**Workshop**

# ‚Modelling large carnivore habitat and population viability‘

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WISO Conference, 26.-28. April 2012, Innsbruck

# 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

Bookmark

**Wetter in der Region Berlin**

| | Sa, 28.04. | So, 29.04. | Mo, 30.04. |
|---|---|---|---|
| Tiefst-Temperatur | 13°C | 13°C | 10°C |
| Höchst-Temperatur | 29°C | 25°C | 22°C |
| Vormittag |  |  |  |
| Nachmittag |  |  |  |
| Abend / Nacht |  |  |  |
| Sonnenstunden | 12 | 10 | 6 |
| Niederschlags | 20% | 20% | 10% |

Precipitation probability

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

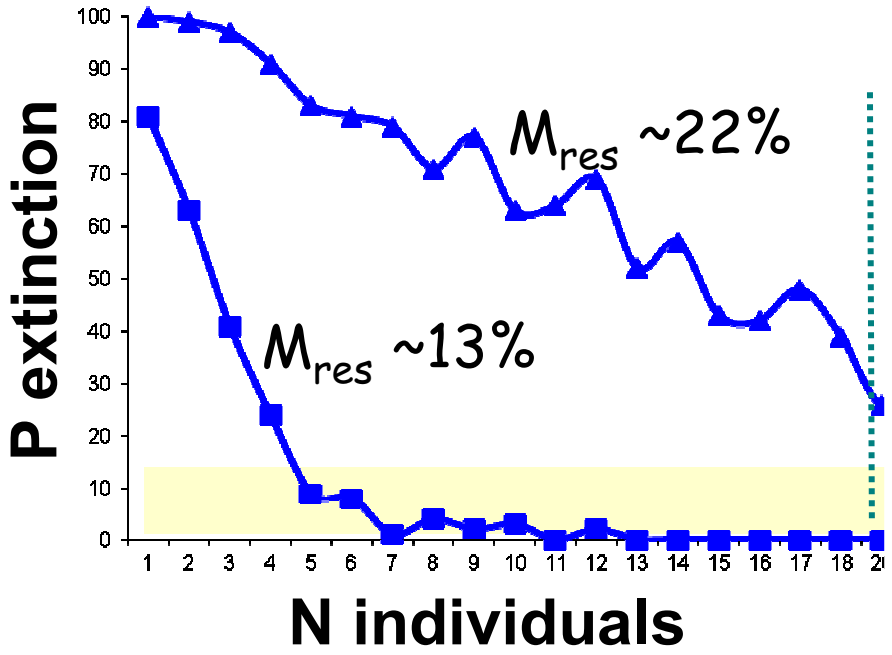
# Specific aims I…

**Habitat and population viability modelling (HPVM)**

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

# 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)

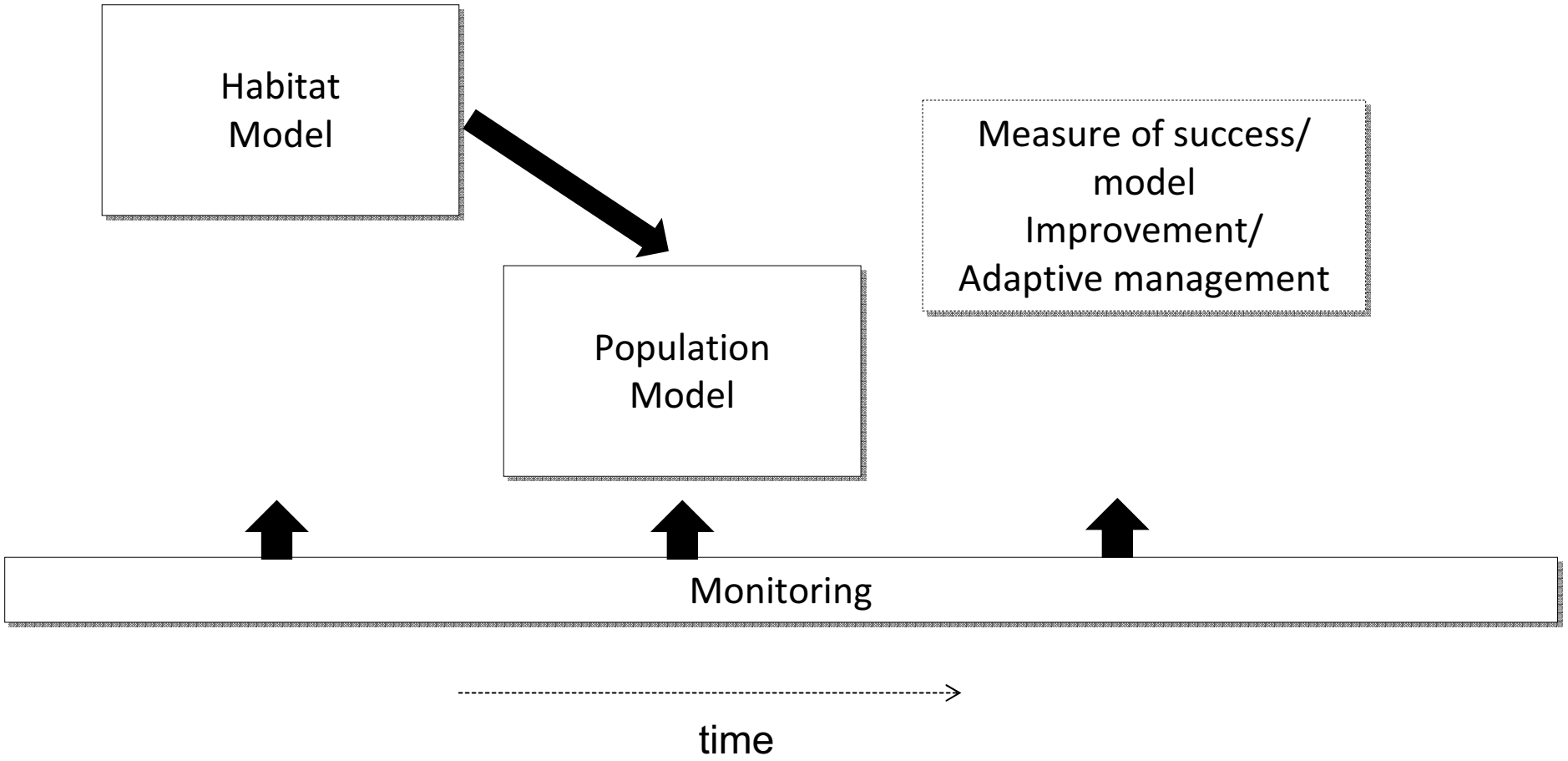
- How high is the carrying capacity (Ke) in the Alps/ per country? (lynx, wolf)

- 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!



# Specific aims II… …

**Habitat and population viability modelling (HPVM)**

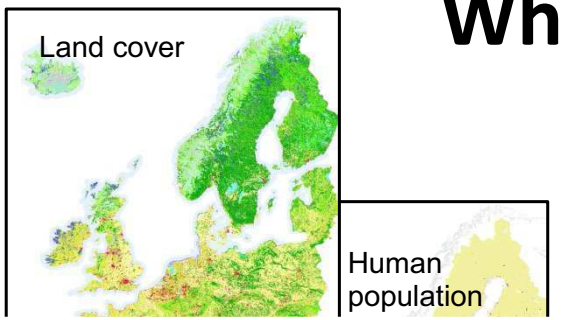
- Recommended methodological approach(es)?

# 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)**.

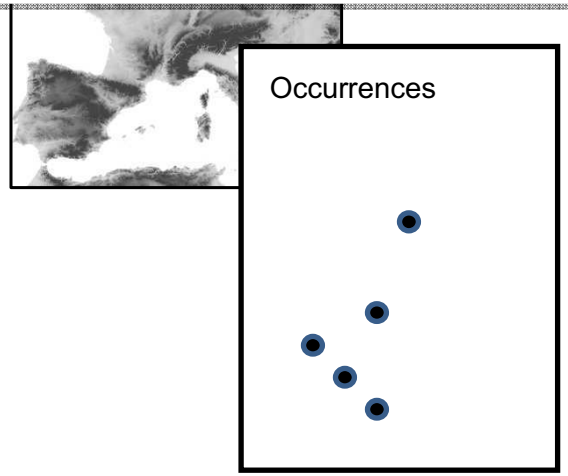
- Approaches can deal with heterogeneity in:
- Space: important for dispersal/ pop. spread
- Spatial reintroduction scenarios
- Spatial layers for different mortality scenarios

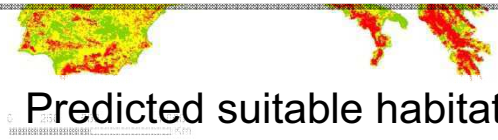
# What is a habitat model?





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

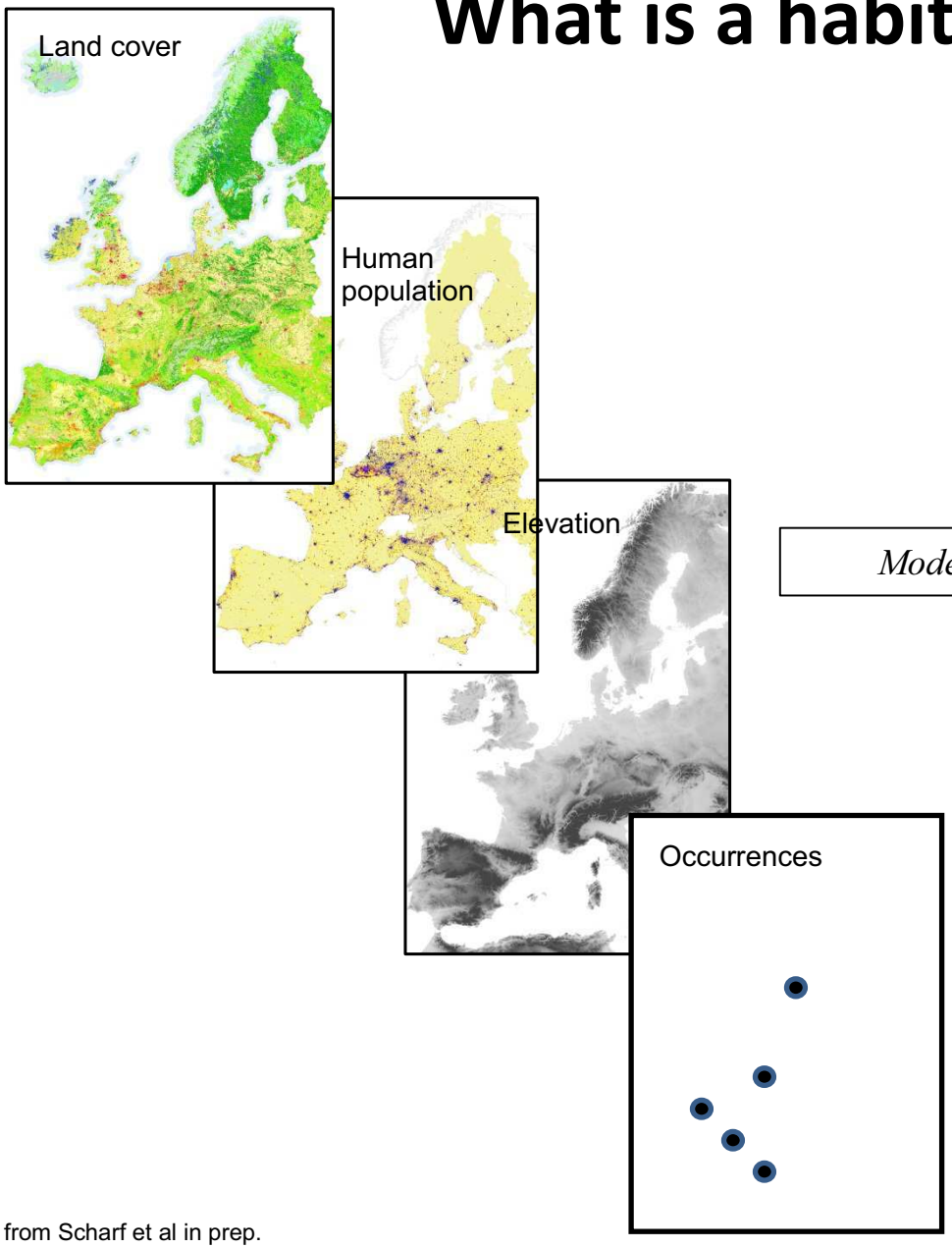


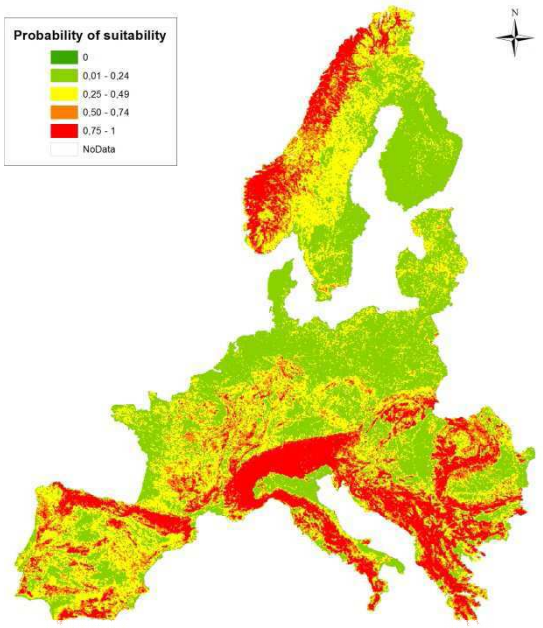
Predicted suitable habitat

Slide from Scharf et al in prep.

# What is a habitat model?




*Model*

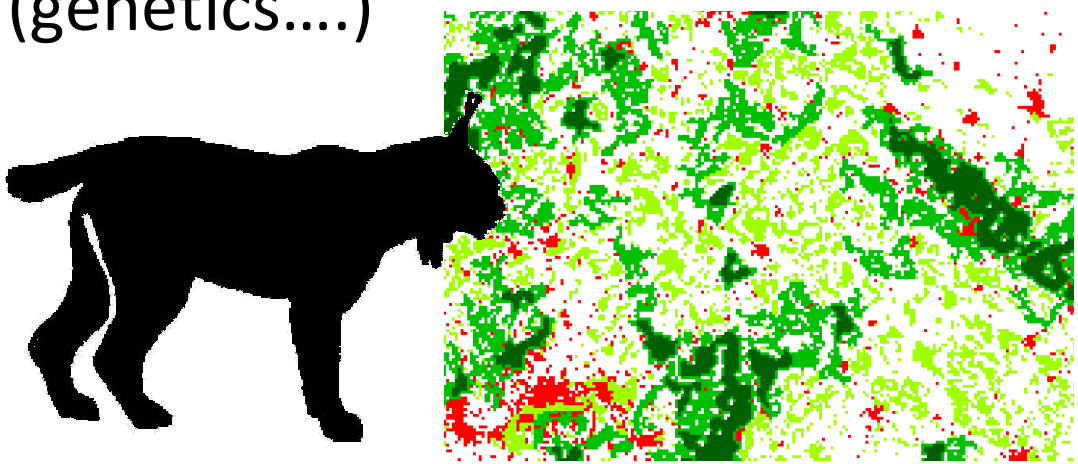



Predicted suitable habitat

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

| | Habitat | HPVM |
|---|---|---|
| Bear | Güthlin et al. 2011 (Äbischer 1993, GLMM, DCM) | Wiegand et al 2004: SEPVM |
| Wolf | Marucco 2009 PhD thesis (occupancy); Fallucci et al. (2012) | Marucco et al. 2010: SEPVM<br>Chapron et al.: different *non-spatial* approaches |
| Lynx | Zimmermann 2004 PhD thesis (ENFA) | Kramer-Schadt et al. 2005: SEPVM<br>*Needs adaptation to Alps* |

# 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

**QUANTITATIVE**

Sensitivity analysis of input parameters
(habitat maps are also input parameters)

**QUALITATIVE**

Using different
modeling approaches
for the same questions

Ranking/Comparison
of output

# 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