



## Integrating variable traits and inheritance into the individual-based model LAVESI for evaluation of their importance for larch forest performance under future adverse conditions

Josias Gloy, Stefan Kruse, and Ulrike Herzschuh

Alfred-Wegener-Institut, Geosciences | Polar Terrestrial Environmental Systems, Potsdam, Germany

With changing climate boreal forest need to shift their distribution further north and become threatened by droughts in the south. However, whether boreal forest species can adapt to novel situations and reduce their extinction risk is largely unknown but crucial to predict future performance of populations. Exploring variable traits and ultimately trait inheritance in an individual-based model could improve our understanding and help future projections.

Hence, we updated the individual-based spatially explicit vegetation model LAVESI to allow for variation in traits values that are normally distributed and the option of determining the trait values based on the parental values, thus allowing full inheritance.

Using historical climate data and future projections, we ran simulation experiments of *Larix gmelinii* stands in the two areas of interest, the northern treeline expanding due to increasing temperatures, and the southern area experiencing increased drought. At these regions, the trait of 'seed weight' regulate migration further north and the 'drought resistance' protecting stands in the south, a comparison of the model variants: uniform, variable and inherited traits is being performed.

The results will be presented and will allow to disentangle how far migration rate and survival rate are influenced by this. In preliminary tests, it was already shown that both the allowing trait variation and inheritance led to an increase in migration rate, with the latter having a stronger impact. Similarly, the early tests for the drought resistance show that in changing temperatures leading to droughts the trait variation allows for adaption and leads to better surviving populations.

We expect that variable traits ensure that if the environment changes necessary trait variants are available. Inheritance could let the populations adapt to environments and promote successful trait values and therefore lead to more optimised populations, that are able to spread faster and

be as resilient as needed.

With this, we show that implementing trait variation and inheritance may contribute to creating more accurately predicting models and understanding responses of boreal forests to global change.