Reserve selection in a dynamic habitat patch network

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Keywords: indicators of biodiversity, metapopulation dynamics, spatial ecology, species distribution models

Abstract: A noticeable fraction of the World's species inhabit disturbed or early-successional habitats. Reserve selection for these species is challenging due to the temporary nature of their habitats and the resulting lack of a stable habitat patch network. Reserve selection tools have mostly been designed assuming static habitat configuration or a deterministic shift of habitats towards the poles due to climate change.

The false heath fritillary, an endangered Finnish butterfly, inhabits moist *Valeriana sambucifolia* meadows that emerge in disturbed or abandoned sites and have a high destruction rate due to succession and land use changes. We prioritized a set of potential conservation sites for the false heath fritillary with respect to the anticipated temporal instability of the species' habitat patch network. We estimated patch destruction rates based on the present condition of 96 sites that had been delineated as false heath fritillary habitat in the past. Next, we identified areas with high likelihood of patch emergence (right soil type and hydrology) by carrying out habitat suitability modelling based on the present locations of habitat patches. Finally, we run repeated simulations of habitat network change and evaluated relative patch values of the candidate conservation sites to the metapopulation capacities of the resulting networks.

False heath fritillary habitat locations can be predicted with topographic wetness index, distance to rivers and fields, land use intensity and calcareous soil type. The model of habitat network change helped us to identify conservation sites that would remain in spatially valuable locations of the habitat network in the course of time and could thus serve as source patches for a dynamic metapopulation. Our method can be generally used in the reserve selection for species living in dynamic habitats.