

September 18, 2017.

To: Prof. William Lahey,

Project Leader for the Independent Review of Forestry in Nova Scotia

Cc: Nature Nova Scotia (Federation of Nova Scotia Naturalists)

Halifax Field Naturalists Conservation Committee

Labi Kousoulis, MLA

From: David Patriquin

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Comments on NSDNR forestry science and a suggestion for a science expert to assist in the Independent Review

I have a PhD in marine sciences from McGill (1973), I was a professor in the Biology Department at Dalhousie University 1975-2008. Beginning about 2005, I have attempted to become as knowledgeable as I can about forests and forestry, the former from a natural history perspective, the latter with a focus on the science underlying forest management in Nova Scotia.

In April of 2017, I drafted a document for the Conservation Committee of the Halifax Field Naturalists (HFN) on [Impacts of forestry in Nova Scotia on conservation of biodiversity: Concerns and Questions](#). After review and input from other members of that committee, we forwarded the document to Labi Kousoulis, the MLA for Halifax Citadel-Sable Island as two of us (myself and Richard Beazley) had been meeting with him over the previous 6 months to discuss forestry issues. Labi arranged a meeting with then Minister of Natural Resources Lloyd Hines, the premier's executive assistant, Labi and MLA Joachim Stroink to discuss our concerns. Lloyd Hines forwarded the HFN document to NSDNR, directing them to respond. We received a reply on Aug 24, 2017.

I have attached the original document, and the reply, marked up with some of my initial comments. (It is still under review by the HFN Conservation Committee.)

The exercise was helpful in clarifying some of the issues, for example, why NSDNR figures for clearcutting as a percent of total harvests are consistently lower than the figures given on the National Forestry Database, the latter being figures that critics commonly cite, and the former the figures the government/NSDNR cite. An example: in 2014, the % of clearcutting on Crown land was 68.7% by NS government figures while it was 88.1% by the National Forest Database figures. The two sources use the same data but apply different definitions of clearcut. For more about this, please see my blog post at <http://nsforestnotes.ca/2017/01/23/whats-a-clearcut-and-whats-not-a-clearcut-in-nova-scotia/> and Question 2 in the HFN document/NSDNR response (attached).

NSDNR and accordingly The—Government-of—the-day have consistently maintained that their harvest decisions are “science-based”, the more recent assertion (Aug 2016, and subsequently) being that “all harvest treatments are aligned with the nature-based requirements of Nova Scotia’s lands”. In the HFN document, we asked “**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?”**

The NSDNR scientific staff continue to stand by that statement when from a scientific perspective - or even looking just at the logic of DNR’s response - it seems clear that simply is not true.

The major scientific issues from my perspective are:

- (i) **Nutrient depletion.** Approximately 60% of the NS landscape is nutrient deficient and excessively acidified due to the extremely poor buffering capacity of the soils combined with acid rain, a condition further exacerbated by clearcutting. One result: we have some of the most acidified surface waters in North America, we have already lost salmon from many systems and now other aquatic life is threatened. NSDNR has done some rigorous, published science on the nutrient status of our forest soils, but has yet to apply it in any significant way, to the detriment of both biodiversity conservation and future productivity.
- (ii) **Lack of landscape level planning for biodiversity conservation/short rotations.** Harvest decisions are based on stand level assessments and landscape level planning for biodiversity conservation comes into the process only late via the Integrated Resource Management teams, if at all. Combined with the short rotations, this is leading to massive loss of mixed, multi-aged Acadian forest and associated biodiversity.
- (iii) **Carbon sequestration/GHG emissions.** Research in Nova Scotia has shown that clearcutting results in large losses of soil carbon and nitrogen which can require more than 100 years to recover; combined with short rotations this is resulting in greater carbon emissions, much less carbon sequestration and overall poorer soils than would occur if the forests were managed to maintain mixed, multi-aged Acadian forest. There is a strong push to develop forest bioenergy and bioenergy products such as ‘Green Fuels’ as a way to compensate for the declining prospects for pulp and paper. The use of primary forest biomass (rather than sawmill wastes) for such purposes results in large net carbon emissions over the next 50 years, a period when we most need to reduce carbon emissions.

The relative isolation of the science staff in the NSDNR Resource Management Division is an overarching issue. There is very little interaction of the science staff in the NSDNR Resource Management Division with the larger scientific community or with the public, e.g. key scientific staff rarely participate in seminars or forums at our Universities, or give public talks. Very little of the critical NSDNR research is published in academic journals. One exception is a paper on the state of the soils/forest nutrient budget model which was published last September; it paints a rather dire picture. Yet this important research is not even mentioned in the State of the

Forest report, or otherwise on the NSDNR website, while their non-peer reviewed research figures prominently. Often in-house documents that have not been submitted to journals are credible none-the-less and cited in regular scientific publications, but I have not seen any reference in journal papers to key NSDNR in-house documents. A draft of NSDNR's 2008 document **Mapping Nova Scotia's Natural Disturbance Regimes** was strongly criticized in peer reviews conducted in-house (but including external reviewers) as revealed by a FOIPOP, but NSDNR made few or no changes in response. There are no annual reports (at least none that are available to the public) describing what projects are underway, who is involved etc. Many or most of the documents related to strategic planning based on NSDNR science are not available publicly. It is very difficult to find out who does what at NSDNR. A Forest Biodiversity Science Advisory Committee was set up in 2015 but except for a statement announcing the committee, there is no information about its functioning available to the public. Most communication is filtered through the DNR media office.

I have found some of the DNR staff to be very cooperative in one-on one communications, for example the people who are involved with the Harvest Maps. The comments above apply to science conducted within the Resource Management Division. Some of the other Divisions or subdivisions seem to have a much better reputation and interaction with the public. It appears from the outside that there is some lack of communication or lack of effective, equitable interaction between the five Divisions.

I had a meeting with some of the scientific staff in October of 2016 to discuss the status and application of the Forest Nutrient Budget Model and asked a colleague to participate (with NSDNR's approval). It was a long route to get there and we were repeatedly reminded not to stray from the topics we had identified coming in. Other staff in the Research and Planning unit have said they would meet with me individually, which I appreciate. (Before I became more public in my critique of NSDNR science by beginning a blog on NS Forest and forestry in June 2016 my lengthy referenced letters or submissions to NSDNR were met only with form replies from the Minister of Natural Resources.) However, what is lacking most is communication of the NSDNR science staff within a larger context, where DNR scientific staff both communicate and defend their science publicly (e.g. in an academic forum) and modify it accordingly. Operating within such a closed context does not make for good science, good forest management or good PR.

Recommendations

I suggest it is critical that the scientific basis for DNRs harvest decisions and overall forest management be critically reviewed by recognized individuals or groups. **I suggest that an excellent person would be Yves Bergeron, Professor, Université du Québec, Montréal Forest Study Centre, or someone within his group as might be recommended by Dr. Bergeron. I don't know him personally, but I have read many of his papers. He is obviously well recognized and his research, e.g. on natural disturbance regimes, relates well to the research conducted by NSDNR and includes research on both boreal softwood and southern hardwood forests in Quebec.**

View:

https://www.researchgate.net/profile/Yves_Bergeron/publications
http://chaireafd.uqat.ca/chercheurs/bergeron/ybergeron_f.asp

I suggest that it would be very appropriate to look to Quebec and Ontario for models of forest management that might be adopted/adapted for Nova Scotia. In particular I am thinking of the operation of the Quebec Sustainable Forest Development Act (RSQ, c. A-18.1), and the Tree By-law act in Ontario. The Quebec Act requires much more consultation than occurs in Nova Scotia, while the Tree By-law Act in Ontario allows municipalities to regulate tree harvesting where they wish to. I have noted that in the U.S., there are many local forest ordinances. (A request from Annapolis Co. to be exempted from the WestFor Agreement has been denied, other counties have also expressed concerns.)

Since June 21, 2016, I have maintained a “forest blog”. Below I have cited some of the posts or pages that elaborate on issues I raised above.

I am grateful for your consideration of these comments.

David G Patriquin

Cc: [Nature Nova Scotia](#) (Federation Nova Scotia Naturalists)
[Halifax Field Naturalists](#) Conservation Committee

Some posts or pages related to issues discussed above on [Nova Scotia Forest Notes](#)

[NSDNR's nature-based forestry](#)

“We have now developed tools that ensure that 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.

I wish it were true, but I don’t buy it. Here’s why. (Webpage)

[Show us the science behind clearcuts on Crown land close to the pending Shingle Lake Nature Reserve, Nova Scotia](#)

[Clearcutting close to the pending Shingle Lake Nature Reserve illustrates transparency issues](#) & raises questions about landscape level planning for biodiversity conservation in Crown land harvest decisions (Post, Aug 9, 2017)

[What’s a clearcut and what’s not a clearcut in Nova Scotia?](#)

[The answer depends on who you ask.](#) (Post Jan 23, 2017)

[The Nova Scotia Forest Nutrient Budget Model surfaces](#) [Post, Nov 13, 2017](#)

[What's good for salmon is good for trees in Nova Scotia...and v. versa!](#)

For the sake of the forests and salmon, it's time for NSDNR/Westfor to heed the science and put the brakes on clearcutting in SW Nova Scotia. (Post Dec 13, 2016)

[Feb 12, 2014 Letter to NSDNR and Replies, re: clearcutting and nutrient budgeting](#)

Separate from the blog site, the letter illustrates my effort to initiate a discussion with NSDNR re nutrient budgets.

[Natural Resources Canada GHG Calculator confirms Nova Scotia forest bioenergy schemes are worse than coal](#)

Post, Jan 3, 2017

[Protected Areas in Nova Scotia help to mitigate climate change, clearcuts do not.](#)

A modelling study shows that Protected Areas increase carbon storage, clearcuts reduce carbon storage (Post, May 26, 2017)

[Are biofuels from Nova Scotia forests good for the environment? Show us the science!](#)

Post, may 4, 2017

[Stats & Regs – Other Jurisdictions](#)

[Annotated Links.](#)

About Maine "...As I see it, the Maine experience illustrates that it is very difficult if not impossible to maintain high levels of harvesting for pulp and paper (or equivalent levels of harvesting for bioenergy or other products which involve low value wood/short rotations) and resolve ecological issues associated with such harvesting whether in fewer large patches or many small patches."

[Tree Marking – why not in Nova Scotia?](#)

Post, Nov 10m 2016. & Why Minga O'Brien says forestry practices in central and southern Ontario are miles ahead of the rest of the country.

[Who does what \[at NSDNR\]](#)

The **NSDNR website** does not provide much detail about who does what at DNR beyond listing some of the staff in various sections. There is next to no information about the qualifications and backgrounds of directors and staff. There are no annual reports describing activities and outcomes over the previous year in any detail. Below is what I have been able to find out about who does what related to forestry. (Webpage)

[Neal Livingston: We need good public policy to drive the transition to better forestry in Nova Scotia](#)

Specifics are given in an 8-stage plan to transition from clearcutting to a selection cutting forest economy (Post, May 22, 2017)

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*

April 19, 2017

Modified April 26, 2017*

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.

*Members: **R. Beazley** (BA, BEd, BPE, MPE, EdD), **R. McDonald** (BSc, MSc, PhD),
D. Patriquin (BSc, MSc, PhD), **C. Robinson** (BSc, MSc, MES).

* 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.

SECTOR	YEAR	2000	2010	2015	Ratio 2015/ 2000
		(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.

AR	YE	2000	2010	2014	2015
		(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.**

SECTOR	YEAR	2000	2010	2015	Ratio 2015/ 2000
		(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 Salenius has written specifically on this topic [28] and how it could be addressed:

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

Peter Salenius 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

1. <http://halifaxfieldnaturalists.ca/>
2. <http://halifaxfieldnaturalists.ca/ArchivedNewsletters/PDF/No1.pdf>
3. <http://halifaxfieldnaturalists.ca/ArchivedNewsletters/PDF/No2.pdf>
4. http://novascotia.ca/nse/protectedareas/docs/CSFF_finalreport_sign.pdf
5. <http://halifaxfieldnaturalists.ca/ArchivedNewsletters/PDF/No132.pdf>
6. <http://birding.aba.org/maillist/NS>
7. **HFN Conservation Committee: R. Beazley** (BA, BEd, BPE, MPE, EdD), **R. McDonald** (BSc, MSc, PhD), **D. Patriquin** (BSc, MSc, PhD), **C. Robinson** (BSc, MSc, MES).
8. F.B. Goldsmith. 1980. **An evaluation of a forest resource - a case study from Nova Scotia.** *Journal of Environmental Management* 10: 83-100.
9. <https://novascotia.ca/natr/strategy/get-here.asp>
10. <https://novascotia.ca/natr/strategy/pdf/phase2-reports/Forests-Health.pdf>
11. <https://novascotia.ca/natr/strategy/pdf/phase2-reports/Forests-Roots.pdf>
12. https://novascotia.ca/natr/strategy/pdf/phase2-reports/Steering Panel_FINAL.pdf
13. <http://novascotia.ca/parksandprotectedareas/>
14. Beazley, K. et al. 2005. **Biodiversity considerations in conservation system planning: a map-based approach for Nova Scotia Canada.** *Ecological Applications* 15(6): 2192-2208

Abstract. Biodiversity considerations in conservation system planning include three main criteria: representation, special elements, and focal species. A GIS-based approach utilizing simple models was used to assess existing biophysical data relative to these criteria for conservation system planning in Nova Scotia, Canada, with potential utility in applications elsewhere. Representative samples of natural landscapes were identified on the basis of size (= or > 10 000 ha) and degree of naturalness (natural cover, uneven-aged forests, low or zero road density). Special elements were selected, including hotspots of diversity and rarity, critical habitat for species at risk, significant wetlands, old and unique forests, and ecosites. Habitat requirements of viable populations of focal species (American moose, American marten, and Northern Goshawk) were identified using species distribution data, habitat suitability, and population viability analyses. Priority core areas for biodiversity conservation system planning were identified on the basis of these three sets of criteria. Key areas of habitat connectivity were delineated by selecting the least-cost paths for focal species between relevant core areas through cost-distance analyses based on habitat suitability, road density, and minimum corridor width. Collectively, these biodiversity considerations indicate that 60% of Nova Scotia, including 32% in core areas, should be managed for conservation objectives to maintain genes, species, and ecosystems over time. Although data and modeling limitations require that our analysis of richness and diversity, habitat suitability, population viability, and core area selection be verified, the area calculations and other results are consistent with those in similar studies. Consequently, the system design and other information generated are useful for local and regional biodiversity conservation planning and management, and the methodological approach is of potential use in other regions where the necessary field-based data may be made available.

15. **A Procedural Guide for Ecological Landscape Analysis.** NSDNR 2008.
<http://novascotia.ca/natr/forestry/reports/Procedural-Guide-For-Ecological-Landscape-Analysis.pdf>
16. <https://nsgi.novascotia.ca/plv>
17. http://novascotia.ca/natr/strategy/pdf/clearcut_FAQs.pdf
18. Taylor, P.D. et al. 2006: **Landscape connectivity: a return to basics.** In *Connectivity Conservation*, Chapter: 2, Publisher: Cambridge University Press, Editors: Kevin R. Crooks, M. Sanjayan, pp.29-43; Groffman, P. et al. 2006. **Ecological Thresholds: The Key to Successful Environmental Management or an Important Concept with No Practical Application?** *Ecosystems*: 9: 1–13 D
19. Daniel Kneeshaw and Yves Bergeron. **Applying Knowledge of Natural Disturbance Regimes to Develop an Ecosystem Management Approach in Forestry.** *Ecological Forest Management Handbook*. Edited by Guy R. Larocque. CRC Press 2015
20. Rempel, R. S., J. Baker, P. C. Elkie, M. J. Gluck, J. Jackson, R. S. Kushneriuk, T. Moore, and A. H. Perera. 2007. **Forest policy scenario analysis: sensitivity of songbird community to changes in forest cover amount and configuration.** *Avian Conservation and Ecology - Écologie et conservation des oiseaux* 2(1): 5. [online] URL: <http://www.ace-eco.org/vol2/iss1/art5/>
21. Peter Neily, Eugene Quigley, Bruce Stewart. **Mapping Nova Scotia's Natural Disturbance Regimes.** Report FOR 2008-5 Ecosystem Management Group Forestry Division Truro, Nova Scotia April 2008
<https://www.novascotia.ca/natr/library/forestry/reports/NDRreport3.pdf>
22. <http://novascotia.ca/natr/strategy/pdf/ThePathWeShareReportOnline5Year.pdf>
23. http://novascotia.ca/natr/library/forestry/reports/Selection_Harvest_Survey_Report_tm.pdf.
24. <http://novascotia.ca/natr/library/forestry/reports/REPORT91.pdf>
25. Fenton, N.J., M. Simard, and Y. Bergeron. 2009. **Emulating natural disturbances: The role of silviculture in creating even-aged and complex structures in the black spruce boreal forest of eastern North America.** *J. For. Res.* 14:258-267.
26. **Reviews and Comments on Neily, P.D. et al, 2007. Forest disturbance ecology in Nova Scotia. Nova Scotia Department of Natural Resources (draft).**
On EAC Website. Includes internal review. The 2007 version differed little from the final 2008 version (i.e. there was little response to the reviews).
27. https://ecologyaction.ca/sites/ecologyaction.ca/files/images-documents/Compendium_of_critiques_of_NSDNR%27s_2007_forest_disturbance_report.pdf
28. <http://www.sciencedirect.com/science/article/pii/S0378112701005722>
<http://www.cfs.nrcan.gc.ca/pubwarehouse/pdfs/27411.pdf>
29. A description of “borealization” can be found in a 2008 Fundy Model Forest document, *Acadian Forest Management and Restoration*
http://www.fundymodelforest.net/images/pdfs/publications/management/Management_2007_INFOR_Acadian_Forest_Management_and_Restorat.pdf
30. <https://www.dogwoodalliance.org/wp-content/uploads/2017/03/The-Great-American-Stand-Report.pdf>
31. <http://www.sciencedirect.com/science/article/pii/S0378112708006956>
32. <http://www.nrcan.gc.ca/forests/climate-change/carbon-accounting/13107>
- 32b. R. Cameron and P. Bush. 2016. **Are Protected Areas an Effective Way to Help**

Mitigate Climate Change?: A Comparative Carbon Sequestration Model for Protected Areas and Forestry Management in Nova Scotia, Canada *The International Journal of Interdisciplinary Environmental Studies* 11: 1-13

33. <http://www.thecoast.ca/halifax/nova-scotia-feeling-the-burn-on-biomass/>
34. [Natural Resources Canada Bioenergy GHG calculator](#)
35. M. E. Fenn et al. 2006. **Status of soil acidification in North America.** *Journal of Forest Science*, 52 (Special Issue): 3–13.
36. C.M. Beir et al. 2012. **Changes in faunal and vegetation communities along a soil calcium gradient in northern hardwood forests.** *Canadian Journal of Forestry Research* 42: 1141–1152.
37. Bird Studies Canada. 2013. **The Canadian Lakes Loon Survey 1981-2012.** Accessed Feb 9, 2013 at www.birdscanada.org/volunteer/clls/resources/CLLSsummary.pdf
38. A. Jeziorski et al. 2008. **The widespread threat of calcium decline in fresh waters.** *Science* 322, 1374.
39. N. M. Hill & D.J. Garbary. 2011. **Habitat may limit herb migration at the northern edge of the Appalachian deciduous forest** *Botany* 89: 635-645.
40. E. Pabian & M.C. Brittingham. 2012. **Soil calcium and forest birds: indirect links between nutrient availability and community composition.** *Ecosystems* 15: 748–760.
41. Sterling, S. M., Angelidis, C., Armstrong, M., Biagi, K. M., Clair, T. A., Jackson, N., and Breen, A.: **Terrestrial liming to promote Atlantic Salmon recovery in Nova Scotia – approaches needed and knowledge gained after a trial application,** *Hydrol. Earth Syst. Sci. Discuss.*, 11, 10117-10156, doi:10.5194/hessd-11-10117-2014, 2014.
42. Clair, T. A., Dennis, I. F., and Vet, R.: **Water chemistry and dissolved organic carbon trends in lakes from Canada’s Atlantic provinces: no recovery from acidification measured after 25 years of lake monitoring,** *Can. J. Fish. Aqu. Sci.*, 68, 663–674, doi:10.1139/F11-013, 2011.
43. Ouimet, R., Arp, P. A., Watmough, S. A., Aherne, J. & DeMerchant, I. (2006). **Determination and Mapping Critical Loads of Acidity and Exceedances for Upland Forest Soils in Eastern Canada.** *Water, Air, and Soil Pollution*, 172, 57-66.
44. **Mapping Forest Sensitivity to Atmospheric Acid Deposition.** 2006-2007 Annual Report Prepared by The Forest Mapping Group For The Committee on the Environment of The Conference of New England Governors and Eastern Canadian Premiers <https://www.mffp.gouv.qc.ca/publications/forets/connaissances/recherche/Ouimet-Rock/Rapport-Forest-Mapping-Group-2007.pdf>
45. NSDNR Slideshow (PDF) **“Nova Scotia Forest Biomass Harvest and Retention Guidelines”** June 2009.
46. J. Noseworthy. 2011. **Mass balance, biogeochemical framework for assessing forest biomass harvest sustainability.** A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Forestry in the Faculty of Forestry and Environmental Management, University of New Brunswick.
47. **A Simple Geospatial Nutrient Budget Model for Assessing Forest Harvest Sustainability across Nova Scotia, Canada**
by Kevin Keys, Joshua D. Noseworthy, Jae Ogilvie, David L. Burton, Paul A. Arp. *Open Journal of Forestry*, 2016, Vol 6, pages 420-444.
http://file.scirp.org/pdf/OJF_2016092914590401.pdf
48. Environmental Goals and Sustainable Prosperity Act <https://novascotia.ca/nse/egspa/>

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
rbeazley@dal.ca, 902-429-6626

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

Office of the Honourable Labi Kousoulis

MLA, Halifax Citadel-Sable Island

365-5991 Spring Garden Road

Halifax | NS | B3H 1Y6

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Email: caitie@labimla.ca

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

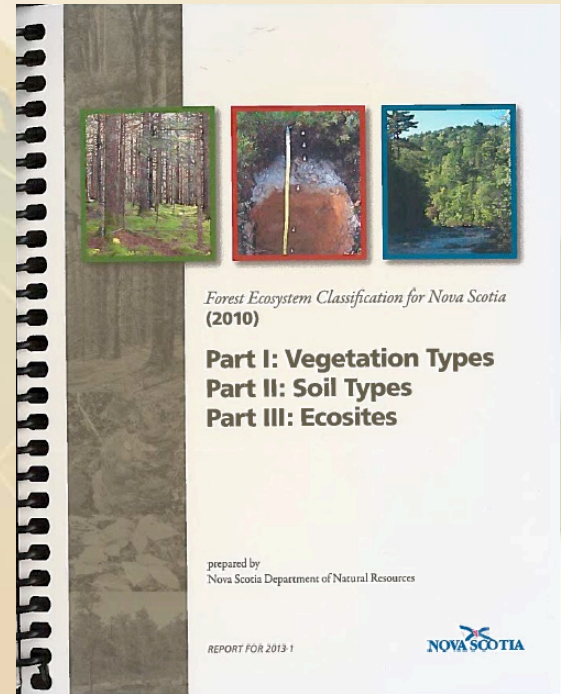
Peter Neily
Eugene Quigley
Tim McGrath

Forestry Division
Truro, Nova Scotia

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

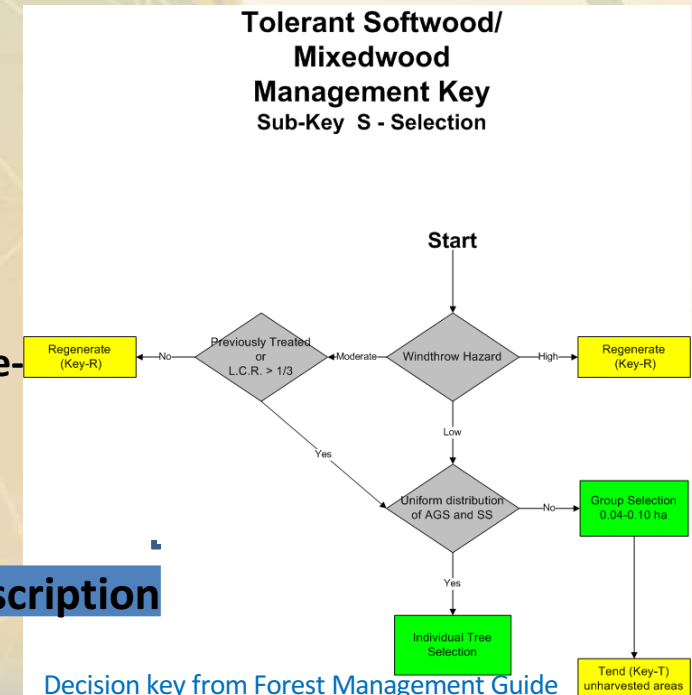


Completed Selection Harvest

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%

Received by e-mail
Aug 24, 2007

Mr. David Patriquin
Conservation Committee of the Halifax Field Naturalists

Dear Mr. Patriquin:

I am responding to the questions you submitted concerning the impact of forestry on conservation of biodiversity. The detailed questions took some time to address and the responses are attached.

Thank you for your interest in the management of our natural resources.

Sincerely,

Margaret Miller
Minister of Natural Resources

Attachment

NSDNR Responses to Questions
from the
Halifax Field Naturalist Submission of April 19, 2017

Question 1: 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?

The data shows that the area of forest cover has actually increased over the past 100 years, including over the past 50 years. The Fernow (1912) forest inventory report was the first comprehensive inventory of land and forest for Nova Scotia (although it only recorded forest, non-forest and agriculture). In 1958 the Department completed its first full inventory of the province. Department inventories since the 1960's are available on-line. Area estimations have improved over time due to aerial and satellite imagery, and computer geographic information systems technology.

	Fernow 1912 (hectares)	NSDLF 1958 (hectares)	State of the Forest 2016
Forests	2 667 730	3 907 278	4 185 812
Non Forests	1 211 703*	420 139	456 254
Agriculture	919 151	588 412	274 683
Water & Wetlands		485 834	393 812
Urban			155 175
Road and Rail			59 278
Excluded Area		149 668**	
Total		5 551 331	5 525 014

* Fernow included old burns, barrens and recent burns in this category.

** Excluded area was Cape Breton H.N.P. and all the area north of the park.

Figures for the area of deforestation – the conversion of forest land to non-forest uses such as agriculture, utilities/transportation corridors and development, in Nova Scotia, has not been calculated.

The table above shows some deforested lands of the past are returning to forested conditions due primarily to agricultural land abandonment and fire suppression.

There is no evidence that deforestation is an issue as a consequence of forest management. Some of the most recent deforestation has occurred in the Cape Breton Highlands ecoregion primarily affecting the National Park and the Pollets Cove Wilderness Area. This resulted from the continuing hyper abundance of moose following the spruce budworm outbreak, which has converted most of the upland balsam fir ecosystems to grasslands. NSDNR has been supporting Parks Canada in restoration initiatives as they seek to address associated biodiversity concerns. Fortunately, this same level of deforestation has not occurred in the region south of the park which is under forest management. It appears that harvesting, silviculture, and reforestation activities along with the logging road networks and associated hunter access has allowed these ecosystems to remain forested, thus maintaining habitat for endangered lynx, marten, and Bicknell's thrush among many other species dependent on these ecosystems. This highlights the potential of integrated planning to direct a variety of land management approaches to achieve balance and optimize the roles that each can play.



Question 2: 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?

No, it would not be appropriate for the following reasons. There is one set of harvest data for Nova Scotia, produced by NSDNR and submitted to the National Forest Database. NSDNR reports data by actual harvest practices, categorizing the treatments as clearcut or partial harvest based on established definitions (Table 1).



The National Forest Database system categorizes the harvest treatments by the 'intent' of harvesting, whether it is expected to lead to even-aged or uneven-aged management. The difference is in the classification of the first stage of a shelterwood harvest. NSDNR considers it to be a partial harvest because that is what the actual treatment is based on the established definitions, with a large portion of the mature trees left standing to provide shade for the next crop of regeneration. Under the National Forest Database system it is classified as a "shelterwood", and considered a clearcut treatment as the intent is to carry out a final harvest to remove the overstorey."

NSDNR believes that harvests should be characterized as clearcut or partial based on the actual harvest treatment and not the future intent. We categorize the first stage of a shelterwood harvest as a partial harvest and, when the final harvest is carried out it will be categorized as a clearcut harvest. Plans for a multi-stage harvest can, and often do, change in between harvests as forest managers review their plans and the overstorey removal stage may not occur. There is often little difference in the appearance of a shelterwood, commercial thin, and selection harvest – they may all produce a regeneration and overstorey growth response from the initial entry. The difference will occur with the follow-up treatments. None of these initial entries will produce the "regenerating young forest habitat" that a clearcut creates. When accounting and auditing, one is interested in quantifying what actually exists. Projections of future conditions is a planning exercise.

Question 3: Does NSDNR consider that Crown lands have come under increasing cutting pressure since 2000, or is there an alternative interpretation of these numbers?

The area of Crown land is not directly comparable for the time periods. The trends are primarily the result of the purchase by the province of industrial (private) lands, particularly the Bowater Mersey lands, thereby increasing the area of Crown lands. The table below shows data, both volume and area harvested for Crown, Industrial (private) and the combined data which shows that both the total volume harvested and area harvested has actually decreased for the combination of Crown and Industrial private over the period.



Annual harvests	2000	2010	2015
Crown m3	587,185	777,814	870,944
Industrial m3	2,169,788	670,439	467,860
Crown plus industrial m3	2,756,973	1,448,253	1,338,804
Crown ha	6,820	7,817	11,342
Industrial ha	18,842	9,292	3,881
Crown plus industrial ha	25,662	17,109	15,223

Question 4. Where do landscape connectivity analysis and fragmentation analysis enter planning procedures?

NSDNR is currently undertaking a pilot project on landscape planning that will include multiple ecosystem measures that examine ecosystem condition and productivity, patch composition and configuration, featured species habitat supply, and forest connectivity. Landscape plans will strive for a distribution of stand conditions; spatial pattern, size, type, composition and age, that is representative of the range of local natural variability. Landscape planning will generate tactical level maps of forest planning operations at the 20-year time scale.

NSDNR conducted Ecological Landscape Analysis following the Procedural Guide for Ecological Landscape Analysis. This includes processes to classify the landscape ecosystem structure (ecosections and elements) as “patch, matrix, or corridor” and assess ecological connectivity functions in relation to this structural character. The ELA’s provide a consistent base of information to support landscape level planning for multiple values including ecosystem functions like connectivity. The 38 ELA reports are currently in draft with publication expected in 2017.

<http://www.novascotia.ca/natr/library/forestry/reports/Procedural%20Guide%20For%20Ecological%20Landscape%20Analysis.pdf>.

NSDNR Forestry Division is the province’s lead agency in New England Governors/Eastern Canadian Premiers (NEG-ECP) Ecological Connectivity Working Group. The department is working with scientists from the other jurisdictions as well as stakeholders within the province to meet the terms of the resolution and report on connectivity recommendations in 2020.

(<http://www.coneg.org/Data/Sites/1/media/40-3-ecological-connectivity-en.pdf>).

Question 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?

NSDNR has completed **Ecological Landscape Analysis (ELAs) for 38 ecodistricts across the province, and plans to release them in 2017.** The Ecological Land Classification for Nova Scotia maps and describes the Province's terrestrial ecosystem structure at multiple scales **based on enduring physical features.** This forms a foundation for ecosystem based planning and biodiversity conservation, particularly at landscape scales. A new edition of this classification will be published in 2017.

NSDNR recently released the **Biodiversity Stewardship Guide** to help landowners recognize and conserve important biodiversity features during forest operations scale planning.

<https://novascotia.ca/natr/library/forestry/reports/Biodiversity-Stewardship-Guide.pdf>

The **Integrated Resource Management system uses detailed GIS mapping of site features and land use classifications to assist in forest management and land-use planning and review on Crown land.**



Strategic Forest Analysis is used to plan and predict forest composition over a 100 year time horizon. It incorporates many habitat related landbase classification layers to support a range of forest sustainability values.

Question 6. Can any of those documents be shared with the public?

There are **plans to release the ELA documents in 2017.** The general procedures for how these analyses were completed can be found at:

<http://www.novascotia.ca/natr/library/forestry/reports/Procedural%20Guide%20For%20Ecological%20Landscape%20Analysis.pdf>.

The other documents are already public in published form, or through the open data portal (<https://data.novascotia.ca/>). There are some exceptions, such as the Significant Habitats Database which is kept confidential to protect important sites from exploitation.

Question 7. How do considerations of connectivity and fragmentation enter into the current process for approving forest harvests?

The **Code of Forest Practice Principles and Guidelines provide direction** for managing ecosystems at landscape and stand scales, as well as **guidelines for wildlife habitat management** at coarse and fine scales. The guidelines are supported through a variety of technical references, guidebooks, procedures and research projects. **Many of these have been released and are in use, while others are still under development.** Some of the key attributes that influence connectivity include the continuity and composition of mature forest, the overall intensity of land use, and the density of transportation networks. Although less well understood, the natural arrangement and structure of ecosystems has a fundamental influence on connectivity and fragmentation. Linear ecosystems like rivers and associated riparian systems provide the natural corridors, as do ridgelines and eskers. Patch ecosystems support a



“stepping stone” type of connectivity with very different attributes and vulnerabilities, while matrix ecosystems support “percolation” and are most vulnerable to fragmentation. Much of this data (including Development Classes, Ecological Emphasis Classes, Road Index, Seral Stage, and Ecosystem structure) is reported in the Ecological Landscape Analysis and is currently available through the Provincial Landscape Viewer: <https://novascotia.ca/natr/landscape/>

Some of this information is used during IRM decision making at the operational plan level, and is reflected in policies like the Forest Wildlife Guidelines and Standards. Some aspects are incorporated as values and landbase themes in longterm strategic level forest analysis. However, connectivity and fragmentation will become most relevant during landscape level planning. Currently, a landscape level planning pilot project is underway which is expected to lead to planning procedures available for broad implementation in 2018.

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?

The 60% threshold was drawn from Percolation Theory, which provides a mathematically based method for quantifying connectivity. Generally, the theory indicates that connectivity begins to erode at the 60% level and hits a critical threshold of fragmentation at 40%.

The clearcut definition, and its 60% threshold, is not intended to define appropriate harvest techniques - it provides a quantifiable means to identify clearcuts in a consistent way in order to measure and audit harvest activity. It is in no way a recommendation for harvest prescriptions. Prescriptions are made through the Province's Forest Management Guides, which are designed to achieve specific desirable results. In practice, most “clearcut” type prescriptions retain well below the definition threshold, while the various partial harvest prescriptions are usually well above. This contrasts, for example, with Maine’s clearcut regulation, which typically results in harvest prescriptions based on the regulatory standard with little consideration for silvicultural objectives.

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

The statement in the update is that “We have now developed tools that ensure that all harvest treatments are aligned with the nature-based requirements of Nova Scotia’s lands.” Those tools have been developed and have been implemented on Crown lands and recommended for use on private lands. All harvests on Crown land are aligned with nature-based requirements of Nova Scotia's lands through the requirement that Pre-Treatment Assessments (PTA) and Nova Scotia's Forest Management Guides (FMG) be used when prescribing harvest treatments. This also includes use of the Forest Ecosystem Classification guides to determine the Vegetation Types, Soil Types, and Ecosites to describe the natural ecosystem conditions and make management recommendations. The Forest Management Guides are designed to favor partial harvesting methods wherever the Vegetation Type, Soil Type, and stand conditions indicate probable success.

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)?

No additional analysis has been done since the 2008 report was published, thus there has been no change.

During the preparation of the Ecological Landscape Analyses no changes were proposed pertaining to NDR descriptions at the ecosection level. The development of the ecosite layer for the Nova Scotia Ecological Land Classification (ELC) is nearing completion and when completed will enable an analysis of NDR using the same criteria at a finer scale of mapping. However, the ELC is based on enduring physical features and does not take into account current forest characteristics. Use of the PTA and FMG takes both factors into consideration. Harvest prescriptions are based on assessment of existing conditions at the site level, and do not use the Natural Disturbance Regime information from the Ecological Land Classification – that is used more for landscape level planning, prediction, and assessment of forest composition. Areas that have been mapped as infrequent/gap may not support partial harvesting today due to current forest characteristics but, by following the recommended ecosystem-based management approach, these areas will be able to support partial harvesting in the future. A common example of this are the stands of “old field white spruce forest”. Many of these short-lived, even-aged, conifer stands have naturally succeeded following farmland abandonment on formerly “tolerant hardwood hill” ecosystems.

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

The 60% threshold and other criteria in the FMG's are based on the scientific literature and NSDNR's trials. Forestry Division's research and planning section has conducted many research trials over the past 30 years to explore many aspects of forest management and silviculture across a wide range of Nova Scotia ecosystems. Data from these efforts is stored in a database system accessible to the current science staff for analysis at any time. The results of many of these trials are published in the Forest Research Report series (<https://novascotia.ca/natr/library/publications/forestry-research.asp>), as well as in scientific journals. This research forms the backbone of the various management guides, manuals, and decision support tools the province produces. DNR also consults scientific literature, subject experts, and participates in collaborative teams. The FMG's are based on the best knowledge obtained from these sources.

However, we work in an adaptive environment that seeks new knowledge and is open to change and continual improvement. As an example, the 60% threshold referred to above has recently been changed to 50%. The Pre-treatment Assessment – Forest Management Guide decision system includes a “variance” procedure in which suggestions for novel approaches are identified and put forward for further research. NSDNR has a responsibility to provide sound advice to recommend activities that have a high likelihood of success. The FMG thresholds are set to identify situations where the prescribed treatment would be successful based on existing stand characteristics.

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?

NSDNR carries out research on partial and selection cuts. These trials, up to now have concentrated on infrequent and gap disturbance forest types as these would most closely match the natural disturbance and successional process supporting those communities. **Trials are currently in place to test partial and selection cuts in frequent disturbance forest types as well as restoration techniques in intolerant hardwood stands.** Harvest prescriptions are based on **assessment of existing conditions** at the site level, and do not use the Natural Disturbance Regime information from the Ecological Land Classification – that is used more for landscape level planning, prediction, and assessment of forest composition.



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

The 2007 document was a draft prepared for review and feedback with the intent to aid DNR as it incorporated an ecosystem-based approach for forest resource management. Feedback from various sectors identified a need for further research. DNR agreed to publish the 2008 document showing how Natural Disturbance Regimes were assigned to the ecosection level of the ELC. Presently DNR is funding disturbance research with Dr. Ponomarenko of the University of Ottawa, continuing along with the earlier work she had done with Kejimikujik National Park.

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?

The 2008 report documents how NDR was applied to the ELC to provide an estimate of the area influenced by the NDR categories and this document is available for all to review (data layers used in the analysis are available (<https://novascotia.ca/natr/landscape/>). The terms "frequent" and "infrequent" are defined using longevity of the potential climax species – this allows separation of short lived species from species of greater longevity. During the review of the 2007 draft it was realized by most participants that Nova Scotia had a unique climatic situation compared to the rest of the Acadian Forest (Northern Appalachian Forest) and that made-in-Nova Scotia research would be more appropriate. While some critics expressed a general sentiment that 43% is too high there have been no spatially explicit suggestions submitted to DNR, and it should be noted that 23% of the frequently disturbed ecosystems occur in the maritime boreal ecoregions of the Highlands and Atlantic Coast.

The Nova Scotia ELC defines and maps ecosystems based on enduring physical features to assist in determining the natural ecological structure of the province (as opposed to the "current" condition). The assignment of interpretations like NDR and Climax Forest to the ecosystem mapping provides a coarse scale tool for understanding aspects of natural forest composition and landscape dynamics, which are fundamental for landscape level planning and biodiversity conservation. Unfortunately, there is a common misconception that frequent disturbance is a prescription for clearcutting. NSDNR forest ecosystem scientists have developed a progressive planning tool based on the best available information. It is built on an adaptive management platform that is responsive to new information, which the science team continues to research.

There are no plans for an external review of the 2008 report as other newer management tools are used instead.

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?

No. The native biodiversity of Nova Scotia’s forest has adapted to a range of disturbance regimes that have created forest patches of various sizes and configurations. An ecosystem approach that strives to provide suitable habitat conditions for all native species is preferred. The more that managed forests resemble the forests that developed under natural disturbances such as wind, fire, diseases and insect epidemics, the greater the probability that biodiversity and ecological processes will be maintained.

NSDNR does not complete forest management for just one disturbance regime across the province. Review of inventory reports spanning the past century do not indicate a borealization of the region (<https://novascotia.ca/natr/library/publications/forestry-inventory.asp#inventory>). In fact, there has been a substantial increase in forest overall, primarily as a result of farm abandonment and fire suppression, and the proportions of softwood and hardwood have remained relatively stable, as has the composition of the major species. The diversity of species and genes in our forests, stands, ecosystems, and landscapes is very broad such that most of the capacity to adapt to future climate change already exists within our forests. Regarding the concept of borealization, the boreal forest is more dependent on climate than it is on disturbance, thus it appears that the distribution of our boreal communities may decline in the future and present associated conservation challenges.

Forest harvesting is the first stage in regeneration. NSDNR has conducted decades of research to understand the relationship between harvesting, regeneration, early stand development, tending, and growth & yield. Much of this is published in forest research reports (<https://novascotia.ca/natr/library/publications/forestry-research.asp>), and reflected in management guides. This includes an extensive regeneration survey of 5 year old clearcuts, which indicated that almost all forest stands, with the exception of pasture spruce, regenerate rapidly with high density, stocking, and tree species diversity. (<https://novascotia.ca/natr/library/forestry/reports/REPORT66.PDF>)

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

One of the ways NSDNR incorporates the need to adapt to climate change is in the design and selection of a large protected areas network. Climate change adaption values were considered, along with other ecological and social values, in the recent (2014, 2015, 2016) and upcoming protected areas expansions.

The tree improvement program that provides the seed for reforestation began 30 years ago with the selection of plus trees from across the Maritimes. In addition to growth and form traits, one of the primary objectives was to develop broad genetic diversity. These populations have been extensively tested across a broad range of climatic zones exceeding the predicted range of climate change in this

area. The data bases from these testing programs will provide a basis for assessing climatic adaptability both in these populations as well as the natural forest ecosystems from which they were collected. NSDNR has participated in a number of climate change modelling projects and will continue to raise capacity in this area. Forest Research Report 2003-4 “A discussion paper on climate change and forestry in Nova Scotia: Ecological Implications and Management Options” can be found on our publications page: <https://novascotia.ca/natr/library/forestry/reports/REPORT71.PDF>

Question 17: Has NSDNR conducted forest carbon budget modeling, 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?

NSDNR works with the CFS carbon accounting team to carryout carbon budget model (CBM) runs for NS. NSDNR provides inventory and harvest information and the actual running of the CBM model is done by CFS staff. The most recent work was completed by CFS staff in 2015 and these results are included in section 8.2 of the recently published ‘State of the Forest’ report (https://novascotia.ca/natr/forestry/reports/State_of_the_Forest_2016.pdf) .

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?

Currently, carbon sequestration specific strategies are not directly incorporated into strategic forest planning. Adaptive management may lead to incorporating specific objectives in future modeling. **NS strategic forest planning does incorporate ecosystem objectives on the working forest.** Modeling of ecosystem objectives maintain natural ranges of species mixes and age class structures that provide diversity and resilience as a form of risk mitigation for climate change.

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?

NSDNR did not model plant specific GHG emissions. NSDNR and NSE have worked with CFS carbon accounting team to extend carbon budget model (CBM) runs to a larger lifecycle analysis (LCA). The LCA looked at atmosphere carbon emissions under various primary forest product life cycle scenarios (lumber/pulp and paper/biomass). This was a CFS led project and we do not believe it has been published to date.

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 clear-cutting may increase losses associated with acid rain by as much as 50%.

Since trees contain nutrients, it is recognized that periodically harvesting them by clearcut or selection will remove nutrients, which has potential to increase nutrient deficiencies on some sites over time. NSDNR is working to integrate nutrient management into regular forest management planning so that this potential can be assessed and avoided through good planning. This is being accomplished (in part) through use of an ecologically based nutrient budget model (NBM-NS) and collection of more current soil, tree, and atmospheric chemistry data to increase confidence in model outputs. Use of this model will aid decision-making with respect to harvest levels in SW Nova Scotia and across the province.

NSDNR is also working with Dr. Paul Arp at UNB to synthesize, publish, and integrate results from the Pockwock Watershed (NS) and Hayward Brook (NB) research projects related to forest management and water quality.

NSDNR is using the latest inventory technologies, including Lidar, to produce better soils mapping and other decision support tools as part of continual improvement.

Regarding precautionary approaches, NSDNR employs a wide range of policy, analysis, research, regulation, planning, inventory, guidelines, manuals, training, and audit systems to ensure resource and environmental sustainability.

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.

Since the nutrient budget model (NBM-NS) can be applied at different scales (each with its own set of limitations and assumptions), we are currently evaluating how best to integrate the model into forest management planning and are looking at both stand and landscape level approaches. Part of this involves assessing whether sustainable Mean Annual Increment (SusMAI) estimates are best generated at an ecosite level to be used as a reference value for PTAs, or whether these should be generated within the PTA program itself (or a combination of both). We are conducting a pilot study on this using western region PTAs from 2016.

We are currently working on a new section of the DNR website to highlight Technical Reports.

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

NSDNR was a lead partner in the Pockwock – Bowater Watershed Research Project. Other partners included the Halifax Water Commission, Environment Canada, Nova Scotia Environment, University of New Brunswick, Bowater Mersey Paper, and Canadian Forest Service. Under this program 8 watersheds in the Saint Margaret's Bay ecodistrict were selected for comparative study to quantify the effects of forest harvesting on water quality and quantity with the specific goal of calibrating the UNB ForHym model to support broad scale predictions across a range of soil and ecosystem conditions. It is important to recognize that forest harvesting can have both positive and negative effects. The goal of management

is to understand the relationships and optimize the positive through good planning. Halifax Water Commission was a lead partner in this research project since they manage their watershed forests by periodic harvesting in order to maintain young, healthy forests that provide optimum water quality. The clearcut method has been preferred since they have experienced blowdown problems with both partial harvests and overmature stands.

NSDNR is a supporting partner in the recently announced research project: “forWater: NSERC Network for Forested Drinking Water Source Protection Technologies”. This is a five-year initiative with partners from Nova Scotia, British Columbia, Alberta, and Ontario. Results will provide important knowledge of forest – water interactions, and will help Nova Scotia build on the Pockwock Bowater Watershed project research results.

The Nutrient Budget Model and Soil Disturbance research will provide future guidelines to help minimize the impacts of acid rain and harvesting on site productivity.

WestFor and all forest licensees are continuously kept informed of all management directives.