Workshop

‘Modelling large carnivore habitat and population viability’

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Ecological Model – what is it

• Simplified representation of a particular system
• Synthesize and structure existing knowledge and data in a coherent framework
• Based on assumptions
• In contrast to expert opinions (gut feeling), assumptions are explicit
• Impartial tool: quantitative (figures) output, thus can be verified or falsified
Ecological Model - properties

• Ecological systems underly variability, eg by disturbance/ behavior

• → Exact predictions not possible

• Instead, only probabilities for future states can be predicted (trends)
The weather forecast is a model

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<tr>
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<tbody>
<tr>
<td>Tiefst-Temperatur</td>
<td>13°C</td>
<td>13°C</td>
<td>10°C</td>
</tr>
<tr>
<td>Höchst-Temperatur</td>
<td>29°C</td>
<td>25°C</td>
<td>22°C</td>
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<tr>
<td>Vormittag</td>
<td>☀</td>
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<td>Nachmittag</td>
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<td>Abend / Nacht</td>
<td>☐/☒</td>
<td>☃/☒</td>
<td>☒/☒</td>
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<tr>
<td>Sonnenstunden</td>
<td>12</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Niederschlagprobability</td>
<td>20%</td>
<td>20%</td>
<td>10%</td>
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Source: www.wetteronline.de
Why modeling...?

„Prediction is very difficult, especially about the future.“

Accredited to N Bohr
Why modeling

Wildlife managers can benefit from models:

– Test different scenarios – extrapolation over large time spans and spatial scales possible (virtual experiments)
– One step in the process towards a knowledge base
– A starting point for pooling further knowledge
– Flexible and dynamic: Can be revised with new records

– Help in decision support but cannot make decisions

– Important: how to deal with uncertainty
Specific aims I...

Habitat and population viability modelling (HPVM)

- Needed for which species/ **questions**?
- Adequate data sets for the respective species?

1) State of the art
2) Further activities
3) Recommendations
Questions identified

• What would be the minimum viable population (MVP)? (lynx, wolf, bear)

• How high is the carrying capacity (Ke) in the Alps per country? (lynx, wolf)
Questions identified

• What would be the minimum viable population (MVP)? (lynx, wolf, bear)

• Which barriers within the Alps (e.g. Brenner freeway) will separate the 3 species into subpopulations? (lynx, wolf, bear)

• How high is the carrying capacity (Ke) in the Alps/ per country? (lynx, wolf)

• Are lynx and bear able to re-colonize the Alps themselves?

• Do we need additional re-introductions, and if yes, when and where? (lynx, bear)
Adequate data sets

• Whatever is available
• Investment into more data, since they would make predictions even better
• Telemetry data would be best
Importance of monitoring!

- Habitat Model
- Population Model

Measure of success/
model
Improvement/
Adaptive management

Monitoring

Time
Specific aims II... ...

Habitat and population viability modelling (HPVM)
- Recommended methodological approach(es)?
Recommended approach

• Habitat suitability modelling (risk mapping)
• Because habitat fragmentation may negatively impact survival and speed of spread, the most suitable approach is a *spatially-explicit individual-based models (IBM)*.

• Approaches can deal with heterogeneity in:
  - Space: important for dispersal/ pop. spread
  - Spatial reintroduction scenarios
  - Spatial layers for different mortality scenarios
What is a habitat model?

A model that relates species distribution data with information on the environmental characteristics of those locations. (Elith and Leathwick 2009)
What is a habitat model?

Land cover

Human population

Elevation

Occurrences

Model

Predicted suitable habitat

Slide from Scharf et al in prep.
What is a spatially-explicit individual-based model?

- Model where fate and location of each individual is tracked in the population.
- Behavior is taken into account
- As well as any other processes happen on the individual level (genetics, ...)
## State-of-the-art: models Alps

<table>
<thead>
<tr>
<th></th>
<th>Habitat</th>
<th>HPVM</th>
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<tbody>
<tr>
<td><strong>Wolf</strong></td>
<td>Marucco 2009 PhD thesis (occupancy); Fallucci et al. (2012)</td>
<td>Marucco et al. 2010: SEPVM; Chapron et al.: different <em>non-spatial</em> approaches</td>
</tr>
<tr>
<td><strong>Lynx</strong></td>
<td>Zimmermann 2004 PhD thesis (ENFA)</td>
<td>Kramer-Schadt et al. 2005: SEPVM Needs adaptation to Alps</td>
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Gaps and recommendations

• We do not want to re-invent the wheel
• BUT: each existing models has some draw-backs that can be improved
• Collection of different modeling approaches
• Running management scenarios with different modelling approaches and compare output → robustness/ sensitivity of results → increases trust in models

• WISO as integrative modeling platform
## Uncertainty in model outcomes

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<tr>
<th>QUANTITATIVE</th>
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<tbody>
<tr>
<td>Sensitivity analysis of input parameters (habitat maps are also input parameters)</td>
<td>Using different modeling approaches for the same questions</td>
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<td>Ranking/Comparison of output</td>
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Specific aims VI...

Habitat and population viability modelling (HPVM)
  – Available land-use data sets and other sets of variables?

CORINE land-cover only option
GAPS: roe/ red deer density map for the Alps
Further recommendations

• Create steering committee for coordinating approaches on large carnivore modeling in the Alps

• With active supervision!
Summary

• Models can only be as good as their input data (sampling bias, digital landuse data,...)

• Sensitivity analysis of input parameters important to assess uncertainty

• Robust design: use different approaches (eg with the same data, do MaxEnt, GLM,...)

• WISO modelling platform as knowledge base