Biogeosciences
Discussions

Interactive comment on "Dispersal distances and migration rates at the arctic treeline in Siberia – a genetic and simulation based study" *by* Stefan Kruse et al.

Anonymous Referee #3

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This study presents seed dispersal improvements made to the LAVESI individual-based, spatially explicit vegetation simulator to investigate larch migration rates on the Taymyr Peninsula in Northern Siberia. The seed dispersal equation updates were based on a field-based study of genetic parentage of trees in the study area, which found that prior to improvement, the model tended to underestimate dispersal distances in general and overestimate the numbers of recruits close to the parent tree. The updated model was used to simulate south-to-north transects and the rate of tree line advance was found to differ from the rate of forest line advance by ∼1m per year. The study is well-structured and presented, and it addresses an important and poorly understood topic related to environmental change in the region. However, two key

points that I think need to be clarified or addressed are topographic gradients and mortality. Microsite effects brought on by topographic variation seem to not be considered here, though they are an important consideration in a study measuring the rate and manner of treeline advancement. In addition, there is no discussion of mortality rates, both in seedlings and seeds. Seedling dispersal and seed/ling mortality are tightly interconnected and should be at least discussed if not reported. Overall however, this manuscript should be accepted with some of these modifications addressed.

Here are some other comments/questions/edits: âĂć What makes LAVESI a spatially explicit model? It would be good if the authors could explain this in a few sentences. Even though the model has been previously published, it helps orient the reader to explain the model and what makes the model unique. âĂć This parameterization as well as the improvements made to LAVESI concerning seed dispersal rates and distances were made based on data collected over a 100m x 100m plot. The size of this plot is quite small to base landscape scale conclusions on. The disadvantages of this plot size are not well discussed in the discussion. âĂć What about topography? Topography is not mentioned and is a very important feature with respect to treeline advancement, seed dispersal rates/distances and seed viability. Microsite climate effects caused by topography are also not addressed. These too are very important to consider here. âĂć The methods surrounding how the needle genotyping (2.2) was used to infer microsatellite data (2.3), and was then used to update seed disperal rates and distances in LAVESI are very confusing. It is unclear what was simulated and how, versus what was measured in the field. For ex., line 108, "We simulated the heritage for 10,000 seeds. . ." How was this simulated? With LAVESI? With a statistical model? With CERVUS 3.0.7? These sections are very confusingly written, readers would not be able to use them to reproduce your study. Please explain more clearly the steps that were taken to go from needle collection to LAVESI updates. âĂć Lines 19-24: The writing is not clear whether the comparison was done before the model code updates or if the model was run on transects to address the shortcoming. âĂć Section 2.4.1: The model though published elsewhere should be explained in a few more sentences

here. Why is it considered spatially explicit? What does that mean for this study in particular? How were the listed updates implemented? âĂć Line 169: "Simulated" is more colloquial terminology than "hypothetical" âĂć Lines 190, 195-196: Are these two different results? What is the difference between "pairs of larch individuals" and "two individuals within a clonal group"? âĂć Line 237: Overemphasize is misspelled âĂć Lines 322-332: Were these other study's all simulated or field-based results?

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