Background
Background

Map

Konstantina

Legend

0 5 10 15 20
Kilometres

Contains public sector information under the Open Government Licence V2.0.

TOWARDS MODELLING FUNCTIONAL CONNECTIVITY AT THE GLOBAL SCALE
What can be done?

Interventions can make a difference.
Landscape scale

Practical interventions based on detailed modelling can lack wider context
National/transnational scale

Planning for protected areas typically relies on simple measures to ensure connectivity

Increasing boundary length modifier in reserve selection
National to global scale

Policy-relevant indicators use characteristics of a few focal species

E.g. dispersal distances with a protected area network
National to global scale

...or they include only a few species

One of ~30 species
What is missing?

*Functional* connectivity modelling with a *representative* sample of species at a *scale* relevant to global indicators
Where to start?

Many options...

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study area</td>
<td>What level was the study conducted? (continental, transnational, national, regional, local)?</td>
</tr>
<tr>
<td>Continent</td>
<td>What continent was it conducted?</td>
</tr>
<tr>
<td>Country</td>
<td>In what country was it conducted?</td>
</tr>
<tr>
<td>Location</td>
<td>In what location was it done?</td>
</tr>
<tr>
<td>Area (Km²)</td>
<td>How large was the area in Km²?</td>
</tr>
<tr>
<td>Pixel resolution</td>
<td>What was the resolution used (m)?</td>
</tr>
<tr>
<td>What, Why</td>
<td>Research objectives</td>
</tr>
<tr>
<td>Environment</td>
<td>What was the type of environment where it was conducted (terrestrial, marine, freshwater)?</td>
</tr>
<tr>
<td>Species</td>
<td>Which species was utilized?</td>
</tr>
<tr>
<td>Tax group/CLASS/ORDER/GENUS/FAMILY/ORDER</td>
<td>What species were utilized, what order?</td>
</tr>
<tr>
<td>Focal species</td>
<td>What focal species were utilized?</td>
</tr>
<tr>
<td>Type of information</td>
<td>What type of information about the local species was used?</td>
</tr>
<tr>
<td>Conservation objective</td>
<td>What conservation objective was proposed?</td>
</tr>
<tr>
<td>Connectivity study methods</td>
<td>How were connectivity studies were used?</td>
</tr>
<tr>
<td>Analytic approaches</td>
<td>What was used to calculate connectivity metric?</td>
</tr>
<tr>
<td>Expert opinion</td>
<td>Was expert opinion used?</td>
</tr>
<tr>
<td>Use of GE</td>
<td>What specific programs were used for connectivity studies?</td>
</tr>
<tr>
<td>MIN/MAX</td>
<td>Presence of habitat suitability models Habitat or habitat quality</td>
</tr>
<tr>
<td>Tools</td>
<td>Were tests pathfinder or current flows used?</td>
</tr>
<tr>
<td>Description</td>
<td>Brief description of how connectivity was analyzed</td>
</tr>
</tbody>
</table>
What are you measuring?

Habitat availability - a well established graph theory metric

Most commonly used tool
Who can help?

Putting together a team
Subject and scale

Forest bird habitat in Africa
Specifics

Modelled dispersal distances based on allometric relationships
Specifics

Species range data for ~1200 species
Specifics

Measuring distances between patches - Euclidean Vs Circuit theory
Specifics

Habitat availability metrics – probability of connectivity (PC)

\[ PC = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} a_i a_j p_{ij}^*}{A_L^2} = \frac{PC_{num}}{A_L^2} \]

See [www.conefor.org](http://www.conefor.org) for details
Specifics

Habitat availability metrics – equivalent connected area (ECA)

\[ ECA = \sqrt{PCnum} = \sqrt{\sum_{i=1}^{n} \sum_{j=1}^{n} a_i \cdot a_j \cdot p_{ij}^*} \]

See [www.conefor.org](http://www.conefor.org) for details
Challenges

Number of habitat patches – a non-linear problem

\[ y = 4E-06x^2 - 0.0025x + 0.1854 \]
\[ R^2 = 0.9599 \]
Solutions

**We used:**

- patch aggregation
- ecoregion by ecoregion
- focus on West Africa
- high performance cluster
Results

Study area
Results

Change in patch importance (example output only)
All species (>600 sp.)

Equivalent connected area decreases more than total habitat area
Threatened species (18 sp.)

Species specific changes
Conclusions

Novel framework based on modelling hundreds of species and relevant to policy, species management and conservation planning.