Optimizing corridor placement using simulated annealing

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how many different chapter ones will i have hmmm

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1 Introduction

Human activity has rapidly reshaped the face of Earth's surface, leaving fragments of patchy habitat. Although there is no shortage of debate as to the effects of fragmentation *per se* on biodiversity and ecosystem function (**cite?**), it is generally accepted that the combination of habitat and ensuing subdivision produce negative outcomes for ecosystem function and services (**resasco?** review).

In order to mitigate the consequences of landscape change on ecosystems, developing landscape *corridors* has seen much attention in the last several decades. Bit more evidence for corridors here. But still, the spatter of fragments in a landscape, where should ecologists choose to use their limit resources to build a corridor?

Here we propose to answer that question by proposing an algorithm to estimate the landscape modification that results in optimizing a specific ecosystem process (in this paper maximizing the time until extinction of a metapopulation, although the algorithm and associated software can be generally applied to any process-based model with a quantifiable target state).

Although algorithms have been proposed for this (**peterman?** etc), they are focused on finding the where the paths of least existance for a given species is given data on that species dispersal.

2 An algorithm for optimizing corridor placement

2.1. Simulated annealing to explore the space of landscape modifications Start with some definitions and notation.

The set of possible landscape modifications, $\mathbb{M}$. The transition probability function, q, which gives the probability of moving from one modification $i \in \mathbb{M}$ to a new proposed state $j \in \mathbb{M}$, as a function of a chains temperature.

Here we define $q(i,j)$ using a logistic function,

$$q(i,j,\alpha) = \frac{1}{1+e^{\alpha(s(j)-s(i))}}$$

$s(i)$ is the function that gives the score of a proposed modification. Here, the mean time to extinction.

Simulated annealing can be written described as the following.

A markov-chain, denoted π_α

Figure 1: concept fig

2.2. Process-based optimization Here we use occupancy dynamics as the process, although we emphasize that this method works for arbitraty process models and is instead limited only by the computational demands of a given process model.

Figure 2: MTE versus epoch fig: shows the chains move toward higher extinction times over time, i.e. it works.

3 Simulation of data for testing the algorithm

3.1. Simulation of occupancy dynamics

3.2. Simulation of landscapes

3.2.1 Generation of landcover maps

3.2.2 Generation of points

3.2.3 Resistance values assigned to each land cover type

Some type of performance fig vs. raster size and budget figure

4 Actual data st. lawrence lowlands

5 Discussion