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Optimal spatiotemporal control of Ailanthus altissima (Mill.) Swingle in the Alta Murgia National Park

(joint work with Baker CM[2,3], Blonda P[4], Casella F[5], Diele F[1], Marangi C[1], Ragni S[6], Tarantino C[4])

Abstract

The threat, impact and management problems associated with alien plant invasions are increasingly becoming a major issue in environmental conservation. Invasive species cause significant damages, and high associated costs. Controlling them cost-effectively is an ongoing challenge, and mathematical models and optimizations are becoming increasingly popular as a tool to assist managers. The aim of this study is to develop a modelling approach for the optimal spatiotemporal control of invasive species in natural protected areas of high conservation value. Typically, control programs are either distributed uniformly across an area, or applied with a given fixed intensity, although there is no guarantee that such a strategy would be cost-effective at the conservation asset. The proposed approach, based on diffusion equations, is spatially explicit, and includes a functional response (Holling type II) which models the control rate as a function of the invasive species density.

We apply a budget constraint to the control program and search for the optimal effort allocation for the minimisation of the invasive species density. Remote sensing derived input layers and expert knowledge have been assimilated in the model to estimate the initial species distribution and its habitat suitability, empirically extracted by a land cover map of the study area. Both the initial density map and the land cover map have been generated by using very high resolution satellite images and validated by means of ground truth data. The approach has been applied to the Alta Murgia National Park, where the EU *LIFE Alta Murgia* Project is underway with the aim to eradicate *Ailanthus altissima*, one of the most invasive alien plant species in Europe. The Alta Murgia National Park is one of the study site of the on-going H2020 project *ECOPOTENTIAL* which aims at the integration of modelling tools and Earth Observations for a sustainable management of protected areas.

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