From Scenarios over Models to Management — Alien Spread Management: A Case Study from the Western Cape, South Africa

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Abstract

In science and policy and its interface, simulation- and scenario-based approaches have been proven useful in understanding complex systems and their response to changing input parameters. For example, climate change models and scenarios developed by the ICPP yield reproducible and transparent results that have been used to guide policy development and implementation on the global and national scale.

Apart from these large scale applications, this approach is also of high value at the smaller regional scale (< 300.000ha). Here, policy (funding priorities and levels), conservation management (what and how much to spend where on conservation) and science (complex simulation- and scenario-based approach) can interact to guide the motivation for funding as well as the allocation of funds to removal of invasive alien plants.

The tool we present here uses

1. budget scenarios, i.e. amount of funding per area unit, and
2. management scenarios, i.e. prioritization strategies to prioritize areas for invasive alien plant clearing,

as input parameter for a spatially explicit simulation model (SpreadSim) to

1. predict the cover of major woody invasive alien plants (acacias, pines and hakeas) over time (30 years) at a regional scale (< 300.000ha) in the Fynbos biome (South Africa) and
2. to demonstrate and assess the impact of different management and budget scenarios on the area under alien cover

The model incorporates spatial and non-spatial scenarios and information, fire and invasive plant spread simulation as well as costs of clearing and budgets. It is a stochastic rule based simulation model build in R, using GRASS for spatial data storage and processing as well as C++.

Simulations were run over 30 years, during which one prioritization strategy was used, and

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the amount of area cleared per year was constrained by financial resources. By using different input scenarios, we demonstrated their impacts and interactions on the area under alien cover.

These simulations enable a transparent and reproducible motivation for appropriate funding, and at the same time provide a tool to develop and optimize management scenarios within a particular budget scenario to maximize the efficiency of IAP management. The Spread-Sim model is designed in such a way that it can feed into other ecosystem service models, therefore allowing to quantify the impact of different management and budget scenarios on different ecosystem services (water yield, carbon sequestration, ...).

In this talk, I will give an overview over the whole study, including

1. the development of the scenarios, budget as well as management / prioritization
2. the model itself
3. some selected results
4. possible further steps to make this system available to conservation agencies and policy makers