

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 undergo 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- Precipitation probability	20%	20%	10%

Precipitation probability

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...

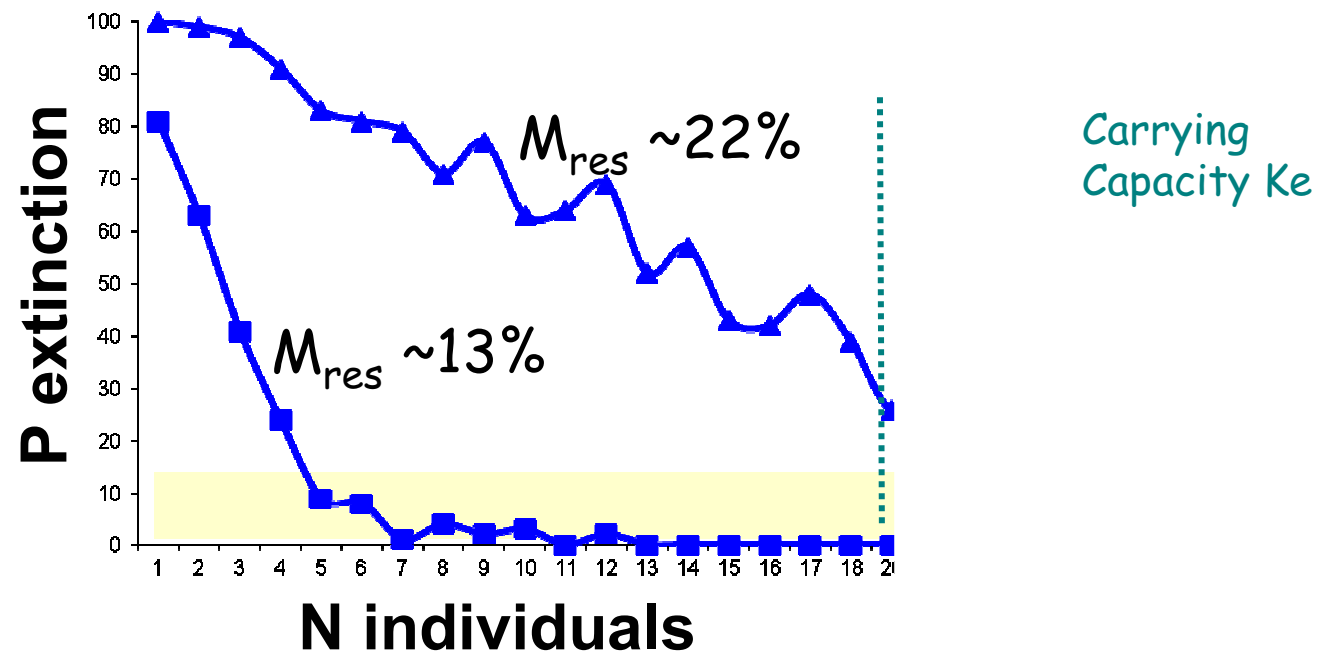
Habitat and population viability modelling (HPVM)

- 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 (K_e) in the Alps/ per country? (lynx, wolf)



Questions identified

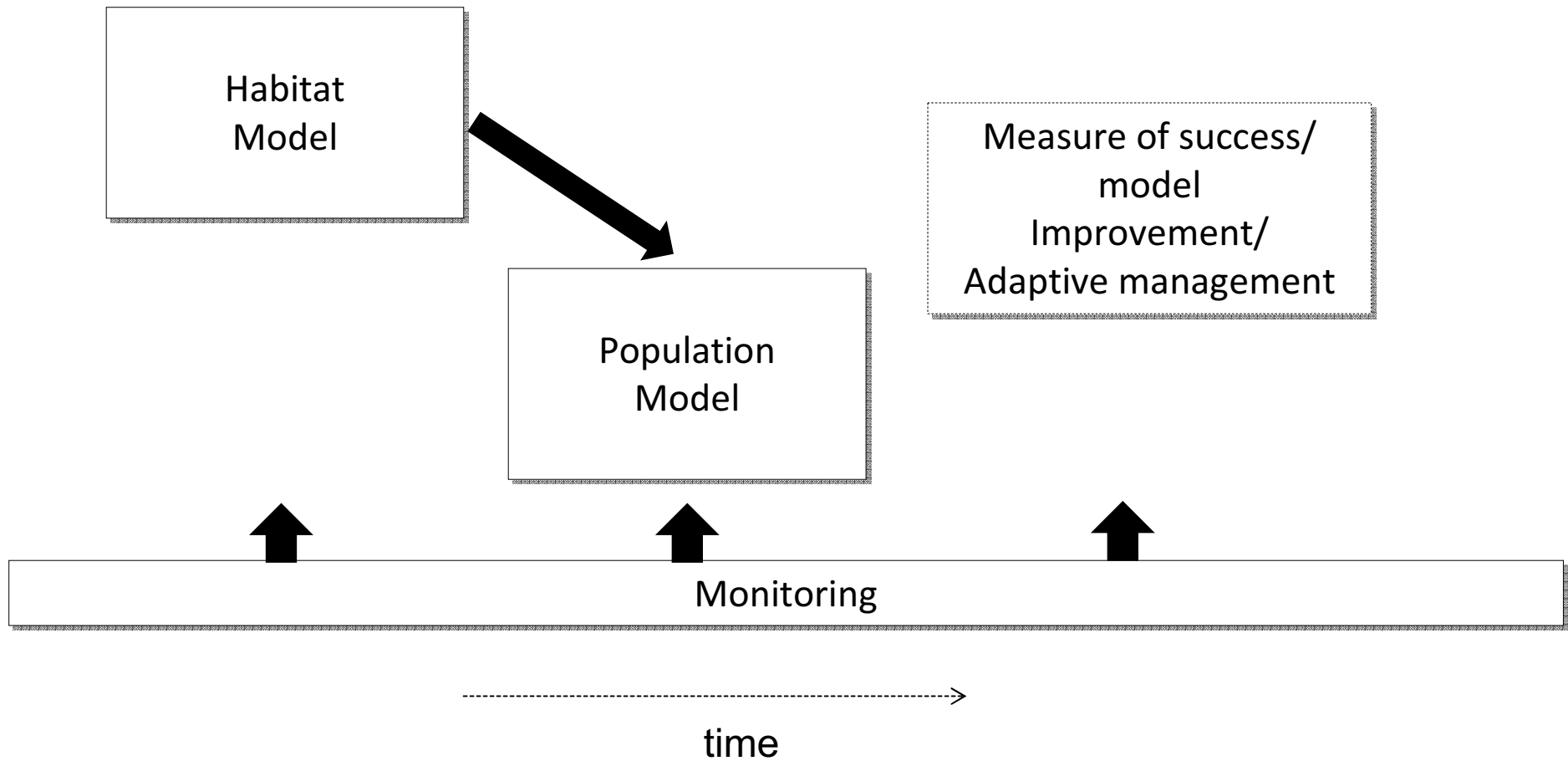
- What would be the minimum viable population (MVP)? (lynx, wolf, bear)
- Which barriers within the Alps (e.g. Brenner freeway) will separate the 3 species into subpopulations? (lynx, wolf, bear)
- How high is the carrying capacity (K_e) in the Alps/ per country? (lynx, wolf)
- Are lynx and bear able 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... ..

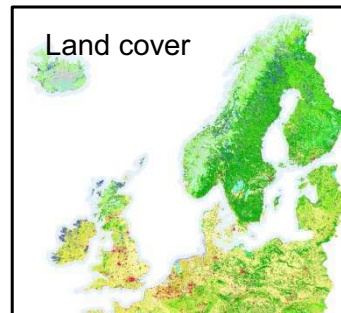
Habitat and population viability modelling (HPVM)

- Recommended methodological approach(es)?

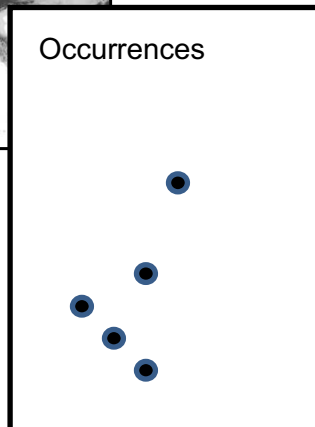
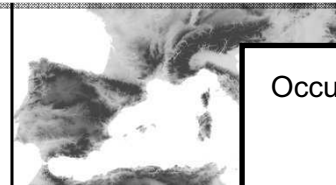
Recommended approach

- **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?

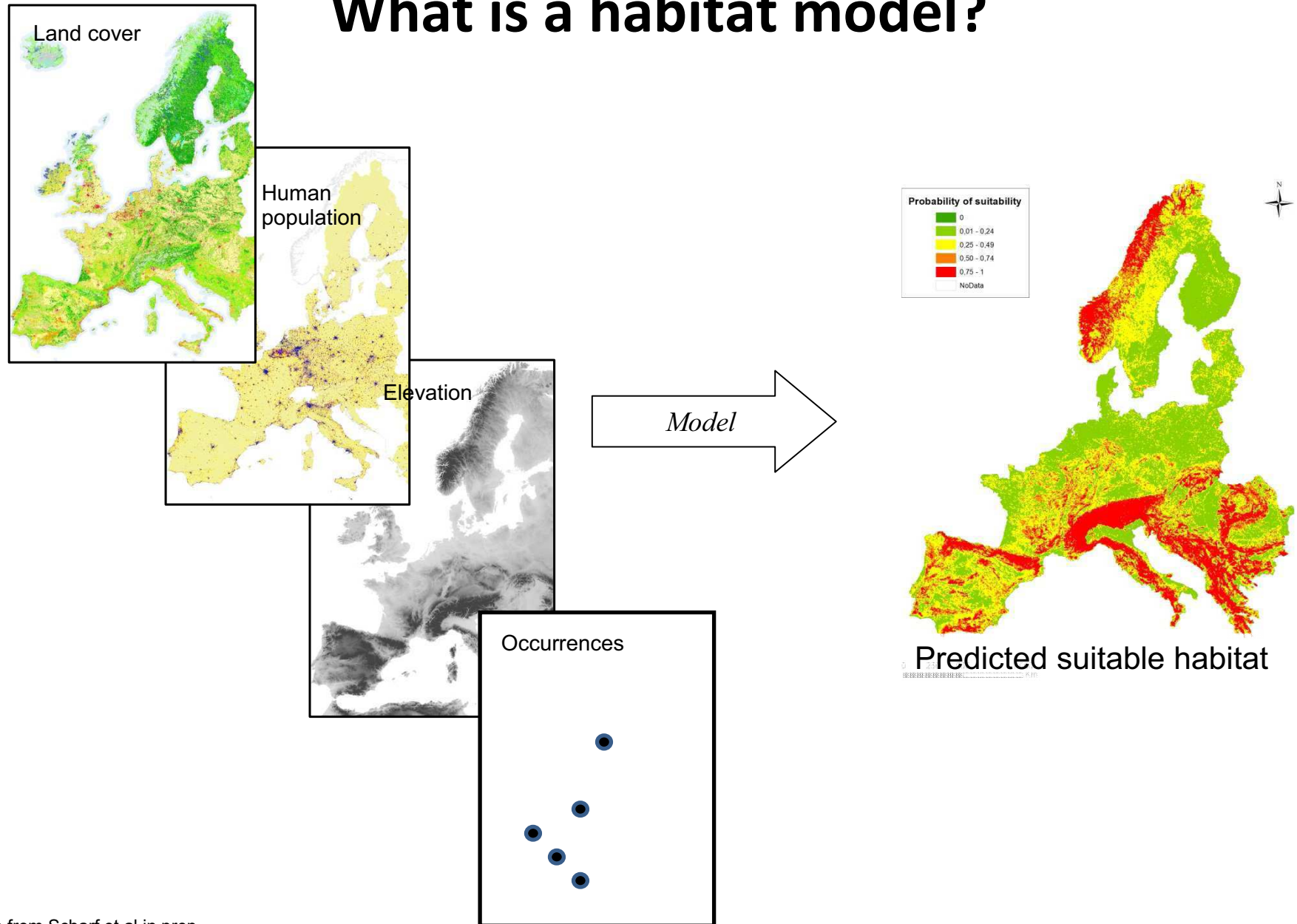


A model that relates species distribution data with information on the environmental characteristics of those locations. (Elith and Leathwick 2009)



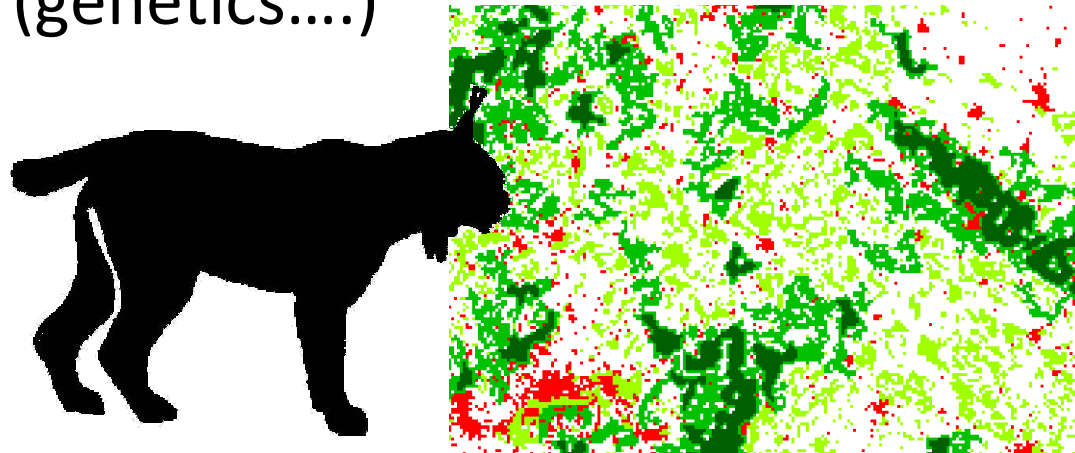
Predicted suitable habitat

What is a habitat model?



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 Chapron et al.: different <i>non-spatial</i> approaches
Lynx	Zimmermann 2004 PhD thesis (ENFA)	Kramer-Schadt et al. 2005: SEPVM <i>Needs adaptation to Alps</i>

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