Design and implementation of a monitoring scheme to assess habitat quality of European protected habitats in Flanders (Belgium)

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Introduction
Introduction

- European **Habitat Directive** and **Bird directive**
  - Maintain and restore protected habitats and species
  - Network of protected sites = Natura 2000 – network
  - List of protected habitats ≈ Natura 2000 – habitats
Introduction
Introduction

- 4.8% of Flanders is covered by Natura 2000 habitat (66000 hectares)
- 47 habitat types
Introduction

- 12.3% of Flanders is covered by Natura 2000 network (166,000 ha)
  - SAC (Habitat directive): 105,000 ha
  - SPA (Bird directive): 98,000 ha
Introduction

- EU member states have to report every 6 years on conservation status of Natura 2000 – Habitats
  - Range
  - Area
  - Habitat quality (Structure and functions)
  - Pressures and threats

- INBO is responsible for monitoring Natura 2000 habitats in Flanders (=~ Atlantic region of Belgium)
  - Habitat mapping → area and range
  - Monitoring scheme → habitat quality
Monitoring scheme habitat quality
What do we need to measure?

**Information needs**

- % habitat with favourable condition > 25%?

**Indicators for habitat quality**

- Key species
- Habitat structure
- Disturbances

**Measurement variables**

- Square plot: species composition and cover
- Circle plot: structure variables

Pictures: Ecopedia
Sample design

- Sample frame: Habitat map of Flanders
  + Covers all habitats/subtypes for the whole of Flanders
  + Update is ongoing
    - Many polygons are partially covered by habitat (but exact location within polygon is not known)

- Sample method: Generalized Random Tessellation Stratified (GRTS)
  - Stevens and Olsen (2004)
  - Spatially balanced sample

- Practical implementation
  - GRTS-package (Onkelinx, 2015)
  - ‘Master-sample’
    - 32m x 32m GRTS-sample covering Flanders
    - Each sample-point has a unique ranking
  - Separate sample for each habitat type
  - Not for rare habitats (< 10 hectares)
Sample design
Master GRTS-sample

Ranking master GRTS
- 0 - 500
- 500 - 1000
- 1000 - 1500
- 1500 - 2000
- 2000 - 2500
- 2500 - 3000
- 3000 - 3314
- Flanders
Sample design

Sample frame
Sample design

Overlay sample frame and master GRTS-sample

Ranking master GRTS

- 35 - 500
- 500 - 1000
- 1000 - 1500
- 1500 - 2000
- 2000 - 2500
- 2500 - 3000
- 3000 - 3300

Sample frame
Flanders
Sample design

Sample (n = 50): select 50 points with lowest ranking
Sample design

Sample (n = 50): select 50 points with lowest ranking
Sample design

Samples can easily be replaced in case of non-respons
Sample design

Samples can easily be replaced in case of non-respons based on ranking.
Sample design

Sample can easily be updated when sample frame changes
Sample design

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Sample design

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Sample design

Sample can easily be updated when sample frame changes.
Sample size

- Sample size calculations give insight in relationship between sample size and precision of estimated parameters.

- Choice of sample size is a policy decision.

- Precision levels
  - Sample size = 170 → Minimal detectable difference (Δ) = 10%
  - Sample size = 80 → Δ = 15%
  - Rule of thumb: Δ /2 → n x 4
    - If we want Δ = 5 % → n = 170 x 4 = 680
Sample size

- Choice of sample size
  - Habitattypes and subtypes (scale of Flanders) → n = 80
  - Habitattypes within Natura 2000 Network → Δ = 170 → oversample within Natura 2000 Network
  - Finite population correction factor → decrease sample size for habitats with smaller areas

- In total
  - Terrestrial habitats ≈ 4000 sampling units
  - Standing water bodies = 300 sampling units
  - Streams = 170 sampling units
**Allocation of samples in time**

<table>
<thead>
<tr>
<th>Year</th>
<th>Sample Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 3</td>
<td>random subset n/4</td>
</tr>
<tr>
<td>4 - 6</td>
<td>random subset n/4</td>
</tr>
<tr>
<td>7 - 9</td>
<td>random subset n/4</td>
</tr>
<tr>
<td>10 - 12</td>
<td>random subset n/4</td>
</tr>
</tbody>
</table>
Implementation and experiences
Implementation

- Start in 2014
- First subset completed for most habitat types
- Analysis is ongoing for 2019 reporting
Experiences

- GRTS-method is a robust and flexible method
  - It can easily handle errors in sample frames
  - It can deal with dynamic sample frames

- Recommended for long-term monitoring