

# ECOLOGICAL MODELLING: Potential, trends & challenges



**Karin Frank**

Helmholtz-Centre for Environmental Research – UFZ, Leipzig  
Department of Ecological Modelling (OESA)

METIER Final Conference, Brussels, 4-6 November 2009

[karin.frank@ufz.de](mailto:karin.frank@ufz.de)



# Background

Methodological focus so far:



If environmental problems are caused by change:

Functioning /  
stability properties?



↑ ↑ ↑  
Change processes

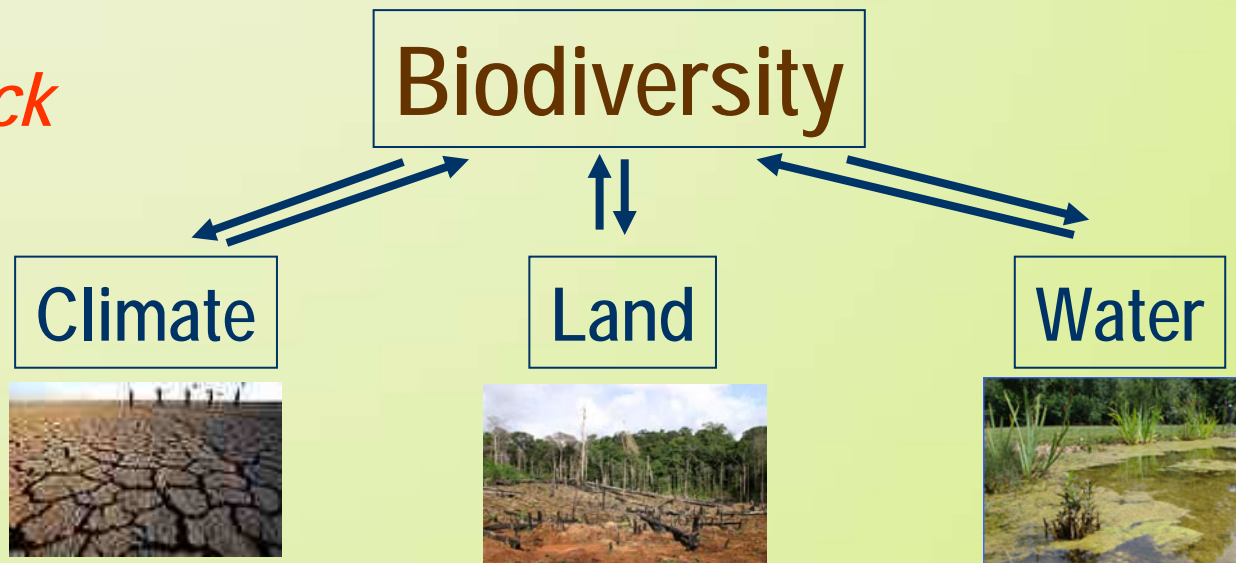
- ↪ Descriptive approaches reach too short.
- ↪ **Need to understand system dynamics.**
- ↪ Especially in case of feedback loops.

# Example: Biodiversity



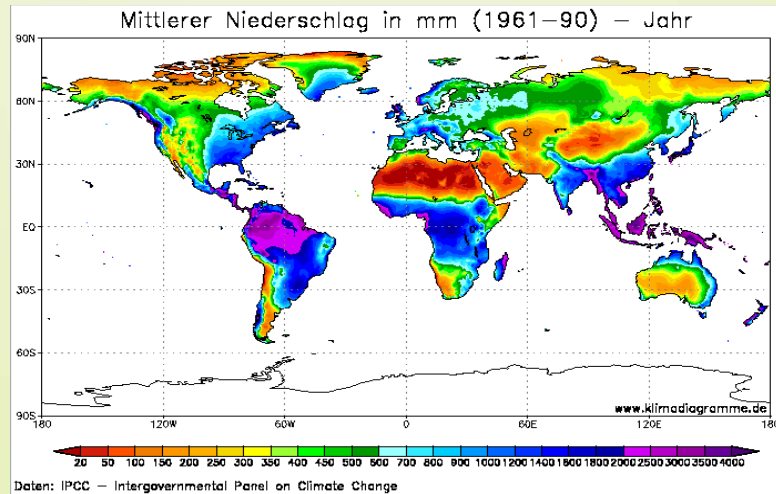
*Organismic interactions & response to change*

*Feedback loops*



*Change processes*

# Example: Biodiversity & Climate



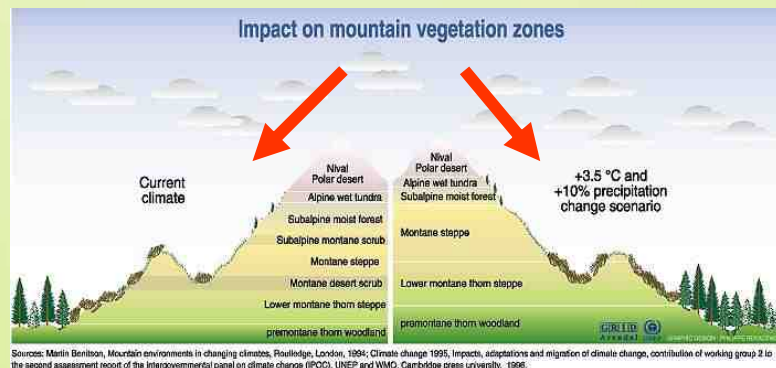
Widely used: Envelop Models to globally assess impacts of Climate Change on ecosystems

Shift of climatic zones



Shift of ecosystems

## Scenarios of Climate Change



**BUT:**

Doesn't this reach too short?

What about differences in the local response of the different species?

# Approach: Ecological Modelling

Model = Simplified picture of the reality  
from the perspective of a question



© Caricatures:  
Doris Böhme, UFZ

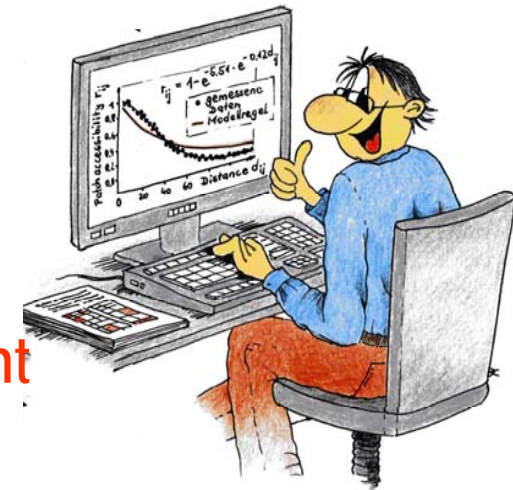
Identification and logical combination  
of relevant information / data

Consistent extrapolations to  
longer terms and larger scales

Simulated temporal development

Sensitivity analysis

**Understanding!**

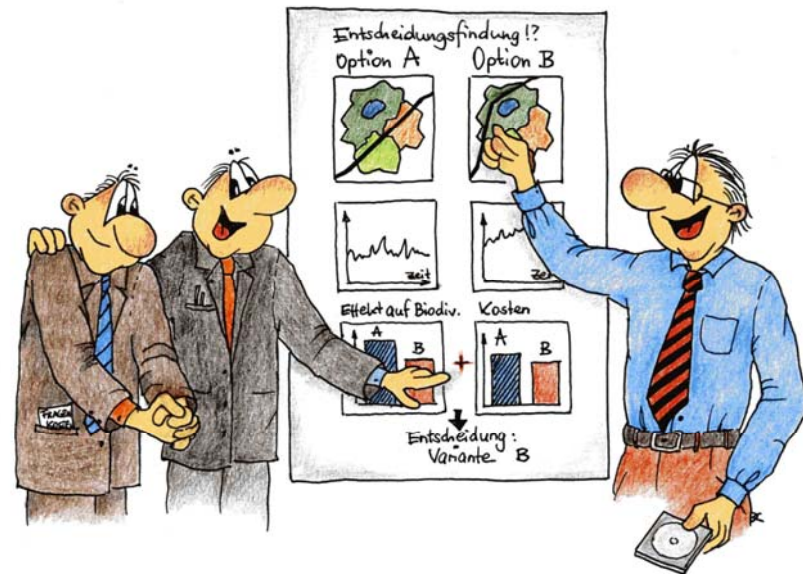


# Approach: Ecological Modelling

In the same way:

Simulation and  
comparative assessment  
of management scenarios

**Decision-support**



© Caricatures: Doris Böhme, UFZ

# Recent trends in ecological modelling

To cover the influence of...

**Spatially explicit modelling**  
(in combination with remote sensing)

- ↪ landscape structure
- ↪ land use change

**Stochastic modelling**

- ↪ climate change
- ↪ unpredictable events

**Individual-based modelling**

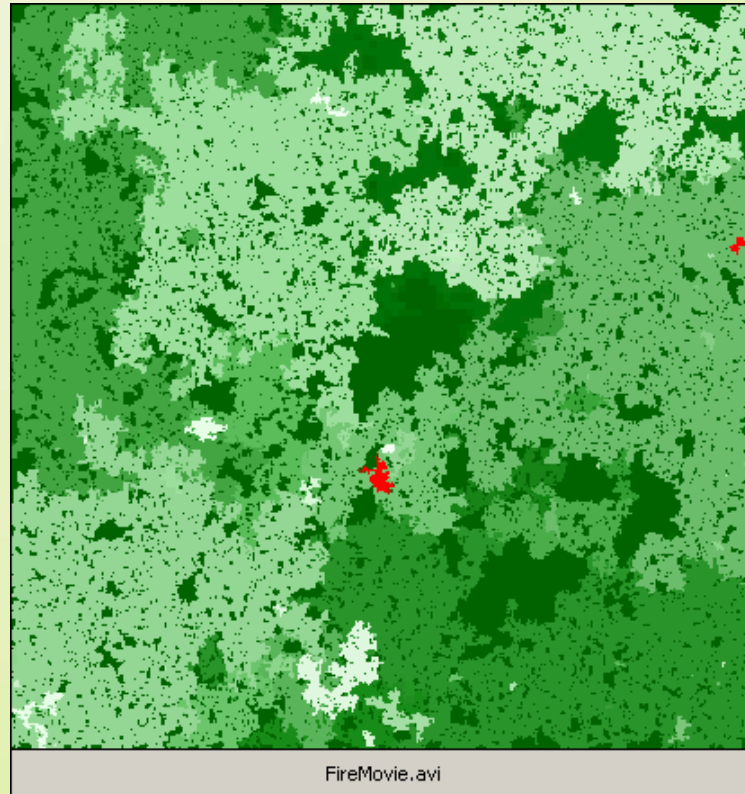
- ↪ organismic interactions  
and response to change

**Ecological-economic and  
agent-based modelling**

To model land use decisions

# One result: Impacts of fire in forests

Müller, M. et al. (2005)



Fire regime  $\leftrightarrow$  Forest structure  $\Rightarrow$  CO<sub>2</sub> balance

METIER Final Conference, Brussels, 4-6 November 2009

karin.frank@ufz.de

 PEER

  
MARIE CURIE ACTIONS

# To summarize



**Environmental Modelling => increasing importance**

- ↪ Integral part of each larger research project (e.g. EU-IP)
- ↪ New: Research projects specifically on modelling methodology, e.g. ERC Advanced Grant SPATIODIVERSITY
- ↪ Own curricula in Graduate Schools (e.g. HIGRADE)