

Impacts of forestry in Nova Scotia on conservation of biodiversity: Concerns and Questions

A Submission to Nova Scotia Department of Natural Resources

From the

Conservation Committee of the Halifax Field Naturalists*

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Contents

1. SUMMARY
2. INTRODUCTION
3. FORESTS ARE THE MAJOR HABITAT TYPE IN NOVA SCOTIA
4. THE NATURE & EXTENT OF CLEARCUTTING/EVEN AGED MANAGEMENT IN NOVA SCOTIA
5. LANDSCAPE LEVEL IMPACTS OF FORESTRY PRACTICES ON BIODIVERSITY
6. MITIGATING AND ADAPTING TO CLIMATE CHANGE
7. SOIL ACIDIFICATION & LOSSES OF CALCIUM
8. CONCLUSION
9. NOTES

Attached: Notes for a meeting with MLA Labi Kousoulis and MLA Joachim Stroink
31 October 2016; and NSDNR response.

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* A minor modification was made to the original version as indicated on page 8.

1. SUMMARY

The Halifax Field Naturalists (HFN), founded in 1975, cater to and promote public interest in the natural history of Nova Scotia and attempt to practice, responsible, science based advocacy. HFN participated in the Citizen Engagement process conducted as part of the development of a new Natural Resources Strategy and were encouraged by the initial commitments of government in 2011 to follow up on recommendations coming out of that process including a commitment to a 50% reduction in clearcutting. We have been highly disappointed in subsequent actions by the government of the day and the ensuing government which have allowed extensive clearcutting to continue. Over the last few years our members are encountering more and more clear-cut land where once stood healthy forests and associated biodiversity. There have been many reports of a sparsity of insects and of many songbirds compared to earlier years and of wildlife coming into urban areas. Obviously there are many factors involved, but it's hard to deny that when extensive habitat is removed, populations of associated species will decline. Thus the cumulative scale of clearcutting over the last 30+ years is alarming to naturalists.

The HFN Conservation Committee has reviewed various documents that NSDNR cites as providing a scientific basis for its forestry policies and practices, some produced in-house, some not. In this document we express our understanding of and raise specific questions related to the nature and extent of clearcutting/even-aged management in Nova Scotia, the policies, the science underlying those policies and some of the impacts on biodiversity.

To the extent that we understand the scientific literature and NSDNR policies and practices, we have concluded that:

- In relation to LANDSCAPE LEVEL IMPACTS OF FORESTRY PRACTICES ON BIODIVERSITY there are serious deficiencies or flaws in some of NSDNR science that is being applied; the resulting extensive clearcutting is having serious negative impacts on biodiversity and ecosystem services.
- In relation to MITIGATING AND ADAPTING TO CLIMATE CHANGE, scientific evidence and procedures developed outside of NSDNR that should be applied to forestry in Nova Scotia are apparently not being applied (or the public has not been informed about NSDNR's application of this science). In this context, Nova Scotia is not meeting its commitments under EGSPA and is doing far less than it could to adapt to and mitigate climate change.
- In relation to SOIL ACIDIFICATION & LOSSES OF CALCIUM, a suite of research by aquatic scientists that should have raised alarm bells about sustainability of forests and forestry and associated aquatic systems a decade and more ago has not been heeded (highlighted) by NSDNR, and now NSDNR is being very reticent about applying and publicizing its own, rigorously conducted science in this area. We are particularly concerned about the impacts of not taking a more precautionary approach to harvesting in SW Nova Scotia, the area most strongly affected by acid rain and nutrient-poor soils. These conditions are known to be seriously affecting aquatic systems, and based on research elsewhere, are very likely having major impacts on forest health and biodiversity.

We would very much appreciate a response to our comments and specific questions from NSDNR and an opportunity to further discuss these issues.

2. INTRODUCTION

[The Halifax Field Naturalists](#) [1] (HFN), founded by graduate students in 1975, have a long history of scientifically based advocacy related to forests and forestry in Nova Scotia. In the [first issue](#) of our Newsletter [2], Paul Keddy wrote:

Our role in conservation activities is under considerable discussion. It is clear that as naturalists we have a vested interest in the protection of wildlife and their habitats. Two avenues of approach need be considered: one, the creation of wildlife reserves; and two, an attempt to change the destructive aspects of our current technological society which make such reserves necessary.

The [second issue](#) [3] of the newsletter addressed the budworm issue from both economic and ecological perspectives.

Over a period of 20 years, the late Colin Stewart was essentially our one man conservation committee. He has been well recognized for his many contributions to conservation in Nova Scotia. Before his untimely passing in 2004, Colin was the driving force in setting up what became known as the Colin Stewart Forest Forum, “an exceptional example of different interest groups working together - in this case major forestry companies and environmental organizations.” The [2009 report](#) [4] from that process laid the groundwork for increasing the area protected in Nova Scotia from 8.2% in 2008 to the current 12.4%.

In 2008, the Halifax Field Naturalists participated in the Citizen Engagement process conducted as part of the development of a new [Natural Resources Strategy](#) [5]. In [A Natural Resources Vision](#) [6], we expressed the hope that selection cutting becomes the norm, clearcutting be restricted to 10 hectare lots and require an environmental assessment, whole-tree harvesting not be permitted, and that there be no clearcutting on crown land.

HFN was highly encouraged, as were many others, when the Steering Committee for the Natural Resources Strategy recommended substantial change in forest management including a 50% reduction in clearcutting, and when then NSDNR Minister MacDonell promised to follow up. We were shocked when, within six months, the NDP government backed off many of these commitments. Together with the actions of the subsequent (Liberal) government and building on policies of prior governments back to Stanfield, industrial forestry has simply become further entrenched as the dominant driver of our forest economy, and even-aged management as the dominant practice. In early 2017, the government is on the verge of handing over management of most of our last modestly harvested Crown woodlands, the Western Crown Lands, to a private consortium.

Over the last few years our members are encountering more and more clear-cut land where once stood healthy forests and associated biodiversity. There have been many reports on the NatureNS

listserv (see [NS Bird News by Date](#) [7]) of a sparsity of insects and many songbirds compared to earlier years, as well as of wildlife coming into urban areas. Obviously there are many factors involved, but it's hard to deny that when extensive habitat is removed, populations of associated species will decline. Thus the cumulative scale of clearcutting over the last 30 or so years is alarming to naturalists.

In the fall of 2016, two members of HFN met with their MLA, Labi Kousoulis, to express concerns about the impacts of clearcutting for biomass energy on GHG emissions, and about the impacts of clearcutting/even-aged management more broadly on biodiversity. MLA Joachim Stroink attended the meeting. They listened carefully to our concerns. Labi told us of some of the actions the Liberal government has taken in regard to direct handouts to the big mills (no more) and in advancing the cleanup of the Pictou mill effluents, and Joachim said he speaks out about Parks and Protected Areas and clearcutting within the caucus. Labi said he could not address our concerns himself but would forward them to the Premier. Subsequently (Jan 9, 2017), R. Beazley received a response from NSDNR (attached). We told Labi that it really did not address the fundamental issues we were raising. Labi said he would set up a meeting with NSDNR personnel to discuss the concerns, and he and Joachim agreed to attend. The brief prepared by Richard Beazley for the initial meeting with Labi Kousoulis and the response from NSDNR are attached.

This document, prepared by HFN Conservation Committee, outlines our principle concerns related to forestry and its impacts on biodiversity and raises specific questions related to those concerns.

We are grateful to Labi Kousoulis for facilitating a meeting, and to NSDNR for participating and/or responding otherwise.

As the document expresses "concerns", its tone may appear highly critical of NSDNR. We wish to emphasize that we are highly appreciative of the bulk of the work conducted by NSDNR.

In this document, we express our understanding or impressions of and raise specific questions related to the nature and extent of clearcutting/even-aged management in Nova Scotia, the policies, the science underlying those policies and some of the impacts on biodiversity. Some of the concerns may be misplaced or based on misunderstandings. If so, we see the interaction with NSDNR as an opportunity to correct those impressions. To the extent the concerns are valid, we hope that they can be viewed as constructive input to the government/NSDNR.

Some citations below are given hyperlinked titles and should be accessible in the PDF version of this document. The URLs are spelled out in the NOTES attached so that they can be read in printouts of this document.

3. FORESTS ARE THE MAJOR HABITAT TYPE IN NOVA SCOTIA

Recently cited figures for forest cover in Nova Scotia are in the range 75-79%; a figure of 84% was cited in the 1970s [8]; pre-Columbian forest cover for the Maritimes was likely over 90%.

Question1: Does NSDNR have good figures for forest cover over time in Nova Scotia that can be shared with us? Has there been significant loss in total forest cover over the last 50 years? Is deforestation an issue?

4. THE NATURE & EXTENT OF CLEARCUTTING/EVEN-AGED MANAGEMENT IN NOVA SCOTIA

The comments forwarded from NSDNR include a table showing the % Non-Clear-cut (Partial Harvest) on Crown Land and Province-wide 2006-2015. Between 2006 and 2015, the % on crown land varied between 22 and 44% with no particular trend up or down over time, while the % Province-wide shows a trend of increase from 9% in 2006 to 17% in 2014 and 2015.

**Table 1: Stats forwarded from NSDNR
Jan 9, 2017.**

% Non-Clearcut (Partial Harvest)		
Year	Crown	Provincial
2006	33%	9%
2007	26%	8%
2008	30%	15%
2009	26%	13%
2010	25%	9%
2011	22%	10%
2012	44%	18%
2013	36%	15%
2014	29%	17%
2015	33%	17%

We assume these figure are intended to show that overall, practices on crown land are better than for the province as a whole and that roughly one-third of the cutting on Crown land is Partial Cutting, i.e. not too far off the 50% target set out in 2010/2011.

Partial cuts in Nova Scotia, however, are mostly conducted within the context of even-aged management regimes which from a conservation perspective are little better than clear-cuts. The pressure to reduce clearcutting in Nova Scotia, as expressed in citizen input to the [Natural Resources Strategy](#) [9], in the [Forest Panel of Expertise I](#) [10] and even in [Forest Panel of Expertise 2](#) [11] and in the [Report of the Steering Panel Phase II](#) [12], came primarily out of concerns about loss of multi-aged Acadian forests and associated biodiversity. In this context, a more appropriate measure of progress is not the % Partial Cuts, but the % of cuts conducted within the context of an even-aged management regimes, and cuts conducted within the context of a multi-aged management regime, the latter being mostly or entirely selection cuts.

In the National Forestry Database (NFD), which compiles stats submitted by the provinces, all harvests that qualify as even-aged management are classified as clear-cuts , breaking those down in three categories:

- clear-cut- 1-stage and 2-stage,
- Shelterwood
- Seed tree

while Selection Harvests, and Commercial Thinning are not counted as clear-cuts.

The statistics below were compiled from the NFD; percentages and ratios are our calculations.

Table 2. **Clear-cuts (even-aged management) 1 and 2-stage.**

SECTOR	YEAR	2000	2010	2015	Ratio
		(ha)	(ha)	(ha)	2015/ 2000
Crown (% of all Crown harvests)		5136 (75.3%)	5777 (73.9%)	7371 (65.0%)	1.44
Industrial		17426	8151	3295	0.19
Non-industrial		28386	22990	17902	0.63
Total Private		45812	31141	21197	0.46
Total Province (% of all harvests)		50948 (93.6%)	36918 (90.1%)	28568 (82.1%)	0.56

Table 3. **Total Clear-cuts (even-aged management)**. Includes 1 and 2-stage clear-cuts, Shelterwood, seed tree.

	YEAR	2000	2010	2015	Ratio 2015/ 2000
SECTOR		(ha)	(ha)	(ha)	
Crown		6420	7221	9493	1.48
(% of all Crown harvests)		(94.1%)	(92.4%)	(83.4%)	
Industrial		18003	8994	3542	0.20
Non-industrial		28451	22990	17902	0.63
Total Private		46454	31984	21444	0.46
Total Province		52874	39205	30937	0.59
(% of all harvests)		(97.1%)	(95.7%)	(89.0%)	

Table 4. **Selection harvests (uneven-aged management)**. Numbers from NFD.
Ratios and percentages calculated from NFD numbers.

	YE	2000	2010	2014	2015
AR		(ha)	(ha)	(ha)	(ha)
SECTOR					
Crown		66	327	778	1108
(% of all harvests)		(0.97%)	(4.2%)	(8.3%)	(9.8%)
Industrial		311	276	227	0
Non-industrial		132	619	1329	769
Total Private		443	895	1556	769
Total Province		509	1222	2334	1877
(% of all harvests)		(0.94%)	(3.0%)	(7.25%)	(5.4%)

Table 5. **All harvests.**

	YEAR	2000	2010	2015	Ratio 2015/ 2000
SECTOR		(ha)	(ha)	(ha)	
Crown		6820	7817	11342	1.66
(% of total for province)		(12.5%)	(15.6%)	(32.6%)	
Crown, long term lease		5467	6418	8756	1.60
Industrial		18842	9292	3881	0.21
Private, non-industrial		28771	23881	19554	0.68
Total private		47613	33173	23435	0.49
Total province		54433	40990	34777	0.64

These more complete statistics appear to present a very different picture from that suggested by the NSDNR figures (Table 1). First, while the percentages of clear-cuts from the NFD (Table 2) are similar to those in Table 1 (calculated as 100% - %Non-clearcuts), the percentages of total clearcuts (all even-aged management cuts) (Table 3) are much higher, and the percentage of Selection cuts was still less than 10% in 2015.*

Second, while the NFD figures show some decline in clearcutting expressed as a percentage, the actual area of Crown lands harvested increased continuously from 2000 to 2015, while the area of private lands declined.

Question2: Wouldn't it be appropriate to separate out Selection Cuts from Partial Cuts or make the same distinctions as the NFD (Clearcuts 1 and 2 stage, Total Clearcuts, Selection Cuts), or distinguish between even-aged management and uneven-aged in reporting progress towards reducing clearcutting?*

Question3: Does NSDNR consider that Crown lands have come under increasing cutting pressure since 2000, or is there an alternative interpretation of these numbers?

5. LANDSCAPE LEVEL IMPACTS OF FORESTRY PRACTICES ON BIODIVERSITY

With recent additions to Wilderness Areas and Nature Reserves, 12.4% of Nova Scotia is now formally protected [13], so perhaps 10% of the forested land is protected. This is laudable but far from sufficient on its own to conserve biodiversity and ecosystem services. The protected areas system is highly fragmented. We need both larger areas to be managed for biodiversity and corridors between core biodiversity areas.

Karen Beazley and associates in the School for Resources and Environmental Studies at Dalhousie used a map/GIS based model to estimate conservation needs in Nova Scotia. They concluded that ~60% of Nova Scotia, including 32% in core areas, should be managed for conservation objectives to maintain genes, species, and ecosystems over time. Similar estimates have been forthcoming from other studies. [14]

NSDNR anticipated these needs and was an early adopter of Ecosystem Based Management (EBM) approaches to forestry that emerged in the late 1990s. One component is an [ecological landscape analysis](#) which recognizes landscape structure in terms of matrix, patch, and corridor ecosystems, and incorporates considerations of connectivity and fragmentation, special features such as rare, uncommon, and threatened species, need for ecological representation etc. [15]. Indeed, the level of mapping and its availability to the public via the [Nova Scotia Landscape Map Viewer](#) [16] could well be second to none in Canada.

*These paragraphs (Question 2 and the related paragraph) are modified (April 26) from the April 19, version, which got muddled in an edit.

Questions:

- 4. Where do landscape connectivity analysis and fragmentation analysis enter planning procedures?
- 5. Does NSDNR have any related specific plans, maps etc. that show the layout of the landscape/forest types/cutting regimes/corridors that is considered sufficient to conserve forest biodiversity over the longer term?
- 6. Can any of those documents be shared with the public?
- 7. How do considerations of connectivity and fragmentation enter into the current process for approving forest harvests?

In the document [*Clear-cut Definition Frequently Asked Questions \(FAQs\) October 1, 2012*](#) [17], item 1.4 reads

1.4. Why set “60% of the area less than minimally stocked” as the threshold for a clear-cut?

1.4.1. According to Percolation Theory, the critical threshold to maintain ecological connection across an area is approximately 60% (Farina, 2000). Therefore, when less than 60% of an area is not sufficiently occupied it loses its ecological connectedness and becomes fragmented. As the area stocked goes up, the amount of edge increases and a harvest area acts less like a clear-cut. When it reaches 60%, there is a better probability of flows of wildlife and other ecological processes, and the site does not act like a clear-cut.

We hope this is not the main venue used to promote connectivity in harvested forest landscapes in Nova Scotia. The 60% threshold figure, derived from fluid dynamics, is mostly conceptual and there appears to be little if any evidence in the ecological landscape literature to support NSDNR’s use of it as described above [18]. Even if it were applicable to one or a few species, it certainly would not apply to a wide range of species; and the “60% minimally stocked” is highly susceptible to blowdown.

Question 8: Does NSDNR have supporting scientific evidence or its own observations to support the contention that at 60% minimally stocked and above, a site “does not act like a clear-cut”? Can we see the evidence?

In addition to landscape level planning, NSDNR manages working forests for biodiversity conservation by conducting harvests in a manner that simulates natural disturbances. This is a cornerstone of EBM, based on the principle that “forest management should maintain or recreate conditions found following natural disturbance regimes as most species are adapted to conditions created by the dominant natural disturbances” [19]; or alternatively stated: “A principal tenet of the [natural disturbance] paradigm is that biodiversity can be conserved by

harvesting in a manner that resembles forest patterns created by natural disturbance processes [20]

NSDNR has mapped disturbance regimes of our forests [21] and concluded (bolding is ours):

Infrequent and/or gap disturbance regimes are dominant on 51% of the landbase and develop forest associations typical of the Acadian Forest. These forests of red spruce, hemlock, white pine, sugar maple, beech, and yellow birch originate or establish from successional processes started by an infrequent or rare stand initiating disturbance. They are maintained as uneven-aged forests by gap disturbances in the canopy until the next stand initiating disturbance. **Frequent disturbance regimes are dominant on 43% of the landbase and develop forest associations of balsam fir, black spruce, white spruce, jack pine, red pine, white pine, white birch, and red maple.** Whether due to edaphic site conditions or disturbances (fire, insects, wind) these forests are predominantly even-aged and unlikely to succeed to longer-lived late successional associations of the Acadian Forest. The remaining six per cent of the landbase has edaphic site conditions that severely limit tree growth and develop the open seral vegetation communities associated with barrens, sparsely treed bogs and swamps, rockland, and severely exposed sites.

[Bolding is ours]

– Mapping Nova Scotia's Natural Disturbance Regimes

Report FOR 2008-5 Ecosystem Management Group

Forestry Division, Truro, Nova Scotia

April 2008

Thus, in principle, selection harvesting in areas of Infrequent and/or gap disturbance would simulate the natural disturbances on 51% of the landbase while some form of even-aged management (EAM) (clear-cutting, shelterwood harvest, variable retention, commercial thinning) would simulate disturbances on the 43% of the landbase subject to frequent disturbance regimes.

However selection harvesting comprises less than 10% of the Crown land harvests and EAM regimes are applied on the remainder (Table 4 above). So the percentage of selection harvesting is less than 1/5th of what it should be, while the percentage harvested for EAM is approximately twice what it should be.

Thus the claim that “ [currently] all harvest treatments are aligned with the nature-based requirements of Nova Scotia’s lands” - Statement under Goal 13 in the [Five-year Progress Report on the 2011-2020 Natural Resources Strategy](#) released Aug 16, 2016 by NSDNR. [22] appears to be inconsistent with NSDNR’s own figures.

This conclusion seems to be acknowledged in a recent NSDNR report, [Selection Harvest Survey: 8 year post-harvest results](#) by Jane Kent et al. Report FOR-2016-4 [23] that acknowledges the low level of selection harvesting historically and comments that “Non-clearcutting harvest

methods such as selection harvesting must be increased to meet this goal [ecosystem-based management]”.

Question 9: Can NSDNR justify the claim that: “all harvest treatments *are* aligned with the nature-based requirements of Nova Scotia’s lands” or should that be stated as a goal?

In 2000, selection harvesting accounted for less than 1% of all harvest on Crown land (Table 4, above). While NSDNR has been increasing the percent of selection harvesting, which is laudable, in the process a lot of forest that should be managed as multi-aged forest is apparently being clear-cut or partial cut in the context of an EAM regime which will likely result in the same stands being assessed as most suitably clear-cut or partial cut in the context of an EAM regime the next time around. By the time NSDNR otherwise approach 51% selection harvesting there will be substantially less than 51% of stands suitable... so the goal could be reassessed. At least that is what the numbers suggest.

Question 10: Has the proportion of landscape that NSDNR would assess as subject to Infrequent and/or gap disturbance regimes using the same criteria as applied by Neily et al., 2008 [21] declined since the assessments for that report were conducted (or conversely, has the proportion subject to Frequent disturbance regimes increased)?

Another concern in this regard is the criterion in the PTA process for choosing selection harvests. For example, in the [Tolerant Softwood/Mixed wood Management Key](#) [24] the first decision diamond requires >60% Long Lived species to proceed towards Selection harvest, likewise for the Tolerant Hardwood Management Key. Surely, that is biasing the whole process against selection management/encouraging re-establishment of a healthy, multi-aged Acadian forest. The number should be very much lower, e.g. 20%. The 60% criterion may make sense from the perspective of industrial logging, but it doesn’t from the perspective of biodiversity conservation.

Question 11: How are the percentages in these decision diamonds identified? Can NSDNR explain the 60% criterion as an example?

Even within frequent disturbance regimes, there is a lot of variability between stands that is not replicated when a single rotation interval is applied, e.g. 55 years, and Canadian experts have urged that a portion (e.g. roughly half in the case of black spruce-feathermoss dominated forest in NE Quebec/NE Ontario) be harvested by partial and selection cuts [25]

Question 12: How is NSDNR adopting research suggesting some partial and selection cuts be conducted within systems dominated by frequent disturbance regimes; is any consideration being given to such strategies?

In addition to these considerations, which raise concerns about whether NSDNR is really following its own science and keeping up with current science in regard to forest EBM,

significant concerns about the science in the Natural Disturbance Regimes 2008 document [21] were raised as it was being developed; overall, reviewers considered that the “conclusion that nearly 50% of our provincial forested landscape is prone to frequent stand initiating disturbances is very questionable.” [26]. It appears that most of the critiques were not heeded in the final (2008) document [21]. and it appears that the research conducted for the Natural Disturbance document was never submitted for publication in a peer reviewed journal (as suggested by one of the reviewers of the earlier document). As well, Natural Disturbance Regimes 2008 document appears not to have been cited in subsequent (post 2008) papers on emulation of natural disturbance regimes by recognized researchers, suggesting it doesn’t carry much credibility in the scientific community.

Notably lacking in the Natural Disturbance Regimes 2008 document [21] is any reference to a well recognized and much quoted earlier paper [27]:

Natural disturbance regimes in northeastern North America—evaluating silvicultural systems using natural scales and frequencies

Robert S Seymour et al. 2002. *Forest Ecology and Management* 155: 357–36. “Many scientists and foresters have begun to embrace an ecological, natural disturbance paradigm for management, but lack specific guidance on how to design systems in ways that are in harmony with natural patterns. To provide such guidance, we conducted a comprehensive literature survey of northeastern disturbances, emphasizing papers that studied late-successional, undisturbed, or presettlement forests... *Widespread application of single-cohort silviculture on rotations of under 100 years thus creates a landscape that has no natural precedent for the types of forests we reviewed.* Management that deliberately produces such stands thus cannot claim to be emulating natural disturbances, as in the common industrial situation where multiple, short rotations are planned, or where such stands dominate the landscape. Furthermore, basing regeneration rates on natural disturbance frequencies alone (e.g. 1% per year), without accounting for the scale of the disturbance, greatly oversimplifies the natural pattern where landscape-level, stand-replacing disturbances are much rarer than small, within-stand patches. If we ignore this relationship between space and time, then management activities might have negative consequences on landscape structure. [Example cited]...The long-term consequence is an unnatural landscape that becomes homogenized in both time and space.”

It’s difficult to see why this work was not cited, except that it clearly would not support NSDNR’s interpretations of natural disturbance regimes in Nova Scotia.

If the critique that the proportion of Frequent disturbance regimes on the Nova Scotian landscape estimated by NSDNR (43%) is highly inflated were accepted as valid, that would not undermine all of NSDNR’s science/forest management and the associated tools, maps etc., but it would bring into serious question the management recommendations based on interpretations of disturbance regimes in the Natural Disturbance Regimes 2008 document.

Bancroft and Crossland [10] reviewed arguments regarding natural disturbance regimes and explored the implications in pp 1-11 of their Panel of Expertise report to the Natural Resources Strategy and made recommendations accordingly, expressing confidence that

...the recommendations in this report will set us on track to achieving the following goals:

- We can restore forest biodiversity by increasing the presence of mature forests across the landscape; we can increase abundances of late-successional tree species; and we can ensure adequate amounts of standing and fallen deadwood habitat. Maintaining biodiversity is the best plan to deal with the impacts of climate change, and the best assurance for continued ecosystem services such as clean water, wildlife habitat, soil maintenance, and flood reduction.
- We can grow high-value trees (valuable species and large sizes) to support an expanded value-added forest products industry, with a particular emphasis on high quality hardwood. An expanded value-added industry will create many more jobs for every unit of wood harvested.
- We can achieve higher timber yields from many of our forest areas through an increase in uneven-aged management.
- We can create new, rural-based, green forestry jobs through a shift in silviculture (the science of managing forest vegetation to meet human needs) and harvesting practices toward uneven-aged forest management.
- We can better ensure an aesthetically pleasing landscape that is more inviting to visitors to our countryside.
- We can ensure that private woodland owners are supported in carrying out responsible land stewardship.
- We can ensure that our Crown lands demonstrate exemplary management.

Question 13: What was (is) NSDNR's response to the critiques of the 2007 Natural Disturbance document?

Question 14: Can NSDNR put the question of whether or not NSDNR's estimate that Frequent Disturbance regimes are dominant on 43% of the land base is highly inflated to rest, e.g., by having it impartially and professionally reviewed by recognized experts in the U.S. and Canada?

6. MITIGATING AND ADAPTING TO CLIMATE CHANGE

It is difficult to see how the Pre-Treatment Assessments (PTA) and related processes encompass climate change considerations, as overall the processes appear to favour increasing cover of softwoods on short rotations. Black spruce and balsam fir are boreal species that are not expected survive climatic warming on the intermediate to long term.

Peter Salonijs has written specifically on this topic [28] and how it could be addressed:

[*Silvicultural Discipline to Maintain Acadian Forest Resilience*](#)

Peter Salonijs 2007. *Northern Journal of Applied Forestry* 24(2): 91- 97.

ABSTRACT: Clear-cut harvesting decreases structural complexity, eliminates old and

genetically superior legacy trees, extirpates mature-forest floor vegetation, and creates hot and dry postharvest microclimates. The short-lived, exposure-tolerant, boreal tree species that regenerate in large forest openings are believed to be less able, than the late-successional Acadian species they replace, to adapt to the climate warming expected during the next forest rotation. A strip silviculture design is presented that includes limited canopy opening, “no-traffic” areas, maintenance of “full-cycle” survivors, and programmed return harvest intervals that approximate natural gap disturbance as a means of arresting the further increase of boreal species and restoring Acadian species on the landscape. Within the confines of this silvicultural discipline, two management options are described to accommodate extremes of future energy availability.

Question 15: Does NSDNR accept the concept that clear-cutting has effectively “borealized” [29] a lot of what was once multi-aged Acadian forest, and that this reduces adaptation to climatic warming?

Question 16: How is NSDNR incorporating needs to *adapt* to climate change in the forestry sector into its overall planning?

As well as being non-adaptive to climate warming, NSDNR’s short rotations clearly limit the sequestration potential of our working forests, and are likely *contributing* to warming. View [The Great American Stand: US Forests & The Climate Emergency](#)” by Bill Moomaw and Danna Smith (Mar 21, 2017) [30]

Research conducted specifically in Nova Scotia suggests that there are very substantial losses of soil carbon after clearcutting and that it can take up to 100 years for soil carbon to reach previous levels [31]. Thus repeated clear-cuts on 40-60 year rotations will greatly reduce soil carbon stocks.

[*Looking deeper: An investigation of soil carbon losses following harvesting from a managed northeastern red spruce \(Picea rubens Sarg.\) forest chronosequence*](#)

A. Diochon et al., 2009. *Forest Ecology and Management* 257: 413-420.

“Forest harvesting in eastern North America has been occurring for centuries but its effect on soil carbon storage and dynamics below 20 cm is not well known. This paper investigates age-related variations in carbon storage and dynamics in the organic layer and 6 depth strata in the top 50 cm of the mineral soil during ecologically important stages of post-harvest succession in a first rotation red spruce forest chronosequence that includes one of the largest old growth reference stands in northeastern North America. Storage of carbon reached a minimum 32 years post-harvest, at which time stores were approximately 50% of the intact forest. However, storage approached the range of the intact forest approximately 100 years post-harvest.”

Question 17: Has NSDNR conducted forest carbon budget modelling, e.g. using the fed’s [Carbon Budget Model](#) [32] or as applied to Protected Areas [32b] to examine the implications of various harvesting scenarios for GHG emissions/sequestration? (Or are there federal data for NS?) Can you share some of the results with us?

Question 18: Does NSDNR have any strategies/plans for increasing carbon sequestration by our working forests, e.g. to offset GHG emissions from coal powered electricity generation?

With the ongoing decline in pulp and paper markets, the Nova Scotia government has been actively involved, with other jurisdictions and private industry, in seeking alternative uses of wood obtained by clearcutting on short rotations, notably for biomass energy, and for “green fuels” and other “value added products” such as plastics. If such materials are obtained from genuine sawmill and other forestry wastes, such uses can reduce GHG emissions compared to coal, (perhaps not compared to natural gas). However, it seems pretty clear in Nova Scotia’s case, that use of primary forest biomass is occurring in the case of biomass,

NSP has “an obligation to its ratepayers to get wood fibre as cheaply as possible” and “the cheapest way is to clear land, not selectively harvest to improve the lot for the future.”
– [*NSDNR Associate Deputy Director Deputy Minister Alan Eddy in The Coast*](#) (April 16, 2016) [33]

and that these value-added products are seen as substitutes for pulp and paper as drivers of industrial forestry in Nova Scotia, i.e., that they would be making use of wood from clear-cuts (and from partial cuts for even-aged management) on short rotations.

Although denied by much of the forest industry, when primary forest biomass is used for such products, CO₂ emissions are increased over the next 30 to 50 years compared to fossil fuels, even coal [30, 34].

Question 19: has NSDNR conducted calculations of GHG emissions from forest bioenergy and anticipated biofuel plants for different mixtures of waste wood and primary forest biomass? Can some of the results be shared with us?

7. SOIL ACIDIFICATION & LOSSES OF CALCIUM

Perhaps the most critical issue facing both forestry and forests in Nova Scotia is the acidification and loss of base cations due to a combination of acid rain and the naturally poorly buffered soils that cover about 60% of the Nova Scotia landscape.

The loss of calcium in particular has been recognized as a major ecological issue for forests in northeastern North America affected by acid rain. Declines in calcium under forests are having diverse adverse effects either through calcium deficiency directly or indirectly through reduced, aluminum mobilization and enhanced mercury toxicity, effects being observed on zooplankton, forest herbs, invertebrates, song birds, cold tolerance of red spruce, sugar maple decline, loon reproduction, [35-40]

For most of northeastern North America, trends of increasing acidification of surface waters (related to loss of calcium in the uplands) have reversed, following 30 years of emission

controls, but not so in Nova Scotia's "southern uplands", with SW Nova Scotia the most heavily impacted area [41-44]

Our results show that the legacy of a problem that began in the 1940s and peaked in the early 1980s is still with us and will continue causing problems in Atlantic Canada for several decades to come. Water chemistry conditions suitable to allow the survival and thriving of Atlantic salmon, the most visible symbol of the acidification problem in much of Nova Scotia, have not improved in the past 30 years. Geochemical modeling and theory suggest that they can only recover under lower acid deposition levels than are currently being endured and after several decades of natural weathering to allow base cation replenishment of soils from resistant bedrock.

- T.A. Clair et al. 2011 [42]

Following reductions in anthropogenic sulphur and nitrogen emissions in North America and Europe in the past decades it is expected that surface waters would show signs of recovery from acidification. Indeed, surface waters in Europe and North America have shown a steady improvement in annual average stream chemistry (Skjelkvale et al., 2005; Stoddard et al., 1999). However, recent analyses of lake chemistry data from Southwest Nova Scotia (SWNS) (Fig. 1) suggest that this region might be an exception as the record shows no increase in pH in recent decades, and calcium (Ca^{2+}) concentrations remain low compared to elsewhere in the world (Clair et al., 2011). Despite being located well downwind of sulphur emissions, SWNS was strongly affected by acid precipitation (Hindar, 2001) due to bedrock types, thin soils with low acid neutralizing capacity, extensive wetlands, and episodic sea salt inputs (Freedman and Clair, 1987; Wright, 2008; Clair et al., 2011; Watt et al., 2000; Whitfield et al., 2007). During the 1980s and 1990s, when the awareness of this issue was at its zenith, acidification was identified as a main cause of the extirpation of native Atlantic salmon populations in many rivers in Scandinavia and the eastern USA (Parrish et al., 1998; Hesthagen and Hansen, 1991) as well as in SWNS (Watt, 1987). Recently, the resident SWNS (Southern Upland) population has further declined.

-S. Sterling et al. 2014 [41]

Terrestrial liming is being researched and conducted on a limited scale currently to rescue some of the watershed streams, lake and rivers [42] but obviously cannot be conducted over the whole area impacted. This leaves a large area of forests with serious base cation deficits currently and requiring decades of natural weathering and likely further reductions in acidifying emissions to re-establish historical norms.

The general problem of aquatic acidification in Nova Scotia was recognized by aquatic scientists in the 1980s and 1990s, and the link to forest soil acidification was clearly identified quantitatively and geographically in 2006/2007 [44].

NSDNR initiated development of a Forest Nutrient Budget Model (FNBM) in 2008 "in response to industry requests for biomass harvesting options in Nova Scotia" [46]. The lead was Paul Arp an internationally recognized authority in this area. Initially, the FNBM was expected to be

“Ready mid-2010”. [45] A UNB MSc thesis presenting the model was completed in 2011, but was not mentioned or made available by NSDNR. Sometime later it was posted on a UNB website [46]. The thesis results suggested the soil deficits are more widespread than had been indicated by the prior studies, and that clearcutting increased nutrient losses substantially. Inquiries of NSDNR about the FNBM or requests to access the FNBM or a report about it were met with replies to the effect that there were problems with the dataset used in the thesis and that more field data had to be obtained and/or that there were issues with confidentiality of the datasets. Such responses led to suspicions that NSDNR was being closed mouth about the FNBM because they didn’t like what it was telling them.

It wasn’t apparently, until June 29, 2016 when a workshop led by Kevin Keys was held for invited participants, that further information about the model became widely available outside of NSDNR. One of us (dp) attended as a rep of NatureNS and in early October spoke at length with Kevin Keys and Bruce Stewart of NSDNR about questions that came up after the June presentation. At that meeting, the NSDNR personnel said that the model had not yet been applied to any harvest approval process.

A week before that meeting, a multi-authored peer reviewed paper on the FNBM was published [47]. The paper provided the first formal confirmation from NSDNR of serious nutrient limitations to forest production in Nova Scotia and that the losses are exacerbated by clearcutting.

NSDNR is to be congratulated for this rigorous scientific work and for reporting it in a recognized peer reviewed journal.

The paper confirms what had been very clear years earlier, namely that SW Nova Scotia in particular has the most serious nutrient limitations, and that nutrient losses are exacerbated by clearcutting (the latter was clearly demonstrated in the 2011 thesis).

In this context, it is difficult to understand why NSDNR has not taken a much more precautionary approach to harvesting Crown lands in SW Nova Scotia, e.g. by restricting clearcutting to 10% of all harvests, or at the very least expanding the buffer zones around watercourses to 100 or even 300 meters.

Question 20: Why has NSDNR not taken a much more precautionary approach to clear-cutting in SW Nova Scotia, given the evidence from aquatic sciences and NSDNR’s own work that SW Nova Scotia is particularly vulnerable, and that clearcutting may increase losses associated with acid rain by as much as 50%.

Question 21: When will nutrient budgeting be incorporated into the PTAs?

We have still not seen in NSDNR literature on its website, or even in the Keys et al. 2016 paper, comments or highlighting of the links between acidification of forest soils and the health of aquatic systems, and effects of calcium deficiencies on the forest biodiversity (trees and

associated species) at large. There is still no mention of the Keys et al. 2016 paper on the NSDNR website.

Question 22: What is NSDNR doing to promote understanding within the forest community more broadly about the adverse effects of acid rain/clearcutting on aquatic systems, forest health and biodiversity? Has the WestFor group been well advised about these issues?

8. CONCLUSION

There are other issues that we might raise, e.g. about buffer zones, but those identified above – landscape level impacts of forestry practices on biodiversity, adaptation to and mitigation of climatic warming, forest soils acidification are core issues.

As an organization attempting to practice, responsible, science based advocacy , we have examined the various documents that NSDNR cites as providing a scientific basis for its forestry policies and practices, some produced in-house, some not. To the extent that we understand this literature and NSDNR policies and practices we have concluded that:

- In relation to LANDSCAPE LEVEL IMPACTS OF FORESTRY PRACTICES ON BIODIVERSITY there are serious deficiencies or flaws in some of NSDNR science that is being applied; the resulting extensive clearcutting is having serious negative impacts on biodiversity and ecosystem services.
- In relation to MITIGATING AND ADAPTING TO CLIMATE CHANGE, scientific evidence and procedures developed outside of NSDNR that should be applied to forestry in Nova Scotia are apparently not being applied (or the public has not been informed about NSDNR's application of this science). In this context, Nova Scotia is not meeting its commitments under [EGSPA](#) [48] and is doing far less than it could to adapt to and mitigate climate change.
- In relation to SOIL ACIDIFICATION & LOSSES OF CALCIUM, a suite of research by aquatic scientists that should have raised alarm bells about sustainability of forests and forestry and associated aquatic systems a decade and more ago has not been heeded (highlighted) by NSDNR, and now NSDNR is being very reticent about applying and publicizing its own, rigorously conducted science in this area. We are particularly concerned about the impacts of not taking a more precautionary approach to harvesting in SW Nova Scotia, the area most strongly affected by acid rain and nutrient-poor soils. These conditions are known to be seriously affecting aquatic systems, and based on research elsewhere, are very likely having major impacts on forest health and biodiversity.

We would very much appreciate a response to our comments and specific questions from NSDNR and an opportunity to further discuss these issues.

9. NOTES

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Notes for a meeting with
MLA Labi Kousalis and MLA Joachim Stroink
31 October 2016

I should introduce myself so you know from where my views have arisen. I was born and raised in a mill town, on the tidal Avon River. Since then I have travelled throughout the province by walk, hike, bike, cross-country ski, snowshoe, skate, canoe, and car. I helped my step-father harvest trees using hand saw and axe and horse and sled, visited two present-day family-managed woodlots, led a field naturalist group on a tour of a tree plantation, and cringed at too many modern-day sites from which trees have been brutally harvested. Forests contain my favorite assembly of plants, and trees are my favorite plants. My life-long passion for the natural world has really developed during my 18 years of retirement, especially for streams and waterfalls, of which I have visited over 200 from Cape North to Yarmouth. I regularly observe, listen, and read about nature, conservation, climate change, and forest management; am a member of and volunteer for the Nova Scotia Nature Trust and the Halifax Field Naturalists; and stay in touch with the Canadian Parks and Wilderness Society and the recently formed Healthy Forest Coalition of NS. This past Summer I collected 125 signatures on a petition to have biomass burning stopped and in doing so (a) talked with people from Lunenburg to Pictou County and (b) learned that almost all of them are deeply concerned about this issue. I was a professional educator in NS for 34 years (public schools and Dalhousie University) and my subject was human health.

My current perception is that the Government of Nova Scotia, of which you are a part, is allowing our forest resources to be badly mismanaged because of the over-reliance on Provincial DNR senior managers who are either inadequately trained in forest ecology or choose to ignore it. For example, Premier McNeil and Minister Hines, as advised by DNR senior managers, consistently includes and defends clear cutting and biomass harvesting as part of NS forest management strategies. We're into what some call a DNR/government-managed "forest tragedy."

I agree with Chris Miller, the highly respected CPAWS-NS Biologist, when he praises Nova Scotia's government for creating 220 new parks and protected areas--a quarter million hectares, two-thirds officially designated since 2013. And when he says, the government is going backwards in its forest policy, allowing too much clear cutting, even going up to the borders of protected areas (Halifax Magazine, November 2016, p. 40).

I recognize that MLA's are caught between a rock and a hard place, so to speak, re growing the economy and protecting the environment; nevertheless, I agree with David Tinker, who wrote a thought-provoking column in the Annapolis Spectator re forest management and the interactions of corporations, governments, and people. In summary: (a) A forest is a complicated biological ecosystem in which a huge number of species interact with each other and with the physical environment." "A forest is a source of livelihood to people who understand its needs and bounty, and who know how to preserve it." (b) "A corporation exists to maximize the benefits to its owners." Corporations play such an overwhelming part in the economy of countries that governments give their interests priority over almost everything else. (c) When corporations are given control over a forest as an asset, that forest will die because corporations have to convert assets into money. (d) Corporations and governments think short term. So, if a corporation has to clear cut a forest, that's just too bad for all the species that live therein. (e) "The truth is, people do care about forests. Otherwise we would want parks to be built in clear cuts, wouldn't we?"

So, what are my specific concerns about what is happening to the forests of NS? They can be summed up in two words: **Clear cutting!**

Clear cutting in NS, includes the government abandoning the 50% reduction goal; actively promoting its use; changing the definition for appearance sake; destroying forest habitat above and below ground during and following harvesting; favoring the forest industry over small, private wood product producers, which has resulted in reduced forest employment and reduced forest value; allowing clear cutting on the border of Kejimikujik National Park and National Historic Site, and other protected areas, giving big industrial forest companies 10 years to take all they want from the government-purchased "Bowater Lands."

Biomass burning for electricity generation, and calling it "green" energy, which even the current federal government no longer seems to accept as a valid statement. The Point Tupper Plant is still burning biomass, and there seems to be no attempt to dampen plans for the building of numerous smaller wood burning plants elsewhere in the province. Rather, a burning process that produces highly polluted emissions that are associated with global warming and with poor health conditions for human (Northern Fibre.pdf), and other living creatures, is promoted.

Biomass harvesting to produce wood pellets for overseas burning. For example, 30,000 tons in one ship load from Halifax this month, and plans to ship much more; this is selling Nova Scotians' birthright. Even the USA acknowledges this is becoming a dangerous business for its forests.

Mixed Acadian forest becoming single-species plantations, herbicide spraying to reduce hardwood growth (the anti-science, anti-nature model that has badly damaged the forests of NB).

Contributing to climate change, holding on to short-term "grow the economy" strategies regardless of damage to the environment, walking out of provincial/federal meeting re carbon emission reductions.

As my representatives in the Government of NS, I want each of you to work for strategies that insure healthy forests in NS that contribute toward a life-sustaining climate globally: strategies such as seriously reducing clear cutting, safeguarding protected areas, eliminating biomass harvesting and burning, and stopping the sale of wood pellets to fuel biomass burning overseas.

Based on what I've been reading and hearing, I believe politicians and political parties who do not "walk the walk" of conserving wilderness places, protecting the natural environment, and controlling climate change likely will not be electable for much longer. Is the Liberal Government of NS headed in that direction--a 10% drop in popularity since June?

Richard Beazley, 804-5800 South Street, Halifax, NS B3H0A7
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From: Caitie Clark <caitie@labimla.ca>

Subject: Info from the Department of Natural Resources

Date: January 9, 2017 at 11:30:29 AM AST

To: Richard Beazley <rbeazley@dal.ca>

Hi Richard,

I've compiled the info the Department of Natural Resources gave to Labi. He's requested I send it to you.

I've included some brief info on clear cutting, herbicide use and harvest methods (in addition to a graph and slide show).

The second part is the department's specific responses to the concerns you mentioned in your October email to Labi and Joachim.

And the third part is responses to other questions you may find useful.

It's lengthy but I hope you find some of this helpful. If you have any other questions or need clarification on some points, please don't hesitate to ask!

Caitie Clark | Constituency Assistant

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Clear cutting, herbicides and harvest methods:

Clear cutting: One of the Department of Natural Resources' harvest methods, but used only after *extensive scientific data collection and consideration of wildlife and other environmental factors*. The government also allows forests to regenerate after clear cutting to return to their previous state (a long process, but a very important one). The government has also protected over 12% of the province's land mass and are now pushing for 13% - those are areas where no logging can take place. As a province, Nova Scotia is one of the leaders in Canada when it comes to protected areas.

Herbicide use:

The application of herbicide on our forests is heavily regulated both federally and provincially. Planted areas in Nova Scotia do not result in monocultures because of the natural ingrowth of native hardwood and softwood trees in our Acadian forests. Application of herbicide to planted areas does not result in elimination of hardwood trees. These broad-leaved trees return a few years after application with the softwood trees now overtop and better able to compete for sunlight and space in the forest canopy. **The active ingredient glyphosate in herbicides applied in forestry is the same active ingredient in herbicides commonly used in agricultural operations throughout the world.**

Harvest methods:

Crown Land timber harvesting prescriptions are determined using Forest Management Guides (<http://novascotia.ca/natr/forestry/programs/timberman/pta.asp>). The decisions in the management guides are based on information collected during an on-the-ground Pre-Treatment Assessment (PTA),

collected by a forest professional who is trained and certified to perform pre-treatment assessments. The Forest Management Guides take into account a number of factors including Forest Ecosystem Classification for soils and vegetation, the amount of timber volume per hectare, the health and vigor of existing trees, the lifespan and shade tolerance of species present, existing regeneration of immature trees & seedlings, as well as the potential blowdown hazard for the site. **The harvest prescription, either a type of clearcut or a type of partial harvest, is the result of using the guides on a case-by-case basis with the actual data from the field.**

Other points relevant the e-mail you sent to Labi and Joachim in October:

- **“Provincial DNR folks who are either inadequately trained in forest ecology or choose to ignore it.”**

There are well-respected forest ecologists, forest soil scientists, biologists and other professionals in DNR who have developed leading-edge tools and practices that are being implemented in NS. These tools include Ecological Landscape Classification (ELC), Forest Ecosystem Classification (FEC), Ecological Landscape Analysis (ELA), Pre-Treatment Assessment (PTA), Forest Management Guides, Nutrient Budget Model etc.

- **“Mixed forest becoming single-species plantations.”**

Most harvested areas in NS are regenerated with a range of species, either entirely by natural regeneration or by natural regeneration supplemented by planting. So called ‘single species plantation’ are rare.

- **“Burning biomass for electricity generation.”**

On April 8, 2016, the Province announced an amendment to the Renewable Electricity Regulations to increase flexibility in managing the electrical system and reduce the amount of biomass necessary to generate electricity from the biomass plant in Point Tupper. Most of the supply to this plant will now be waste products from sawmills and other wood processing facilities.

- **“Producing wood pellet for overseas burning.”**

Current pellet production in NS is focused on the domestic residential market and uses waste products, principally sawdust, from sawmills.

The pellet plant in Upper Musquodoboit that produced industrial pellets, primarily for overseas markets, is currently closed. It primarily used sawmill waste products and low grade material that had no higher value market.

- **“Destroying forest habitat by clear cutting, etc., thus making Nova Scotia more vulnerable to climate change.”**

Clear cutting does not destroy forest habitat. Applying the forest management guides using information from a pre-treatment assessment determines the most appropriate harvest method.

Other common questions:

1. **Re-establish local involvement in forest management and don't use a "one size fits all approach".**

This is the practice on Crown land in NS.

We have regional advisory committees provide input into Crown land management. Committees are functioning in Eastern and Western regions and currently being formed in Central region.

We have established a pilot Community Forest in western NS, the first in eastern Canada

We are working with the Mi'kmaq on a Mi'kmaw Forestry Initiative and Crown land is being held in Bear River and St Croix for this purpose.

All proposed Crown land harvests are posted online for public input. Pre-treatment assessment data is available for each site.

All Crown land harvest prescriptions are developed using Forest Management guides based on input from a required Pre-treatment Assessment carried out in the field by a trained forest professional. Note of harvest methods below. This process is also recommended for private landowners.

2. **Save old growth forest.**

This is the practice on Crown lands in NS.

DNR has an Old Forest Policy under which true old growth forests on public lands are conserved (very rare) and a network of the best old forest restoration opportunities is established (total of 8% of public land in each ecodistrict to be identified as old growth and old forest restoration opportunity).

In addition, over 12% of the province has been designated as protected areas.

3. **Save legacies when clearcut.**

This is a normal practice in NS.

Provincial Wildlife Habitat and Watercourses Protection Regulations (introduced in 2002) require watercourse 'special management zones' and 'legacy trees and habitat structure' be retained during forest harvesting on all forest lands (including private ownership). These regulations supplemented the Forest/Wildlife guidelines and standards (introduced in 1989).

In addition, Special Management Practices such as those that apply to Mainland Moose Concentration Areas require additional retention practices on Crown lands.

DNR is currently finalizing a biodiversity stewardship field guide to assist private landowners in managing their lands.

4. **Regenerate with a diversity of species.**

This is the normal practice in NS.

In most cases, harvested areas regenerate naturally to a variety of native species. In other situations, natural regeneration is supplemented with planted trees. Note on herbicide use below.

Harvesting Decisions on Crown Land

Forest Management Guides (FMG)

Pre Treatment Assessment (PTA)



FOREST RESEARCH REPORT

Nova Scotia Department of Natural Resources
Forest Management Planning

Contents
Introduction..... 1

Tolerant Hardwood Management Guide

FOREST RESEARCH REPORT

Nova Scotia Department of Natural Resources
Forest Management Planning

Contents
Introduction..... 1

Tolerant Softwood & Mixedwood Management Guide

FOREST RESEARCH REPORT

Nova Scotia Department of Natural Resources

Contents
Introduction..... 1

Intolerant Hardwood Management Guide

FOREST RESEARCH REPORT

Nova Scotia Department of Natural Resources

Contents
Introduction..... 1

Spruce – Pine Management Guide

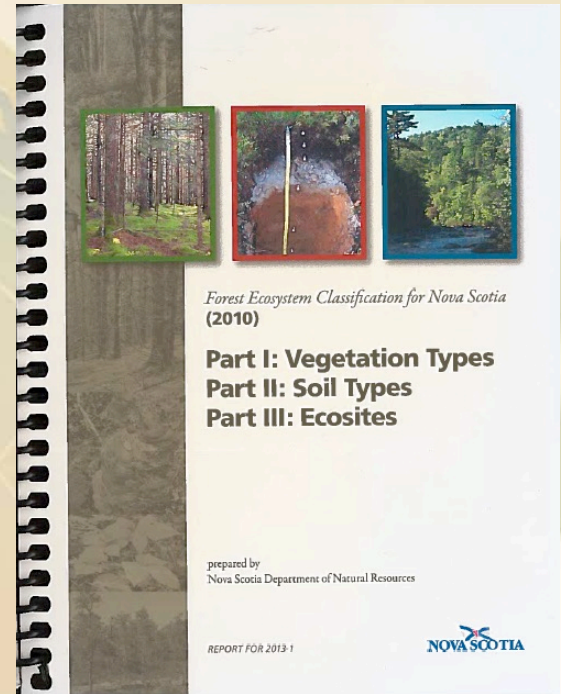
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Introduction

Nova Scotia's Natural Resources Strategy (NSDNR, 2011) commits the province to fully implement an ecosystem based approach to forest management. In support of this initiative, ecosystem based management guides (McGrath, 2007; McGrath, 2011) have been developed for Tolerant Softwoods, Mixedwoods and Hardwoods. These guides provide silviculture prescriptions by interpreting the ecological, site and stand conditions required to make an ecosystem based management decision. The system designed to collect the site and stand information required for using these guides is referred to as the Pre-Treatment Assessment (PTA) and is described in McGrath (2013) and mandated by the Code of Forest Practices (NSDNR, 2012).

Forest management prescriptions should be designed to emulate ecological processes and incorporate structures that would occur under a natural disturbance regime. In the Spruce – Pine forest group, fire and windthrow can occur frequently as stand-level natural disturbances resulting in the rapid mortality of an existing stand and the establishment of a new



Forest Ecosystem Classification (FEC)

[Forest Ecosystem Classification | novascotia.ca](http://novascotia.ca/natr/forestry/programs/timberman/pta.asp)

Pre-Treatment Assessment (PTA) data collected in the Forest on:

- Soil Type (FEC)
- Vegetation Type (FEC)
- Wind Exposure
- Wildlife
- Geology
- Tree Species
- Tree size
- Regeneration
- Patchiness of Stand
- Acceptable Growing Stock (AGS)



Certified PTA staff collecting data

Harvest Type prescribed using Forest Management Guides (FMG) using PTA data:

- Tolerant Hardwood Management Guide
- Tolerant Softwood/Mixedwood Management Guide
- Spruce Pine Management Guide
- Intolerant Hardwood Management Guide

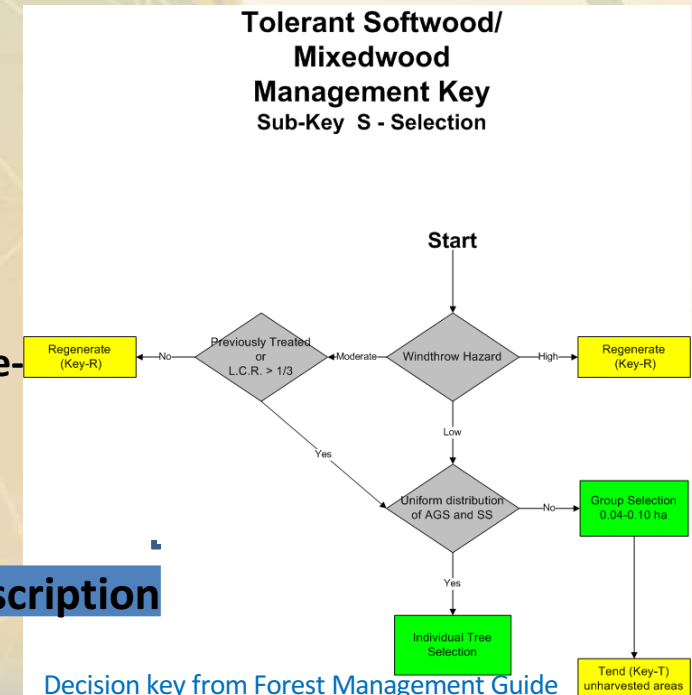


Completed Selection Harvest

Harvest Approved/Implemented:

- Prescription Audited (Pre-Harvest)
- Prescription Approved
- Harvest Audited (Post-Harvest)

Prescription



Overview

Harvest Planning/Implementation

- Pre-Treatment Assessment (PTA) data is collected in the forest on ecosystems, soils, tree species, climate, tree conditions, site conditions wildlife, ground conditions and other factors by certified staff.
- Appropriate harvesting technique (Clearcut, Selection, Commercial Thinning, or Shelterwood) prescribed using the Forest Management Guides and PTA data. Non-Clearcutting harvests (Selection, Commercial Thinning, or Shelterwood) are prescribed where the forest conditions allow.
- The data is audited and harvest plan approved if accurate.
- Harvest operation audited for success

% Non-Clearcut (Partial Harvest)		
Year	Crown	Provincial
2006	33%	9%
2007	26%	8%
2008	30%	15%
2009	26%	13%
2010	25%	9%
2011	22%	10%
2012	44%	18%
2013	36%	15%
2014	29%	17%
2015	33%	17%