A critical issue: nutrient depletion in soils of Nova Scotia's forests

Diagram and comments prepared for the Healthy Forests Coalition by
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The issue (See diagram)
A. The broad outlines of this issue have been known since the 1980s when declines in salmon on the Atlantic coast of Nova Scotia were related to acidification of surface waters, that in turn attributed to acid rain and the poor buffering capacity of the forest ecosystems, especially those developed on slates, granites and felsic bedrock.[1]

B. By the mid-2000's, it was clear that forest soils over more than 50% of Nova Scotia's land mass have unusually low buffering capacity in comparison to most other jurisdictions in eastern North America and are critically low in nutrients (notably calcium) essential for the health of both the forests and aquatic systems in many of our forested watersheds.[2]

C. 2009-2011 Nutrient modeling commissioned by the Nova Scotia Dept of Natural Resources illustrated that clearcutting increases nutrient losses substantially, thereby further threatening aquatic systems and future productivity of forests. DNR will not release the report received in 2011, citing confidentiality concerns.[3]

D. 2011 Elsewhere in eastern North America, reductions in surface water acidity and levels of toxic aluminum have been observed following reductions in sulfur emissions. However, in SW Nova Scotia in particular, waters continue to acidify and levels of toxic aluminum to increase, which is attributed to extremely low levels of calcium.[4]

E. 2016 Clearcuts continue in the most susceptible landscapes, e.g. in the St. Margaret's Bay ecodistrict, threatening both the future productivity and biodiversity of forests and the health of aquatic ecosystems.

What can we do

- Immediately ban all clearcuts in watersheds that are being severely impacted by acid rain.[5]

- Lobby the federal government to require further reductions in sulfur emissions.[6]

Notes and References

1. E.g., Watt, W.D. 1987. **A summary of the impact of acid rain on Atlantic salmon (*Salmo salar*) in Canada**. *Water Air and Soil Pollution* 35:27–35.

2. Miller, E. et al. 2007. **Mapping Forest Sensitivity to Atmospheric Acid Deposition**. Conference of New England Governors and Eastern Canadian Premiers Forest Mapping Group Report. 12pp.

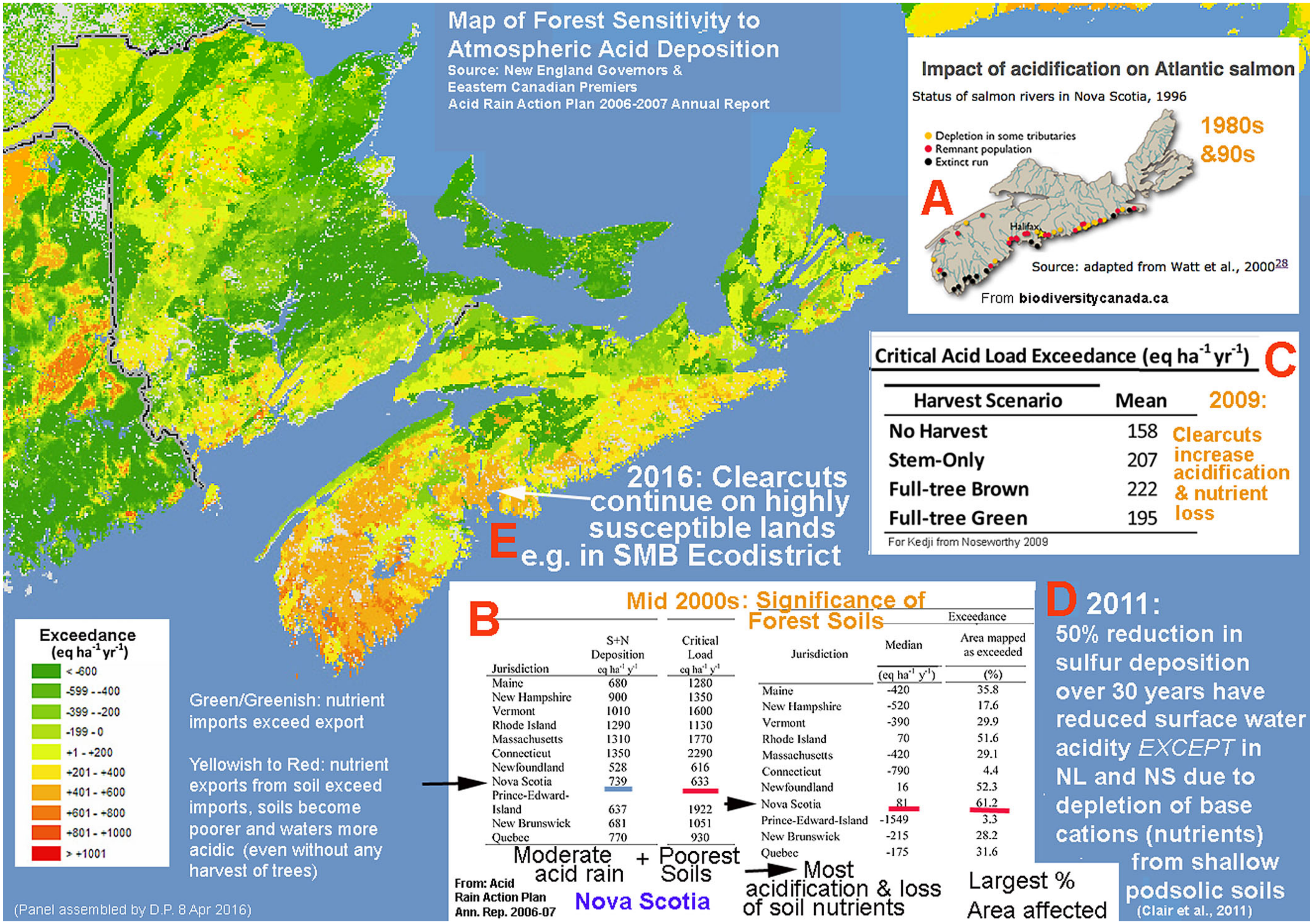
3. A DNR Slide Presentation in 2009 titled **Nova Scotia Forest Biomass Harvest and Retention Guidelines** highlighted a "soil nutrient budget computer model–a decision support model to assess site suitability for biomass harvest in NS.DNR contracting with UNB", which would be released mid-2010. The only publicly available document available to date from that study appears to be a thesis released independently by UNB: Noseworthy, J. 2011. **Mass balance, biogeochemical framework for assessing forest biomass harvest sustainability**. MSc thesis, University of New Brunswick. Data are presented only for Kejimkujik National Park "due to confidentiality concerns with Nova Scotia forest inventory data". A 2014 slide presentation by a DNR soil scientist (Kevin Keys: **Forest Nutrition Management in Nova Scotia Overview of some NSDNR research initiatives**) describes the current state of the NBM-NS (Nutrient Budget Model for Nova Scotia) which was received in 2011. The delay is said to be due to a need to "clarify, check, and update (as needed) model components." I was told by another DNR official in the fall of 2015 that it could be another 5 years before the model is ready for use.

4. Clair, T.A. et al. 2011. **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** *Canadian Journal of Fisheries and Aquatic Sciences* . 68: 663–674. Dennis, I.F. ,& T.A. Clair. 2012. **The distribution of dissolved aluminum in Atlantic salmon (*Salmo salar*) rivers of Atlantic Canada and its potential effect on aquatic populations**. *Canadian Journal of Fisheries and Aquatic Sciences* 69:1174-1183.

5. Under DNR's developing NBM-NS (cited in note 3 above), sustainability would be assessed at the stand level with "sustainability assessment… based on whether estimated primary nutrient inputs are ≥ primary nutrient outputs under each harvest scenario over the long-term, and on whether current base saturation levels have been maintained." Such a scheme would not allow harvesting of the most nutrient stressed stands which reduces risks to their future productivity. However it would, for example, allow harvesting on a nutrient rich drumlin within an otherwise highly acidic watershed which could threaten localized populations of brook trout or salmon as well as accentuate acidification of all downstream waters. Banning all clearcuts within a highly acidic watershed would be necessary to protect both future forest productivity and aquatic ecosystem health. It would also simplify the decision-making process and could be implemented immediately as the necessary information is already available for most watersheds. Such an approach would benefit from, if not require, more integration of activities related to soil and water acidification within government departments (Environment at both federal and provincial levels, NS DNR, NS Fisheries and Aquaculture) as well as with researchers at universities.

6. "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 seveal decades of natural weathering to allow base cation replenishment of soils from resistant bedrock." – Clair et. Al, 2011 (cited in note 4 above).

For more on this topic, see my letter to the Premier (2014): **Need for transparent and objective assessment of our forests' potential to meet demands for forest fibre and biomass sustainably, available** at http://wrweo.ca/wrweo2014/posts/2014/LetterWRWEOFeb12.pdf
and Jamie Simpson's ECLAW report (2015): **Forest Biomass Energy Policy in the Maritime Provinces: Accounting for Science** available at
http://www.ecelaw.ca/forest-biomass-energy-policy-in-the-maritime-provinces-accounting-for-science.html



Harvest Scenario	Mean
No Harvest	158
Stem-Only	207
Full-tree Brown	222
Full-tree Green	195

For Kedji from Noseworthy 2009

Jurisdiction	S+N Deposition eq ha-1 y-1	Critical Load eq ha-1 y-1
Maine	680	1280
New Hampshire	900	1350
Vermont	1010	1600
Rhode Island	1290	1130
Massachusetts	1310	1770
Connecticut	1350	2290
Newfoundland	528	616
Nova Scotia	739	633
Prince-Edward-Island	637	1922
New Brunswick	681	1051
Quebec	770	930

Jurisdiction	Exceedance: Median (eq ha-1 y-1)	Exceedance: Area mapped as exceeded (%)
Maine	-420	35.8
New Hampshire	-520	17.6
Vermont	-390	29.9
Rhode Island	70	51.6
Massachusetts	-420	29.1
Connecticut	-790	4.4
Newfoundland	16	52.3
Nova Scotia	81	61.2
Prince-Edward-Island	-1549	3.3
New Brunswick	-215	28.2
Quebec	-175	31.6