MAPPING WITH SPATIAL REGIONS FOR IMPROVED ECOSYSTEM MODELS

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Nature is complex

Biotope
- e.g. oak forest

Ecotope
- 80% tree cover

Ecotope
- 90% tree

Ecotope
- 100% open

Ecotope
- Edge shrubs

Habitat for bats

Reproduction

Food
Models simplify

Spatial objects
- Categorical description
- Well defined boundaries

Spatial regions
- Arbitrary boundaries
- Quantitative description

Field
- No boundaries
- Quantitative variables
Land cover needs context

2-m pixels
93% OA
« Historical » use of grids for matching inventories

- Black swift (*Apus apus*)
- Yellowhammer (*Emberiza citrinella*)
- Common chaffinch (*Fringilla coelebs*)
- Western yellow wagtail (*Motacilla flava*)
Relief draws landscapes
Land cover proportions inside landscape polygons

Automated segmentation

Pixel-based classification (2 m)
enriched with 100+ variables

<table>
<thead>
<tr>
<th>From remote sensing</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land cover proportions</td>
<td>Soil parameters</td>
</tr>
<tr>
<td>Height</td>
<td>Specific ecological value</td>
</tr>
<tr>
<td>Topography</td>
<td>Protected areas</td>
</tr>
<tr>
<td>Light pollution</td>
<td>Climate</td>
</tr>
<tr>
<td>Snow and vegetation phenology metrics</td>
<td>Distance to water, roads, settlements...</td>
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</tbody>
</table>
Good results on biotope models

Relative contribution of topography

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>0.5</th>
<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td>Matches</td>
<td>17</td>
<td>60</td>
<td>87</td>
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<tr>
<td>GAM OA_Tot</td>
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<td>99.8</td>
<td>99.9</td>
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<td>GAM OA</td>
<td>96.1</td>
<td>95.7</td>
<td>97.3</td>
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<td>GAM AUC</td>
<td>81.4</td>
<td>95.6</td>
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<tr>
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<td>93.1</td>
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<tr>
<td>GAM UA</td>
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<td>21.9</td>
<td>37.2</td>
<td>22.5</td>
</tr>
</tbody>
</table>

(same ranking with Random Forest)

Accuracy indices taking area of spatial regions into account

Red: identified spatial regions
Green: field inventory

Radoux et al, 2019, Remote Sensing
Shape and size tested for habitats

Butterflies
- A. iris
- B. aquilonaris
- B. eunomia
- B. selene
- E. aethiops
- L. helle
- N. quercus

Birds
- C. nigra
- C. circlus
- C. canorus

Amphibians
- S. salamandra

Reptiles
- C. austriae

Mammals
- M. meles
Shape is important for conservation

Geographic objects

Regular grid

Irregular polygons better than regular grid for 8 out of 13 species

Delangre et al, 2017, Ecological Informatics
Conclusion

Spatial support is of paramount importance

Topography positively contributes to spatial region homogeneity

Quantitative parameters facilitate model making
uclouvain.be/lifewatch to test « for real »
Also supporting data distribution and ecosystem dynamics

Science Advances

Saigas on the brink: Multidisciplinary analysis of the factors influencing mass mortality events