanisms to help landowners make informed forest management choices that align with their values and the triad approach.

    b. Providing at least basic reforestation programs on harvested lands, while prioritizing silviculture funding based on a variety of optimization criteria and long-term forest management objectives.

    c. Designing and implementing the appropriate mechanisms to encourage a range of partial harvesting techniques that are associated with developing and maintaining multi-aged forest types, including irregular shelterwood systems.

    d. Reviewing and updating funding levels and credit rates for the various silviculture activities, and the range of silvicultural activities eligible for inclusion in the program.[45]

    e. Improving public reporting, independent auditing, and effectiveness monitoring.[46]

    f. Making the program more understandable.

119. The overall impact of this combination of measures on forestry practices on private land is difficult to predict and therefore impossible to model. The goal is not simply to reduce the amount of harvesting on private land that is clearcutting, which is currently roughly 83 per cent. Rather, the goal is to improve the general level of management applied to private land, including making it more productive in the high-production leg of the triad. This said, it is clear that there is a much higher proportion of clearcutting on private land than can be reconciled with an ecosystem-based system that seeks to emulate natural successional

[44] The treatment of partial harvesting is complicated by the fact that it includes selection harvesting, commercial thinning, and the first-removal shelterwood harvest, but excludes seed-tree harvesting, for example. Not all of these methods are currently eligible for funding silviculture credits.

[45] The silviculture contractors and workers who participated in the Review very consistently stated their view that the rates at which they are paid for their work also needs to be reviewed.

[46] See Van Damme and Duinker, "Silviculture Reporting, Progress and Accountability," for a discussion of options and approaches.

dynamics and disturbance regimes. The amount of harvesting – and therefore of clearcutting – on private land is likely to increase as much less of it happens on Crown land, at least on a transitional basis. It is therefore of interest to note that if the implementation of the changes to harvesting on Crown land recommended by this report reduced clearcutting to 25 per cent of harvesting on Crown land, clearcutting would still represent around 70 per cent of all harvesting, assuming the amount of clearcutting on private land remained unchanged. The level of clearcutting on private land would have to be reduced to roughly 60 per cent of private-land harvesting (a reduction of 30% from 2015 levels) to bring the overall level of clearcutting to approximately 50 per cent of the total provincial harvest, as was envisaged by the province's natural resources strategy.

120. As noted above, the Environmental Goals and Sustainable Prosperity Act (EGSPA) is currently being reviewed for updating and revision. The shift in paradigm toward a triad model of ecological forestry on private lands is of fundamental relevance and importance to the social, economic, and environmental philosophy of sustainable prosperity embedded in EGSPA. It therefore follows that EGSPA should specify a goal or goals relative to the implementation on private lands of the triad model of ecological forestry. Like many of the other goals in EGSPA, these should be aspirational and focused on outcomes rather than on all of the detailed steps that could or must be taken to achieve those outcomes. They should also reflect the particular complications and challenges that have to be addressed in implementing a triad model of ecological forestry on private land that is widely held across a regionally diverse province.

3.6 Conclusions on Market Access Issues

121. The issue of market access arises due to the weak demand that prevails, or is thought to prevail, in the western region for woodlot owners who would like to sell wood, or more wood. Among those who spoke to this issue, there was no debate that the market was weak. The issue is what is causing the weak market. More specifically, the issue is whether it is caused or exacerbated by forestry operations on western Crown lands, which are largely lands that became Crown lands after they were purchased by the province from Bowater. The "working forest" portion of these lands is now largely under temporary license to WestFor, a not-for-profit company formed by a consortium of mills consisting of regionally based sawmills and specialized mills. The question raised for the Review is whether the level of harvesting on these lands accounts for or contributes to the soft market conditions for woodlot owners in western Nova Scotia. On multiple occasions, this Review was told that demand for private stumpage dropped in the western region when WestFor started harvesting on Crown land and, more specifically, in response to a high volume of observed cutting on Crown land by WestFor shareholders and their contractors.

122. My conclusions on this issue, based on the paper on market access written for this Review by Dr. Jeremy Williams,[47] are as follows:

[47] Jeremy Williams, "Market Access," in the Addendum.

a. The primary reason for the drop in demand for wood from woodlots in the western region is the drop in overall demand for wood in that part of the province due to the closures of the Bowater paper mill and the associated Resolute sawmill.

b. To the extent I am able to determine, the amount of wood being harvested on Crown land in the western region relative to the demand for wood in the region is roughly comparable in proportionate terms to the amount harvested on those lands when the Bowater and Resolute mills were operational. In other words, harvesting on these lands, previously managed by Bowater and now by WestFor, has dropped by an amount that is roughly proportionate to the drop in demand for wood in the western region.

c. There have been short-term fluctuations in demand, possibly – even likely – related to how much wood the WestFor mills have been able to source from Crown land, but overall, the percentage of wood being sold by woodlot owners in the western region is moderately higher than historical levels while Bowater and the related sawmill were still in operation. This suggests that the fluctuations stem from the fact that there was no harvesting on the lands in question between the termination of the operations of Bowater and Resolute and the commencement of the operations of WestFor.

d. The loss of Bowater is not only a loss in general demand but also a significant loss in the regionally based demand for low-quality wood, much of which could be sold as pulpwood. This is resulting in an absence of buyers of wood from woodlots in the region having a significant percentage of low-quality wood, or an absence of buyers willing to give the owners of these woodlots a value for their low-quality wood that is acceptable to the owners.

e. The problem of weak demand for low-quality wood is greater for woodlots that are a greater distance from Northern Pulp because of the costs involved in trucking pulpwood from those lots to that mill. Contractors buying and cutting directly or indirectly for Northern Pulp are either unwilling – or unwilling at prices acceptable to owners – to pay for pulpwood that has to be trucked beyond a certain distance to the Northern Pulp Mill.

f. Business practices, such as agreeing to purchase the pulpwood from areas harvested by a buyer's contractors in preference to pulpwood from landowners who do their own work or contract with other contractors, may be exacerbating the difficulty some woodlot owners have experienced in selling their wood. They may also be causing difficulties for contractors who are not doing work for certain buyers.

123. The changes proposed for DNR's system of ecosystem-based management – which will include measures to apply appropriate precaution to the kind of harvesting allowed on sensitive soils when applied to the western Crown lands – should increase demand for wood from privately owned land in the western region.

124. The percentage of harvest in the western region conducted on western Crown lands should continue to be consistent with one of the stated purposes of the Forests Act: to encourage the development and management of private forest lands as the primary source

of timber in Nova Scotia. This seems very likely, given the anticipated robust implementation of ecological forestry on all Crown land; the instituting of a forest-planning process with a scope encompassing consideration of economic and social values and impacts; and the development of local markets for low-quality wood such as small-scale wood-energy projects.

125. Following the example of successful projects in Prince Edward Island, DNR and other relevant agencies of the provincial government, along with municipal governments and regional development agencies, should work together with project developers to bring small-scale wood-energy projects, particularly for heating, online in the western region for public buildings such as hospitals, schools, government office buildings, and correctional facilities.

126. The organizational structures for governance and management of western Crown lands should be revitalized and reconsidered, including by the creation of a planning process along the lines proposed below. Another opportunity is revitalization of the western Crown lands stakeholder group as a forum for meaningful dialogue between WestFor (and others who operate on the western Crown lands) and representatives of western region constituencies. These processes should create opportunities for buyers and sellers in the western region to work together to ensure fairness and balance between timber harvesting on Crown and private land and in the operation of the market for wood from private lands.

3.7 Conclusions on the Management of the Western Crown Lands

127. The acquisition of the Bowater lands by the province created opportunities for a new and more inclusive approach to the management of forested Crown lands in Nova Scotia, one more strongly grounded in community and less exclusively situated in the industrial model of forestry. The processes through which those lands were acquired and their management initially planned – particularly the “Buy Back the Mersey Campaign” and the “Western Crown Lands Planning Process” – created expectations that those opportunities would be seized and developed.

128. The creation of WestFor was responsive to some of those opportunities by giving local multigenerational family-owned mills the opportunity to play a direct and significant role in the management of forestry on Crown land that has historically been preserved for multinational companies operating pulp and paper mills. In these respects, WestFor is a potentially different approach to the forestry component of the management of Crown lands in Nova Scotia.

129. At the same time, WestFor is very much an industrial forestry entity that is managing western Crown lands within the same model under which other Crown lands are managed through long-term and exclusive licences to produce timber for the forestry economy. It is less about a new model for sawmills than it is about asking sawmills to play a role that has typically been played by pulp mills and which is still played by pulp mills in the central and eastern regions.

130. Specifically, WestFor's potential to create a different model of Crown land management is limited by its membership and mandate: it is a company in which membership is limited to consuming mills and whose mandate is, quite rightly, to ensure the profitability of those mills. At the governance level, this creates a system in the western region that, in relation to the parts of Crown lands in the western region to be licensed to WestFor, largely decides the debate between the interests of the forest industry and other interests over the management of Crown lands by putting the management of those lands largely into the hands of the industry.

131. This view of things is reinforced by the cautious approach that has been taken to the establishment and operation of the Medway Community Forest, one of the changes or innovations promised in the Buy Back the Mersey Campaign and in the Western Crown Lands Planning Process. The Medway Community Forest has been given significantly less land to manage than it applied for and, in my view, less land than it needs under management to have a reasonable prospect of viability. It has also been hampered in its efforts to take a different approach to conducting forestry on Crown land by a bureaucratic attitude that is resistant to its desire to use clearcutting less often than the current DNR ecosystem-based system prescribes.

132. WestFor itself proposed to take a broader and more inclusive approach to its organizational structure and mandate. Its licence instead contemplates the corporation acting primarily as a large mill would if it were licensed to operate on the western Crown lands.

133. My conclusion is that a planning process should be instituted on the western Crown lands to make planning for the development and utilization of those lands into an inclusive and broadly participatory exercise among the broad array of constituencies who have interests in those lands and their management. This process should be instituted in such a way as to honour and protect the existing interests of WestFor, the Medway Community Forest, and the Mi'kmaq Forestry Initiative. I see two possible approaches: one is to put the planning and high-level management for the western Crown lands into the hands of a new authority created for the purpose, and the other is to create a multi-stakeholder land use planning process unique to the western Crown lands.

134. The first option is to create a western Crown land planning authority. It would be established to develop the forest management plan for the western Crown lands that in the eastern and central regions will be created by holders of existing forest utilization licence agreements. It would oversee the implementation of the plan, while leaving the conduct of forest operations, in accordance with the developed plan, to WestFor and the Medway Community Forest, as well as with the Mi'kmaq Forestry Initiative (subject to negotiations on that Initiative between the Mi'kmaq and the Crown).

135. In other jurisdictions, particularly in parts of Quebec and Ontario, overall responsibility for forest management on some Crown lands has been given to an incorporated entity that is inclusive of multiple constituencies, including First Nations, forestry companies, landowners, municipalities, park and wilderness area administrators, and those defined as environmentalists. For the most part, these entities do not conduct forestry. Instead, they

authorize others to conduct forestry within planning parameters they develop, while at the same time authorizing and overseeing other kinds of activities on the land they manage or plan for. While their role is to decide how to balance the interests of forestry against other and competing interests, one of their responsibilities is development of forestry resources. Examples include Westwind Forest Management Inc., an Ontario organization that participated in this Review, Nawiinginokima Forest Management Corporation, another Ontario organization created under the Local Forest Management Corporation framework set out in Ontario's Forest Tenure Modernization Act of 2011, and 41 other forest management corporations that have delivered forest management services through diverse governance and ownership models since 1997. Similar objectives are being pursued in British Columbia through a community forest program, although entities created under that program are more directly involved in forestry operations.

136. To apply this approach in Nova Scotia, a statutory entity such as Westwind would be created for the western region. Its primary role would be to develop and oversee the implementation of the forestry management plan for the western Crown lands that would be required for all Crown land licence areas and to otherwise involve constituencies, including the community and Mi'kmaq forests and WestFor, in planning the management of the western Crown lands. It would do this through the same Class II environmental assessment process – or a separate process designed to be the equivalent of a Class II environmental assessment – more generally applicable to forestry on Crown land. On this approach, the three existing entities (WestFor, Medway Community Forest, and the Mi'kmaq Forestry Initiative) would continue to operate and to pursue their specific objectives within an overall plan for the western Crown lands developed by the more-broadly framed entity. Indeed, one of the obligations of the new overarching entity would be to encompass the forest management activities of WestFor, the Medway Community Forest, and the Mi'kmaq forest within the architecture of a larger plan for the western Crown lands. Its relationship to the Mi'kmaq forest currently under development would have to be negotiated, via the Crown, with the Mi'kmaq.

137. One concern with this approach is the separation it creates between responsibility for the development of the forest management plan and the implementation of the plan. This can be addressed to some extent by giving the authority the job of overseeing the implementation of the plan, leaving forest operators to act as contractors to it. I have concerns about both the feasibility of that approach and whether it is justified: it can raise issues about accountability and clarity of roles and responsibilities that I have said above are already too characteristic of how the management of forestry on Crown land operates. Another difficulty may be sustaining interest in the work of the authority on the part of those who constitute it. Another concern is interference with, or complication of the relationship between the Crown and the Mi'kmaq relative to, the Mi'kmaq Forestry Initiative. A further consideration is that the more-robust development of the Medway Community Forest may be a better way of directly involving a broad range of constituencies in forestry on these lands. It has also to be remembered that these constituencies will have the opportunity to participate in the legislated forest management

planning process that I have recommended for all Crown land, whether it is conducted by an authority or by an entity such as WestFor.

138. The second option for opening up and including others in the planning of the development of the western Crown land would be a land planning process. Under this approach, a land use management plan would be developed under the supervision of an independent third party (or panel) appointed by the Minister of Natural Resources (or jointly by the Minister and the Minister of Environment). This planning process would be broader in its orientation than the forest management planning process contemplated in the previous option. It would spend as much or more time on the other uses to be accommodated within the development of the Crown lands as it would on the forestry component of activities on those lands. It would, in fact, leave the responsibility for a forest management plan for most of the western Crown lands with the holder of the forest utilization licence agreement, presumably WestFor. That plan would, however, be developed in the context of the broader land management plan. Unlike the planning authority option, this process would be more like a continuation of the Western Crown Lands Planning Process that functioned in the wake of the purchase of the Bowater lands by the provincial government, with the critical difference that the process recommended would be under the authority of an independent individual or panel.

139. Either of these approaches will take time and therefore carry the risk of delay and uncertainty for WestFor and the community forest and their respective stakeholders. The same is true for their potential negative impact on the Mi'kmaq Forestry Initiative. Measures would have to be taken to minimize this delay and to otherwise ensure the protection of the interests of each while a broader process, and its structure and organization, is designed, established, and made operational. With such measures in place, either of the approaches I have recommended would

    a. shift planning authority from DNR to an organization or process representative of constituencies from across the western region, while preserving the role of DNR to ensure the organization's accountability and effectiveness and the compliance of forestry with applicable law and DNR policies and standards, including the ecosystem-based management framework.

    b. give communities, including through their municipalities and their participation in entities such as the Southwest Nova Biosphere Reserve, the opportunity and the responsibility to participate directly in the governance of Crown lands in which they are directly interested, including in relation to forestry and its economic importance to communities within the western region.

    c. provide continuing transparency on the development of the western Crown lands, including by directly involving Nova Scotians in the process of managing forestry on Crown lands.

    d. create opportunities for collaboration and cooperation between constituencies currently in opposition to each other on forestry and the management of Crown lands more generally.

e. give municipalities and other constituencies who are seeking opportunities to see Crown lands managed in a different way the opportunity to experiment and to explore those alternatives.

140. My conclusion is that the land use planning process is the better way to proceed. By separating the broader question of how the western Crown lands will be developed from the forest management planning applicable to a large part of the forestry component of that development, it will give constituencies and the public a say in how forestry should fit into the broader plan for developing and utilizing the lands. At the same time, it will leave responsibility and accountability for forest management planning with the organizations that will be conducting forestry. The public will, however, also have its say in the forest management through the legislated process I have recommended for the development of forest management plans. In addition, a land use planning process, as opposed to a planning authority, will minimize the potential for interference with the existing community forest and the Mi'kmaq Forestry Initiative, while perhaps encouraging broader public interest in the management and operation of the Medway Community Forest.

3.8 Conclusions on the Department of Natural Resources

141. Judging by what I heard in this Review, there is a general lack of trust and confidence in DNR shared by people who otherwise strongly disagree on forestry practices and other forestry issues. Those opposed to how forestry is currently conducted argue that the department is beholden to industrial interests, pointing to its failure or refusal to implement the commitments contained in the natural resources strategy and the number of former Bowater employees who are now in senior DNR positions. Those in the forestry business complain of the politicization of the decision-making process, both in making policy that lacks scientific basis and economic realism and in making public opposition (or its absence) the litmus test for approving forestry operations on Crown lands. On both sides, there is sharp criticism of DNR's science and of its tendency to do science in-house, with limited resources, without engagement with external academic experts, including through the peer review process.

142. Some believe a departmental realignment of responsibilities is needed, with responsibility for stewardship of Crown lands in one department, such as Environment or a DNR without responsibility for forestry, and responsibility for the business of forestry in another, such as Business. The rationale is to eliminate the conflict of interests embedded in DNR's current mandate for stewardship and economic development. I question whether I have the mandate or the evidence to make such a recommendation. I am skeptical of what it would achieve, even if it could be done in alignment with the mandates of other departments, which is debatable. If the underlying diagnosis of the problem is accurate, it could simply replace the hierarchy within DNR between the stewardship and forestry mandates of the department with a hierarchy between the department that is responsible for stewardship and the department responsible for the business of forestry. Also, what is needed is an approach that achieves integration among the ecological, social, and economic aspects of forests and forestry. Further fragmentation of authority between departments will not make that easier but harder.

143. I have instead concluded that forestry on Crown lands should be governed by a forest management planning process under which "FULA holders" will be required to develop a forest management plan for the lands they are to manage through a Class II environmental assessment under the Environment Act or a process under the supervision of an independent third party that emulates such an environmental assessment. In either case, there should be a written report to the deciding minister or ministers and a decision with supporting written reasons from the minister or ministers. The requirement for such plans developed through a public process is a level of forest management on Crown lands – required in other jurisdictions – that is missing in Nova Scotia. It is a level that should be instituted however forestry is to be conducted on public lands, but it is especially important if Nova Scotia is serious about conducting ecosystem-based forestry on a landscape basis. Other provinces use environmental assessment, or a process like environmental assessment, to conduct this level of planning, including using it as a vehicle to facilitate the public's participation in forestry at a strategic planning level. Doing so in Nova Scotia under the authority of the Minister of Environment creates an opportunity to bring transparency and accountability to the process and to mitigate the concerns about how DNR internally manages its competing responsibilities.

144. The other opportunity created by such a process is to reduce DNR's micromanagement of forestry on Crown lands. It would do this by making it clear that the industry is responsible for conducting forestry, including silviculture, in accordance with a forestry management plan transparently developed with public participation through a process overseen by an independent third party, not DNR or industry. Above, I lay out the advantages of extracting DNR from operational decision making, except as a regulator. Here, I only reiterate that it would on the one hand increase DNR's opportunity to be an effective policy maker and regulator and on the other hand allow industry to achieve efficiency and operational predictability.

145. I have observed a significant gap between what DNR says it is doing to manage forestry on Crown land and how it is actually managing forestry on Crown land. It says it is making a transition to ecosystem-based forestry, a version of what this report calls ecological forestry. As noted by Van Damme and Duinker in their paper, "Silviculture Reporting, Progress, and Accountability," the 2017 State of the Forest Report states: "The Department of Natural Resources is committed to advancing the practice of ecosystem-based landscape scale management." In reality, the forestry taking place on Crown lands continues in significant measure to be governed by the philosophy and methods of the 1984 Royal Commission. Unless the minister and deputy minister of the department make it clear and unequivocal that the department is fully committed to ecosystem-based management, within a triad model of doing so on a landscape basis, this gap will continue to exist. The result will be confusion and uncertainty for the industry and distrust and opposition from those concerned, including much of the public, about how forestry is being conducted on Crown land. Further, the idea that DNR is setting an example for management on private land will be an illusion.

146. DNR must deeply and pervasively embrace a culture of transparency and accountability. It must institute the information management, sharing, and distribution systems needed to

put that culture into routine operational practice. For example, the practice of giving written reasons for decisions on matters of public interest should, wherever practicable, become standard. Measures must also be taken to prevent the protection of privacy provisions of the Freedom of Information and Protection of Privacy Act, as well as bureaucratic systems or resistance to disclosure, from limiting the operation of the freedom of information provisions of the same legislation relating to matters of clear public interest. In broad terms, such matters include decisions taken in relation to, or activities conducted on, land that belongs to Nova Scotians through their government.

147. DNR must dramatically increase its reliance on science and its role in conducting, enabling, and applying the scientific research needed to move Nova Scotia in the direction of ecological forestry, with healthy forests and thriving forestry-based industries. Within reasonable limits, the instinctive approach of the department in the face of scientific uncertainty should be to enable its own excellent scientists to undertake the necessary research or to work with the broader scientific community to address or understand that uncertainty. In this regard, building strong connections with schools of forestry, as well as with scholars in the full range of disciplines relevant to forests and forestry, is critically important, as more than episodic engagement on specific topics is needed. DNR's involvement in research, its application of science, and its rationale for balancing science against other variables should consistently be a matter of public record.

148. Another critical element is encouraging and supporting research by Nova Scotia's forestry sector, including partnering with the sector on its research endeavours. This should include supporting research on innovation in how forestry is best managed and practised in Nova Scotia within an ecological forestry paradigm. It should include true support for experimentation by the licensed community forest and the Mi'kmaq Forestry Initiative as well as by other licensed forestry operators. Further, it should include support for research on innovation opportunities for woodlot owners. One option for doing so may be the centre of excellence concept suggested during this Review by the executive director of the Nova Scotia Woodlot Owners and Operators Association at a workshop convened at the request of the Review by the Mersey Tobeatic Research Institute.[48] The need for research and technological and operational innovation is a primary theme of an Addendum paper by Laird Van Damme on the role that technology could play in enabling and facilitating the transition to ecosystem-based forestry in Nova Scotia.[49]

149. In particular, DNR should more aggressively explore opportunities to better leverage existing assets to support and contribute to innovation in Nova Scotia's forestry industry. For example, DNR has maintained since 1965 a network of over 2,000 permanent sample plots to monitor changes in forest condition every five years.[50] These data have been

[48] "Workshop Notes: Opportunities for Consensus and Conflict Resolution in Forestry," Appendix E in the Addendum.

[49] Laird van Damme, "The Impact of Emerging Technology on Forest Practices," in the Addendum.

[50] This is one of a kind and does not exist anywhere else in Canada.

complemented with aerial photography interpretations generating maps useful for forest-planning purposes. Nova Scotia enjoys a leadership position in the quality of its forest inventory data system. These data can be further leveraged to strengthen monitoring and reporting within an active adaptive management framework.

150. Plans are already in place to supplement and combine these data with advanced active remote sensing systems, such as LiDAR, that will for the first time generate accurate terrain elevation models and allow for full enumeration of trees by size and condition across the province. The elevation models alone will be invaluable engineering planning assets for infrastructure projects and emergency response (e.g., flood and spill mapping). Watershed management will also be enhanced.

151. In addition to making pre-treatment assessment procedures more cost effective, the tree size and condition data available via LiDAR technology will be useful for forest management planning at all scales, including on private wood lots. Understanding of wildlife habitat and endangered species associations will also be enhanced, thus creating opportunities for enhanced and cost-effective biodiversity conservation efforts, on Crown as well as private lands.

152. The forest industry could be enabled to use these new data, in conjunction with existing data, to better manage the forest products supply chain. Private landowners, if given access and interface tools online, will also be able plan their own activities and integrate their forests into a virtual market place.

153. Overall, across the full range of these activities, measures, and approaches, DNR (and the forestry industry) should formally and systematically adopt an adaptive management framework for driving the evolution toward ecological forestry; discharging their accountability for doing so; learning how to make it happen; and building the knowledge and expertise of their people and teams and the capacity and robustness of their systems.[51]

3.9 Conclusions on Forestry Professionals

154. The role of forestry professionals – foresters and forestry technicians – is critical to forestry practices and, more particularly, to how and if those practices evolve and change over time.[52] They do much of the work to gather and interpret the information that shapes the identification of treatment options at the stand level and either decide or recommend what, if any, forestry treatment should be applied. Only so much can be accomplished by regulation using across-the-board rules. Unavoidably, if there is to be forestry, critical decision making must happen at the stand level. This makes the knowledge, training, judgment, and ethics of the forestry professional of critical importance. All this is

[51] See the discussion of adaptive management in Laird van Damme and Peter Duinker, "Silviculture Reporting, Progress, and Accountability," in the Addendum.

[52] This section draws on Laird Van Damme, "Different/Better Forestry: The Role of the Forestry Profession," found in the Addendum.

reinforced when stand-level decision making takes place under a complex and sophisticated decision-making framework such as DNR's ecosystem-based management framework. A broader discussion of the role of forestry professionals in changing forestry through adaptive management that aligns it with changing social values – while influencing those values – is provided in the Addendum paper on the forestry profession by Laird Van Damme.

155. The importance of the role of forestry professionals receives less attention than it should in discussions and disagreements about forestry practices in Nova Scotia. The profession that was once able to focus on biophysical sciences and the economics of growing and harvesting timber must now understand and accept responsibility for ecosystems and have broader skills in the social sciences, technology, collaboration, and communication. There should also be attention to the profession's improvement through diversity, including generational, gender, and racial diversity. As with any profession, these factors can influence awareness and understanding of, and willingness to try, new or unfamiliar methods. Likewise, there should be wider appreciation that, compared to some other jurisdictions, Nova Scotia has a relatively small forestry profession, as this may limit the capacity that the profession has to play – or can be asked to play – in the development of forestry in Nova Scotia. For example, it may restrict the availability of professional advice to many woodlot owners, even if the other factors limiting the availability of that advice are addressed. Another relevant consideration is that Nova Scotia does not, like many other forestry jurisdictions, host its own forestry school.

156. The success of DNR's ecosystem-based management system for Crown lands depends on the understanding of it by the forestry professionals who will operationalize it. Concerted and dedicated attention must be given to their training and professional development on not only the mechanics of the system but also its underlying theory and science. In particular, dedicated attention is required to ensure that Nova Scotia's foresters, many of whom were educated before the emergence of ecological forestry, have the opportunity to become proficient in practising that kind of forestry and comfortable with the wider and interdisciplinary responsibility and opportunity it confers on forestry professionals.

157. A wide range of other kinds of options should be considered to support forestry professionals in the crucial role they will play in the transition to ecological forestry. A sector-wide human resources strategy built on the appeal of ecological forestry to a younger generation of foresters could be developed to recruit and retain foresters and to support their professional development. Of course, such a strategy will be successful only if Nova Scotia's forestry sector is growing and developing.

158. Another option is to adopt a version of right-to-practice legislation that the associations for foresters and technicians are currently proposing. Under such legislation, foresters and technicians would be responsible for their statutory self-regulation and have exclusive right to perform professional services within their respective and overlapping scopes of practice. In this context, the argument is that it will enhance and reinforce the professionalism of both foresters and technicians and ensure that forestry is practised by those who have the necessary skill and knowledge, under statutory accountability. The arguments against are

all those routinely made against this kind of regulation in many fields, including that it unduly restricts the choice of the customer in exchange for a protection (accountability) that is more illusory than real. The additional question in Nova Scotia is whether there are enough foresters and technicians to discharge the responsibilities that come with statutory self-regulation. A closely related concern is that conferring right-to-practice status on a small profession may restrict access to forestry advice, especially by woodlot owners and small forestry businesses.

159. I conclude that the contribution statutory self-regulation could make in supporting and building the vitally important professionalism of Nova Scotia's forestry professionals weighs in favour of the statutory self-regulation for foresters and forestry technicians that has already been adopted in a number of other Canadian jurisdictions. There are four conditions or qualifications, all designed to improve the feasibility of self-regulation, to limit its restrictiveness on the market for professional forestry services, and to enhance the profession's capacity to contribute to the success of ecological forestry in Nova Scotia: (a) there should be one regulatory body for foresters and technicians; (b) it is likewise essential that technicians retain a wide scope for independent practice; (c) significant scope for delegation of professional acts to adequately trained and properly supervised unregulated service providers should be part of the model; and (d) associate membership by those in other disciplines or professions who have expertise and experience in forestry and forestry-related issues, knowledge, and science should be welcomed.

3.10 Conclusions on Implementation and Accountability

160. The conclusions I have reached, with the associated recommendations, are interrelated and mutually dependent on one another. For example, without adoption of a forest-planning process through environmental assessment, I would consider other options for addressing concerns about DNR's competing mandates and for ensuring that forestry on Crown lands is generally conducted in accordance with ecological forestry principles. Similarly, without that recommendation, I would be less inclined to emphasize the importance of extricating DNR from operational decision making and leaving that responsibility with industry and its professional advisers. As another example, without action on effective implementation of the Endangered Species Act and the changes I have proposed to the regulations that already apply to private land, I might reconsider my conclusion that forestry on private land should not be more generally regulated.

161. Adopting and implementing the changes I have proposed will take time, if the implementation is to be effective. This will both provide a period of transition to the industry and ensure that it has time to make the transition. It will be important to ensure that transition actually occurs during this implementation period and also that the duration of this transition period is determined by the time needed to achieve effective implementation, not foot-dragging. In light of recent history, in which DNR prepared a series of reports evaluating its own progress on implementing the commitments made in the natural resources strategy, there is a need for a mechanism of arms-length and external accountability. One option to consider would be a Forest Practices Board, such as the one created in British Columbia, to give citizens an avenue to make complaints against

DNR (or company) decisions at the stand level.[53] I have concerns about the suitability of that approach in a province the size of Nova Scotia. Such an approach may also be too limited, narrow, operational, and reactive. Instead, I have concluded that the responsibility for evaluating DNR's implementation of this report should be given to an independent committee of technical experts.

162. This committee should report to the Minister of DNR, not to DNR staff. It should include members from the Review team. It could also include members of the advisory committee proposed above to work with DNR on implementing the recommended changes to DNR's framework for ecosystem-based management on Crown lands. This committee should report annually to the public on its evaluation of DNR's progress on the implementation of this report. One of the issues on which it should evaluate DNR is the timeliness of its progress, taking into account the complexity of the issues, the volume of work involved, and also the need, a decade after work began on the natural resources strategy, for urgent action on aligning forestry practices with an ecological approach to forestry.

163. In reviewing the progress of DNR, the technical committee should recognize that the experience of implementing this report may reveal that that some of my conclusions were mistaken or incomplete or that some of my recommendations will not work or may not work as well as alternative measures. In those scenarios, the role of the committee should be to evaluate and report on such DNR determinations and to evaluate and report on the alternative measures that DNR has taken, or proposes to take, to implement ecological forestry, including the triad, in Nova Scotia.

[53] Al Gorley, "Brief Overview of the Forest Policy and Implementation Framework in British Columbia," in the Addendum.

4 Recommendations

1. In respect to forestry practices and related forestry policy, economic, social, and environmental values and objectives must be balanced within a policy and operational framework that gives priority to the conservation and sustainable management of ecosystems and biodiversity.
2. To align forestry with the priority to be given to ecological protection and enhancement, policy and operational decision making relating to forestry practices should be guided by an overall approach to forestry called "ecological forestry," which seeks to
    a. align forestry with ecological considerations and with ecological protection and enhancement by integrating ecological knowledge, principles, and concepts, including traditional knowledge, into how forestry is conducted
    b. combine the societal mandate to both protect ecological systems and biodiversity while sustaining a productive and profitable forestry sector by aligning forestry practices with natural processes, including disturbance regimes, that ecological forestry emulates
3. Consistent with the ecological forestry paradigm, the objective of forestry practices in Nova Scotia should be, wherever appropriate, to maintain or restore multi-aged and mixed-species forests in which late-successional species have the opportunity to grow and mature where they represent the forest's natural condition. Practices that do otherwise in those forests should be curtailed.
4. Nova Scotia should explicitly and strongly embrace and robustly implement the triad model of ecological forestry and seriously develop each of its three legs: the conservation leg, the high-production leg, and the intervening landscape (or matrix) where conservation and production objectives are both applicable and combined.
5. Whether the forests are in good, poor, improving, or declining condition – regionally and provincially, both from an ecological perspective and as an economic resource – should be the guiding question in discussions and decision making for forestry in Nova Scotia. To that end:
    a. The State of the Forest Report should include the kind of comprehensive information that is required to allow people to come to holistic conclusions on the state of the forests and forestry and to put their personal observations and opinions and those of others on the condition of the forests into a broad context of objective data.
    b. Specifically, the State of the Forest Report should aim for comprehensiveness on information that is useful in understanding and explaining the ecological condition of the forests, the forests as an economic resource, and the condition, functioning, and prospects of all forest-related industries.
    c. Tracking and reporting of the state of the forests and the forestry industry should happen at multiple scales, including provincial, regional, and landscape levels.
    d. Nova Scotia should fully utilize Canada's Sustainable Management Criteria and Indicators (2003) and collaboratively adapt them to a Nova Scotia context.

e. Action must be taken to improve confidence levels in datasets about ecosystems.

f. The metrics tracked and reported in the State of the Forest Report should include all those recommended by the Mersey Tobeatic Research Institute's report, "State of Nova Scotia Forest and Biodiversity Review," prepared for this Review.

g. Measures should be taken to make information on the forests and forestry-related industries easier to access and to understand, including profiling information on the most important metrics in a smaller document that focuses attention on those metrics.

6. DNR should work transparently and collaboratively with interested parties, including representatives from the academic community, in making improvements to reporting on forests and forestry, including in the State of the Forest Report.

7. DNR should

   a. transparently acknowledge and address, with peer-reviewed science, the concerns and critiques that have been raised with DNR's mapping of natural disturbance regimes in Nova Scotia and align its ecosystem-based management framework for forestry on Crown lands with its revised and peer-reviewed mapping of Nova Scotia's natural disturbance regimes

   b. align its ecosystem-based management framework for forestry on Crown lands with its revised and peer-reviewed mapping of Nova Scotia's natural disturbance regimes

8. In general, those responsible for forestry practices, including DNR and licensees on Crown land, should make decisions that favour uneven-aged management and which recognize that clearcutting is inappropriate in the following circumstances:

   a. In natural stands that are governed by gap dynamics and infrequent stand initiating regimes

   b. In young stands that are still exhibiting rapid growth in volume and/or value

   c. In forests with high recreational or social value

   d. Where ecological values are likely to be impaired at a landscape level

   e. In areas characterized by sensitive or thin soils or on steep slopes

   f. In situations that may cause deterioration of aquatic values through processes such as erosion and siltation of runoff of surface water

   g. In municipal watersheds (subject to research under way in Pockwock Watershed) or when a high proportion of any watershed area has already been clearcut or otherwise disturbed

   h. Adjacent to the boundaries of parks, nature reserves, wilderness areas, or other ecological reserves

9. In general, subject to limitations that should be placed on the overall amount of clearcutting to protect and enhance ecosystems and biodiversity at the landscape level, those responsible for forestry practices, including DNR and licensees on Crown land, should limit clearcutting to the following situations:

a. In vegetation types that are naturally subject to frequent stand-replacing disturbance regimes (subject to appropriate retention)

b. In stands in which shade-intolerant, early successional species are to be perpetuated

c. As part of well-considered restoration activities intended to address degraded conditions caused by anthropogenic influences (e.g., poor regeneration, infestation by alien species)

d. In extraordinary circumstances, such as salvage cutting after intensive natural disturbance

e. To create areas for plantations managed intensively to provide long-term stable sources of industrial fibre, especially within an overall triad approach to the implementation of ecological forestry

10. DNR should continue to develop and implement its ecosystem-based forestry management framework to manage forestry on Crown land, specifically as mandated in the *Forest Management Guide*. For application to Crown lands that are part of the intervening matrix between protected areas and high-production areas, amendments should be made to remove features that unduly favour even-aged silviculture in natural forests and to strengthen the support the framework provides for multi-aged silviculture prescriptions. These amendments should be developed with input from an advisory group with membership from industry, technical and academic experts, representatives from forestry policy stakeholders, and foresters. This advisory group should also include representation from this Review.

11. The pre-treatment assessment process under the ecosystem-based forestry management process should be expanded to encompass and address relevant wildlife issues, and the harvest planning process should more generally be designed to ensure that wildlife issues are considered earlier in harvest planning and design.

12. In deciding the percentage of post-harvest retention required on Crown lands under the revised ecosystem-based forestry management framework, DNR should

    a. conduct a range of wood supply scenarios to determine the impact that different ranges of retention would have on wood supply in the short, medium, and longer terms

    b. conduct operational trials or other applied research to test the ecological and economic outcomes of different levels of retention under various ecosystem conditions

13. DNR should work with interested parties, including representatives from the academic community, to assess the work that is underway for landscape-level planning, including

    a. the implications of changes to forest practices as a result of this Review on the objectives and methodology for landscape-level planning

    b. to the extent that landscape-level planning will rely on mapping of natural disturbance regimes, aligning it with its revised and peer-reviewed mapping of Nova Scotia's natural disturbance regimes

c. reviewing the methodology and basis for setting forest condition targets at the landscape scale (e.g., what percentage of a landscape should have old forest)

14. To ensure the productivity of plantations and high-production forestry where it is conducted in accordance with ecological forestry, licensees on Crown land should have access to public funding for the use of herbicides to control competing species and as a density control measure within plantations.

15. DNR should require areas of high-production forestry on Crown land, including plantations, to be managed to achieve outcomes such as those required under the State of Maine's Outcome-Based Forestry Policy.

16. DNR, with Crown licensees, must take immediate and sustained action – including by conducting or commissioning appropriate scientific research, engaging interested parties in collaborative problem-solving forums, and adopting precautionary measures – to be responsive to concerns about the potential adverse impact of forestry on Crown lands on the following interests:

    a. Sensitive soils, particularly on Crown lands in the western region
    b. Bird populations
    c. Tourism operations and developmental plans
    d. Outdoor recreation activities, including established trails
    e. Protected Areas

17. Steps should be taken to improve the abundance and conservation of old forests, including the following:

    a. Implementation of ecological forestry, with emphasis on long-rotation stand development and multi-aged stand structures.
    b. Accelerated and improved data collection on the existence of old forests across all unprotected Crown lands. This could include improvements to the pre-treatment assessment process, targeted field assessments, and advanced applications of spatial modelling (GIS) and data capture technology such as LiDAR.
    c. Reconsideration of the area-proportion targets in the Old Forest Policy, as well as potential inclusion of other tree species in the climax group (e.g., red oak, red maple). This will require a targeted research program that, like other DNR initiatives, should become an inclusive process with participation of a suitable range of scholars and experts from various walks of life.
    d. Addition of old-forest restoration targets alongside the old-forest protection targets in the policy.
    e. Development of a silvicultural manual for old-forest restoration.

18. DNR must ensure, as an immediate priority, that the Endangered Species Act is fully implemented on Crown land, including the completion of recovery plans that identify and make provision for protection of core habitat for species at risk located on Crown lands.

19. The Crown Lands Act should be amended to ensure that its purpose clause encompasses and gives equal weight to the full range of the values (and uses) relevant to the management of Crown land, thereby eliminating the statutory preference the statement of purpose currently found in the act gives to timber production objectives.

20. The forestry management planning process for Crown lands should be conducted under a legislated environmental assessment process, either as a Class II environmental assessment under the Environment Act or in a process that emulates the Class II process under the supervision of an independent third party (or panel) under the authority of the Minister of Natural Resources or the Ministers of Natural Resources and Environment. This process should be required before the issuing or renewal of forest utilization agreements. One of the objectives of this assessment will be to ensure that forestry on Crown land will adhere to the principles of, and contribute to the objectives of, ecological forestry, as embodied in the strengthened framework for ecosystem-based forestry and the outcome-based accountability to be applicable to areas of Crown land managed for high-production forestry.

21. DNR should develop and implement an outcomes-based approach to management of Crown land under which operational decision making on Crown land, governed by the amended ecosystem-based management framework, will be the responsibility of licensees, subject to the following conditions-precedent being satisfied:

    a. The Crown Lands Act is amended as recommended.

    b. The legislated forestry management process, with strategic environmental assessment conducted by an independent third party, is implemented.

    c. Measures have been taken to ensure full and effective implementation of the Endangered Species Act.

    d. DNR has developed and implemented a comprehensive and rigorous monitoring, oversight, and accountability system that fully addresses the recommendations made by the Auditor General in his 2015 report on his review of DNR's activities in Forest Management and Protection.

    e. DNR, licensees, and their forestry professionals have demonstrated that they are committed to an approach to forestry on Crown lands consistent with modern principles of ecological forestry.

22. The system of silviculture on Crown lands, as part of a larger review of silvicultural programs in Nova Scotia, should be reviewed with a view to improvements that ensure its alignment with and support for the implementation of ecosystem-based forestry on Crown lands, including in the following respects:

    a. Ensuring it enables a broader range of silvicultural options to protect and promote uneven-aged management, including irregular shelterwood harvesting.

    b. Ensuring it enables silvicultural practices that can improve the yield obtained from high-production forestry, including planting and the use of herbicides to discourage competing species.

c. Ensuring accountability for the effectiveness of silviculture applied to Crown lands, including the effectiveness of silviculture for high-production forestry.

d. Improving and strengthening transparency and accountability for management of silviculture-funding trust accounts.

23. DNR should either

a. through an open and transparent process, conduct a study of the costs to the forest industry, including the transition costs, and of the socio-economic and ecological costs and benefits of accepting and implementing the recommendations of this Review and a study of the socio-economic and ecological costs and benefits of current forest practices (i.e., the status quo), particularly on Crown land; or

b. dedicate the resources required to complete these studies to the implementation of the recommendations contained in this report, including by identifying, designing, and testing options for making the change to ecological forestry that is right for Nova Scotia.

24. Full-tree harvesting combined with clearcutting (i.e., as a method of clearcutting) should be prohibited by regulations made under the Forests Act on Crown and private lands, with limited exceptions, if any, such as to permit use in salvage operations.

25. The efficacy and adequacy of a 20 metre riparian zone that is only varied on the basis of slope conditions, currently required by the Wildlife Habitat and Watercourse Protection Regulations, should be independently studied with a view to determining (a) if it should be changed and (b) how it should be changed to better address the ecological rationale for riparian buffer zones.

26. The “wildlife clumps” currently required by the Wildlife Habitat and Watercourse Protection Regulation should

a. be inapplicable on Crown land subject to the amended ecosystem-based forestry management framework requiring higher and more dispersed levels of retention up to 30 per cent.

b. continue to apply to plantations and other areas of high-production forestry on Crown land and to private land, including industrial lands managed under the outcomes-based regulatory framework recommended below for private lands classified as industrial lands.

c. be independently reviewed to determine their efficacy and adequacy relative to their intended purpose and amended in accordance with the outcome of that review.

27. The objective of provincial forestry policy in relation to private lands should be to achieve widespread participation in ecological forestry – and the associated forestry practices – by the owners of privately owned forests, recognizing that landowners can participate in any of the three branches of the triad, or in a combination of them, by

a. adding some or all of their forested land to the land that is privately conserved in Nova Scotia under the Conservation Easements Act.

b. managing their forested land in accordance with the stewardship principles – and associated forestry practices, such as partial harvesting – that would apply to lands that are part of the ecological matrix in which a balance between conservation and harvesting objectives is expected to prevail.

c. managing their forested land in accordance with the forestry practices used to conduct high-production forestry, adhering to the limits and constraints on clearcutting that apply even in the high-production branch of the triad in an ecological forestry paradigm.

28. A regulation should be adopted under the Forests Act requiring owners of lands classified as industrial to manage those lands to achieve outcomes such as those required under the State of Maine's Outcome-Based Forestry Policy.

29. Working with landowners, DNR must, as an immediate priority, develop and implement a plan of action for fully and effectively implementing the Endangered Species Act on private lands.

30. DNR, in collaboration with Registered Buyers, private landowner groups, silviculture contractors, and others, including technical experts, should initiate a review of the private-land silviculture system, to be conducted in conjunction with the review of silviculture programs on Crown land. The scope of the review should address, but not be limited to, the following matters:

    a. The system's alignment with the effective implementation of the triad model of ecological forestry on private land, including appropriate support and incentives for intensive forestry and management of forests in accordance with the tenets of the ecosystem-based framework being implemented on Crown land.

    b. Mechanisms for assisting landowners in making informed choices about how they want their management of their land to contribute to the triad model of ecological forestry.

    c. Options for ensuring that at least basic reforestation activities are more consistently conducted on harvested lands, while prioritizing silviculture on a variety of optimization criteria that will contribute to long-term forest management objectives.

    d. The appropriate mechanisms to encourage a range of partial harvesting techniques associated with developing and maintaining multi-aged forests, including irregular shelterwood systems.

    e. Updating the credit rates for the various silviculture activities and the range of silvicultural activities for inclusion in the program.

    f. Public reporting, auditing, and effectiveness monitoring.

    g. The understandability of the program.

31. A comprehensive, multi-faceted and integrated strategy should be developed for encouraging and enabling private landowners, including woodlot owners, to engage in forestry management in accordance with the triad model of ecological forestry, to include

a. accentuated efforts by DNR to model ecological forestry practices for private landowners – and those who buy wood from them – by making its ecosystem-based management system more restrictive of clearcutting and more enabling of multi-aged management, in line with the recommendations of this Review, any by more generally moving clearly to develop and effectively implement the triad model of ecological forestry on Crown land.

b. continued support for the efforts of woodlot owner membership-based organizations, including regionally based woodlot service organizations, to support and promote responsible forestry management among their members. The condition and accountability for this support should be demonstrated organizational commitment to a triad model of ecological forestry.

c. actions to ensure private landowners have better access to the tools, information, and assistance needed to engage in effective and responsible forest management.

d. consideration of the feasibility and utility of a financing program for those who want to buy woodlots to manage them in accordance with the triad model of ecological forestry.

e. identification of options for making greater use and achieving higher value for private landowners from the credibility and capabilities of the Association for Sustainable Forestry.

f. concerted work on growing and diversifying markets for a broader range of forest products, including local markets.

32. DNR should commission an independent study on opportunities and options for enabling owners of forested land to earn and trade in carbon credits for storing and sequestering carbon, particularly when they manage their lands in accordance with ecological forestry (or ecosystem-based forestry management).

33. Working with the Departments of Environment and Energy and other relevant departments as well as with interested stakeholders, DNR should develop, or oversee the development of, a framework for maximizing the access of Nova Scotia landowners, including woodlot owners, to carbon credit trading opportunities in and beyond Nova Scotia.

34. DNR should be aware of the percentages of wood acquired in the western region from Crown and private lands to ensure that western Crown lands, including the part of them under licence to WestFor, are managed in accordance with the stated purpose of the Forests Act: to encourage the development and management of private forest lands as the primary source of timber in Nova Scotia.

35. DNR and other relevant agencies of the provincial government, along with municipal governments and regional development agencies, should work together with project developers to support and enable small-scale wood-energy projects that will allow low-quality wood to be used in heating hospitals, schools, government office buildings, correctional facilities, and other public buildings.

36. A land use planning process to be conducted by an independent person or panel should be established for the western Crown lands.

37. The community forest should be given a licence with a term and for an area of Crown land that will provide the community forest the opportunity to be viable and self-sustaining. The Mi'kmaq Forestry Initiative should proceed as quickly as possible.

38. DNR must deeply and pervasively embrace a culture of transparency and accountability. It must institute the information management, sharing, and distribution systems needed to put that culture into routine operational practice, including (a) adopting a practice of giving written reasons for decisions on matters of public interest wherever practicable, and (b) measures to prevent the protection of privacy provisions of the Freedom of Information and Protection of Privacy Act, as well as bureaucratic systems or resistance to disclosure, from inappropriately limiting the operation of the freedom of information provisions of the same legislation as it relates to public policy on forestry or the management of Crown lands.

39. DNR must dramatically increase its reliance on science and its role in conducting, enabling, and applying the scientific research that is needed to move Nova Scotia in the direction of ecological forestry with healthy forests and thriving forestry-based industries. Within reasonable limits, the instinctive approach of the department in the face of scientific uncertainty should be to enable its own excellent scientists to undertake the necessary research or to work with the broader scientific community to address or understand that uncertainty.

40. DNR should more aggressively encourage and support research and innovation by Nova Scotia's forestry sector, including partnering with the sector on its research endeavours, to improve how forestry is managed and practised in Nova Scotia within an ecological forestry paradigm. This should include true support for experimentation by the community forest and support for research on innovation opportunities for woodlot owners.

41. DNR should work with industry, landowners, researchers, and other stakeholders to make data and technology systems, including LiDAR, available for the purposes of research and innovation such as virtual markets, planning templates for private landowners, better management of the forest products supply chain, and improved and more cost-effective conservation measures and activities.

42. DNR should formally and systematically adopt an adaptive management framework for directing its own and Nova Scotia's transition to the triad model of ecological forestry.

43. An overall strategy for attracting and retaining forestry professionals to Nova Scotia and for attending to their professional development – including in the mechanics, principles, and science of ecological forestry and of DNR's ecosystem-based forestry framework – should be developed and implemented. Elements to be considered should include

    a. education and training on ecosystem-based forestry and the social and communicative dimensions of forestry and its relation to society.

    b. a sector-wide human resources strategy for forestry professionals, with attention to the profession's generational and gender diversity.

c. right-to-practice legislation for forestry professionals on a legislative model that (i) applies to registered foresters and forestry technicians, (ii) recognizes and protects the competency of forestry technicians to play an independent role in providing professional advice on forestry matters, (iii) authorizes broad delegation of authority to well-trained paraprofessionals and nonprofessionals, and (iv) provides for and encourages associate membership in the professional body by those in other disciplines or professions that play an important role in forestry

44. Establish an independent committee of technical experts, including members of the Review team, to annually evaluate and publicly report on the progress of DNR in implementing these recommendations and otherwise embracing and achieving an ecological model of forestry management in Nova Scotia.

45. Goals for the implementation of the triad model of ecological forestry should be added to the Environmental Goals and Sustainable Prosperity Act.