Estimating current and future bioclimatic suitability of alien tree species *Ailanthus altissima* on tree-related land cover types in Europe

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Ailanthus altissima (Mill.) Swingle is a rapidly spreading invasive alien tree in Europe (Sladonja et al. 2015), threatening biodiversity across multiple land cover types. Spreading from urban environments into seminatural vegetation (Pergl 2017), it poses an increasing threat to forested areas. This pathway raises an important question: under climate change, which tree-related land cover types are most exposed to suitable bioclimatic conditions, and how will this threat develop over time?

We modelled the current and future Bioclimatic Suitability (BS) of *Ailanthus altissima* across Europe using MaxEnt (Phillips et al. 2006), trained on 23,997 GBIF occurrence records and five bioclimatic variables. Winter temperature was the dominant predictor (94.31%). Models were stratified by forest-related CORINE Land Cover classes.

Artificial non-agricultural vegetated areas (CLC 14) showed the highest BS, representing key dispersal sources. Forests (CLC 31) showed the widest variability (SD = 0.231), reflecting the diversity of European biomes. Under SSP5-8.5, the pan-European mean deviation for CLC 31 increases by +0.338 by 2100, the largest shift among tree-related classes. The emission pathway has the strongest impact in Atlantic and Boreal regions, where forests are currently below the bioclimatic suitability threshold but are projected to exceed it by 2100. Continental and Pannonian forests already exceed threshold, while Mediterranean landscapes are already at maximum suitability.

These findings call for land-cover-specific management strategies. BS models can inform invasion impact assessments (El-Khalafy et al. 2025) and support integration of invasive species risk into forest management and climate adaptation policy.

References

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