Negotiation-support toolkit for learning landscapes

Editors
MEINE VAN NOORDWIJK
BETHA LUSIANA
BERIA LEIMONA
SONYA DEWI
DIAH WULANDARI

WORLD AGROFORESTRY CENTRE
Southeast Asia Regional Program

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35 | Ecological corridors (ECor): a distributed population model with gender specificity

Meine van Noordwijk, Rachmat Mulia and Sonya Dewi

To counteract the effect of habitat fragmentation, the concept of restoring ecological corridors is popular in conservation circles. The expected effectiveness of such corridors depends strongly on the dispersal characteristics, which for species such as orangutan are strongly dependent on gender. A distributed population model allows ex ante impact predictions of various corridor designs.

Introduction

Habitat fragmentation is a major cause of loss of biodiversity, as populations of plants and animals may get too small to survive and recover from the shocks that tend to occur with climate variability and other stress factors. Reconnecting remaining small habitat fragments through 'ecological corridors' through which plants and animals can disperse is a response to the fragmentation challenge. However, the effectiveness of such corridors must be weighed against the costs and alternative uses of conservation funds so an ex ante impact predictor is needed. We found that existing tools did not handle gender-specific dispersal yet male and female individuals of a species such as orangutan have very different dispersal distances.

The ECor model MetPop001 was developed by the Ecological Modeling Unit of the World Agroforestry Centre Southeast Asia Regional Program in September 2010 to provide options to analyze ecological connectivity in landscape mosaics, as the next step in dynamic land-use-change models such as FALLOW. This is a beta version of a landscape mosaic and corridor meta-population model. It is based on simple principles of population dynamics in a number of separate populations that are linked through dispersal. The default application is for orangutan (OU) population dynamics in a small forest patch with or without active corridors to a 'stable reservoir' population in a large protected area. Other species can be added to the database and then evaluated. The model is initially described for discrete (default: yearly) time steps and a continuous variable population density rather than discrete individual counts.

Meta-populations can be described through local birth rates and mortality plus an annual transfer coefficient matrix. Corridors can play a significant role through the transfer coefficient matrix even if their mortality exceeds birth rates. Within the confines of this model, habitat quality can be translated into a carrying capacity concept, capping off local population increase. Connectivity with corridors implies both gains and losses and the net effects depend on access to (relatively) large source areas. For an organism such as orangutan, the dispersal behavior differs between males and females and this affects corridor effectiveness. The following life-history traits have to be provided as parameters

to the model: sex ratio at birth, average inter-birth interval, litter size, juvenile mortality multiplier, pre-productive years, adult annual mortality rate (%/year), male dispersal and female dispersal. These jointly determine the natural increment rate feasible for the population in the absence of disturbance.

Objectives

Objective of the model is to allow details of life history at species level, including male and female dispersal traits, to be related to a land-use mosaic with time-dependent habitat types to explore effects on sub- and total population size. The tool can be used to explore the likely effectiveness of alternative ecological corridor designs.

Steps

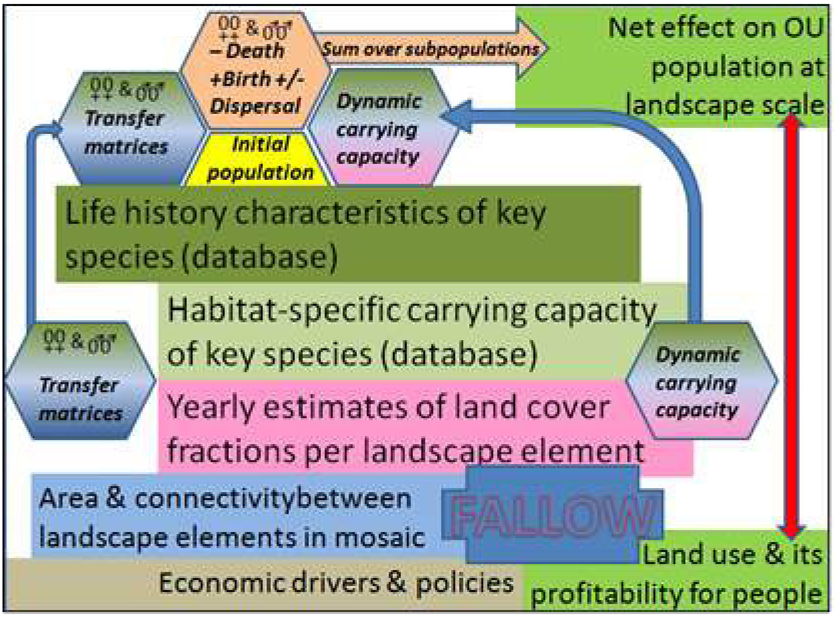

Figure 35.1. Logical flow of the MetaPop model

Case study: ECor in Indonesia

In line with broader efforts to restore ecological connectivity in landscape mosaics, the potential relevance of restoring connections between the habitats of (sub-) populations of Sumatran orangutan is expected to support survival of the species. One of the last chances to do so may be in the Tripa swamp where a (sub-) population of over 100 individuals has become separated from the main population in the Gunung Leuser National Park as a result of the conversion of peat swamp-forest into oil-palm plantations. While there may be opportunities to use funding mechanisms linked to the United Nations-mandated mechanism for Reducing Emissions from Deforestation and Degradation plus conservation (REDD+) for both protecting remaining forest and restoring

(ecologically) the surrounding landscape, the effectiveness of such efforts on orangutan survival forms a key argument for seeking broader investment beyond the issues of avoided carbon-dioxide emissions and net carbon sequestration. The expected functionality of landscape corridors must be weighed against their costs and local acceptability.

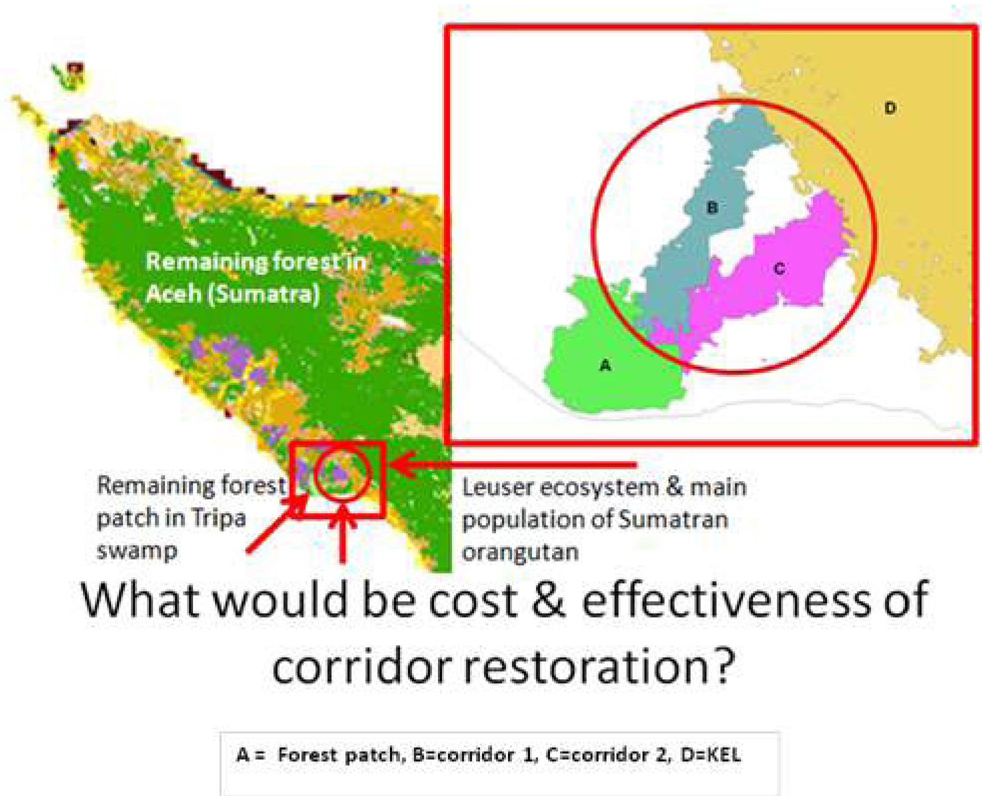

Figure 35.2. The model explored potential corridors B and C, singly or in combination, between forest remnant A and the national park

Key references

Tata MH, van Noordwijk M, Mulyoutami E, Rahayu S, Widayati A, Mulia R. 2010. *Human livelihoods, ecosystem services and the habitat of the Sumatran orangutan: rapid assessment in Batang Toru and Tripa.* Project Report. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.

Download ECor: http://www.worldagroforestry.org/sea/files/MetaPop001BV.zip.

The landscape scale is a meeting point for bottom–up local initiatives to secure and improve livelihoods from agriculture, agroforestry and forest management, and top–down concerns and incentives related to planetary boundaries to human resource use.

Sustainable development goals require a substantial change of direction from the past when economic growth was usually accompanied by environmental degradation, with the increase of atmospheric greenhouse gasses as a symptom, but also as an issue that needs to be managed as such.

In landscapes around the world, active learning takes place with experiments that involve changes in technology, farming systems, value chains, livelihoods' strategies and institutions. An overarching hypothesis that is being tested is:

> Investment in institutionalising rewards for the environmental services that are provided by multifunctional landscapes with trees is a cost-effective and fair way to reduce vulnerability of rural livelihoods to climate change and to avoid larger costs of specific 'adaptation' while enhancing carbon stocks in the landscape.

Such changes can't come overnight. A complex process of negotiations among stakeholders is usually needed. The divergence of knowledge and claims to knowledge is a major hurdle in the negotiation process.

The collection of tools—methods, approaches and computer models—presented here was shaped by over a decade of involvement in supporting such negotiations in landscapes where a lot is at stake. The tools are meant to support further learning and effectively sharing experience towards smarter landscape management.

World Agroforestry Centre
ASB Partnership for the Tropical Forest Margins
AARD
Federal Ministry for Economic Cooperation and Development
Norad
IFAD Enabling poor rural people to overcome poverty
CGIAR Research Program on Forests, Trees, and Agroforestry