SCIENCEDOMAIN *international*
www.sciencedomain.org

**SDI Review Form 1.6**

## PART 1:

| | |
|---|---|
| Journal Name: | **International Journal of Plant & Soil Science** |
| Manuscript Number: | **2013_ IJPSS 4233** |
| Title of the Manuscript: | **Role of soil nitrogen for the conifers of the boreal forest: a critical review** |
| Type of the Article | **Review Paper** |

**General guideline for Peer Review process is available in this link:**
**(http://www.sciencedomain.org/page.php?id=sdi-general-editorial-policy#Peer-Review-Guideline)**

- This form has total 7 parts. Kindly note that you should use all the parts of this review form.

## SDI Review Form 1.6

**PART 2: Review Comments**

| | **Reviewer's comment** | **Author's comment** *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)* |
|---|---|---|
| **Compulsory** REVISION comments | The authors have taken on a enormous task in reviewing the nitrogen literature pertaining to forests, a topic with many hundreds of citations at least from the last couple of decades. Having worked in this area for over a decade I can appreciate the challenge in pulling all of these topics into one critical review. Each of these topics – overview of the N cycle, N uptake and nutrition, N metabolism, N deposition – could each be the subject of a critical review. I think as a consequence of including so many topics, the authors were forced to rely on some broad and perhaps traditional generalizations about boreal forests that greatly undermine the interesting details in the ecology of these systems. There | |

| | | |
|---|---|---|
| | were a few points, or hypotheses really, in section 6 about succession and N cycles that I would argue are not well supported. My advice would be to reduce the complexity of the review and focus in on a subset of topics to better cover your ideas; it is probably unwise to attempt to cover all N topics for all people.<br>Some specific comments -<br>Lines 11-16. Fire can remove hundreds of kg N per ha, whereas DON leaching is in the order of a few kg per ha. Surely wildfire deserves far more attention as an output of N. Also, in Table 1, if this is to a comprehensive review then there should be more data on estimates for biological N fixation and volatilization to match the good detail on N deposition and leaching. Estimates of biological N fixation could include alder shrubs (e.g. *Alnus viridis*), legumes (*Lupinus* spp.) and *Suillus* tuberculates; volatilization should include wildfire and managed fire (broadcast burning). | |

| | | |
|---|---|---|
| | Lines 59-62. Boreal landscapes with complex topography can have a range of N forms, including $NO_3^-$ on the most productive forest ecosystems (fine-textured fluvial terraces, toeslopes). There is probably less nitrate in boreal systems as a whole compared to temperate forests, but your comments here are an oversimplication. See<br>Giesler, R., Högberg, M., Högberg, P., 1998. Soil chemistry and plants in Fennoscandian boreal forest as exemplified by a local gradient. Ecology 79: 119-137;<br>Högberg, M.N., Myrold, D.D., Giesler, R., Högberg, P., 2006. Contrasting patterns of soil N-cycling in model ecosystems of Fennoscandian boreal forests. Oecologia 147: 96-107.;<br>Nordin, A., Högberg, P., Näsholm, T., 2001. Soil nitrogen form and plant nitrogen uptake along a boreal forest productivity gradient. Oecologia 129: 125-132; | |

| | | |
|---|---|---|
| | Kranabetter, J.M., Dawson, C. and Dunn, D. 2007. Indices of dissolved organic nitrogen, ammonium and nitrate across productivity gradients of boreal forests. Soil Biol. Biochem. 39: 3147-3158.<br>Line 54. The term 'late-successional mature boreal forests' can refer to two distinct types of ecosystem change. The species replacement illustrated in Figure 2, where deciduous shrubs give way eventually to spruce stands, has undoubtedly strong influence on N cycles because of the complete change in litter quality and microclimate. However, in the boreal forest there is also abundant areas under secondary succession, where tolerant species such as spruce and fir establish immediately after a disturbance and persist through to the next stand-replacing event. In this scenario there might be pioneer shrubs and tree species in the mix but they drop out over time rather than initially dominate and be replaced. | |

| | | |
|---|---|---|
| | This latter form of succession is probably most common, and I would think the authors might consider both pathways in describing N dymanics of late-successional stands as they probably differ substantially. In addition to trees, there is the fundamental role of carpet mosses in boreal forests, and the authors might want to describe how the establishment of mosses during forest succession could influence N dynamics – e.g., Nilsson and Wardle 2005. Understory vegetation as a forest ecosystem driver: evidence from the northern Swedish boreal forest. Frontiers in Ecology and the Environment 3: 421–428.<br>Line 61. A good reference on forest disturbance and N for the boreal would be<br>Jerabkova L, Prescott CE, Titus BD, Hope GD, Walters MB, 2011. A meta-analysis of the effects of clearcut and variable-retention harvesting on soil nitrogen fluxes in boreal and temperate forests. *Canadian* | |

| | | |
|---|---|---|
| | *Journal of Forest Research* 4: 1852-1870. Some of these numbers could be added to Table 2.<br>Line 63. A recent paper on this point LeDuc SD, Rothstein DE. 2010. Plant-available organic and mineral nitrogen shift in dominance with forest stand age. Ecology 91:708-720. Probably the only paper I know of that makes this point, certainly more studies are needed to substantiate this is a universal pattern.<br>Line 76. The 'great losses' of $NO_3^-$ is followed by the comment that 'high $NO_3^-$ losses are rare or limited' – seems contradictory. Again, in line 81, the dramatic losses in site N through fire is left almost as an afterthought, which makes no sense to me when you consider the actual values of N in flux between these processes.<br>Lines 549-561. This sweeping generalization needs a more critical discussion as mentioned previously. I just find this dismissal of $NO_3^-$ hard | |

| | | |
|---|---|---|
| | to accept, surely rich fluvial boreal ecosystems with productive spruce stands are exploiting nitrate as a N source.<br>Line 563-589. Another potential issue with controlled studies is that the role of ectomycorrhizal is largely generic, with no ability to control the assemblage of fungal species on a root system. There is a considerable diversity in functional attributes among ectomycorrhizal species (Chalot, M., and Passard, C. 2011. Ectomycorrhiza and nitrogen provision to the host tree. In Ecological Aspects of Nitrogen Metabolism in Plants. 1st Edition. Eds J.C. Polacco and C.D. Todd. John Wiley & Sons), and it may be argued that the species composition of ectomycorrhiza facilitate uptake of whatever predominant form of N is available in soils.<br>Line 641. A recent publication on this point could be helpful<br>Coates, K.D., Lilles, E.B., and Astrup, R. 2013. Competitive interactions across a soil fertility gradient in a multispecies forest. Journal of Ecology.<br>Line 685, 691. In my opinion there is not much evidence to substantiate these comments. The vast number of silvicultural studies have reported a short-term assart flush of N followed by little to no mid- to long-term effects of clearcutting (Jerabkova et al. 2011), making it hard to contend that late-seral stands are fundamentally poorer in | |

| | | |
|---|---|---|
| | N availability. See also Smithwick et al. 2009 Long-term nitrogen storage and soil nitrogen availability in post-fire lodgepole pine ecosystems. Ecosystems 12:792-806 for a thoughtful discussion on long-trends in N availability. Furthermore, the supposed difference in decomposition rates of old-growth stands has not held up to scrutiny – Prescott C 2005. Do rates of litter decomposition tells us anything we really need to know? Forest Ecology and Management 220: 66-74. The effect of 'time' in all these studies is so minute that it is unlikely the literature would support early or late-seral conifers utilizing predominantly different forms of N. There is also the point made earlier concerning secondary succession, and the authors should recognize that the majority of boreal forests undergo adjustments in species composition over time, not complete species replacement.<br>Line 706. Although the author's hypothesis on N as a successional driver is an interesting idea, any of these arguments has to recognize and accomodate the well established role of light in forest succession (see for example Messier et al. 1999. Functional ecology of advance regeneration in relation to light in boreal | |

| | | |
|---|---|---|
| | forests. Can J For Res 29 812-823). It seems well established that shade-tolerant species (fir, spruce) can compete or regenerate well in low light conditions (either under a forest canopy or interspecific competition) and eventually outlive or replace the shade-intolerant species (pine, aspen). In addition to Coates et al. 2013, another paper that explores the interaction of light and soil fertility is Lilles and Astrup 2012. Multiple resource limitation and ontogeny combined: a growth rate comparison of three co-occurring conifers. Can J For Res 42: 99-110. | |
| **Minor** REVISION comments | | |
| **Optional/General** comments | | |

**Note: Anonymous Reviewer**