Modelling landscape connectivity in an aquatic invasive frog

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Abstract

Connectivity models are widely used to locate corridors for species of conservation interest and give recommendations for management actions. However, these models are also useful tools for invasion biology, especially in case of large-scale invasive populations for which eradication cannot be achieved. Identifying the main dispersal corridors of an invasive population may help to predict its future spread and test efficacy of different management strategies based on containment or local extirpation. Here, we build a connectivity model around the largest invasive population of the African clawed frog *Xenopus laevis* in France. This species is considered "principally aquatic", spending most of its life in water but adopting overland locomotion to disperse. The invaded area, estimated through trapping effort, eDNA surveys and opportunistic observations, is about 4300 km2 and extends across four departments in western France. We used IGN data and multispectral remote sensing images captured by Spot6/7 satellites to classify the invaded landscape into discrete land cover types (such as forest, bare soil and pastures). Then, we performed laboratory and field experiments on juveniles and adults of *X. laevis* to investigate species-specific behavioural and physiological responses to each land cover type. Empirically derived resistance surfaces were thus obtained by integrating the classified landscape with experimental data to depict functional connectivity between water bodies. A connectivity model was built using the Python-based tool UNICOR, which combines the obtained surfaces with a grid-based resistance kernel. The model visualizes dispersal pathways, identifies areas with high risk of invasion and tests efficacy of some proposed management strategies such as the removal of invasive individuals from invasion hubs, biodiversity hotspots and riparian zones. The output of the model is also used to estimate to what extent the main dispersal corridors of the species overlap with zones of maximum ecological potential/high ecological status across the invaded area.

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