# Testing options for adaptive forest seed sourcing under climate change using individual based models

Richard Whittet*[1,2], Daniel Chapman[2], Stephen Cavers[2], Joan Cottrell[3], and Richard Ennos[1]

[1]Institute of Evolutionary Biology, University of Edinburgh – Ashworth Laboratories, Charlotte Auerbach Road, Edinburgh, United Kingdom
[2]Centre for Ecology and Hydrology (CEH) – Bush Estate, Penicuik, Midlothian, United Kingdom
[3]Forest Research – Northern Research Station, Roslin, Midlothian, United Kingdom

**Abstract**

Seed sourcing policies and practices for creation and restoration of forests have historically been based on the assumption that climatic conditions are stable in the long term. Many tree species show evidence of local adaptation for a range of phenotypic traits and for this reason, a long-held view is that sourcing seed from similar environments to the planting site will offer the greatest chances of survival and tolerance of local conditions.
With increasing recognition of rapid environmental change, the capacity for local genotypes to adapt quickly enough has been called into question and as such, opportunities to deploy seed collected from populations which already experience conditions expected for the planting site in the future should be taken to help 'pre-adapt' newly established forests to warmer and drier conditions.

To investigate factors affecting the relative merits of these strategies, we have developed a multi-patch, individual-based allelic model. We simulate the early survival and adaptive responses of tree populations to climate change planted either with currently adapted local seed, seed collected from currently warmer populations, mixtures of the two or seed sampled randomly from the entire species distribution.

Results indicate that where tree populations are locally adapted and early survival depends on their phenotype, there are demographic risks associated with using seed which is not currently adapted, suggesting that attention must be paid to short term trends as well as those anticipated in the long term.

**Keywords:** climate change adaptation, forests, individual, based model, assisted migration, seed origin

*Speaker