

Biodiversity and climate change

New challenges to nature conservation

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Second Sino-German Workshop on Biodiversity Conservation, 30.03.2009



Outline of the presentation

- **Climate change is still going on – some data and facts**
- **Effects of climate change on species, habitats and landscapes**
- **Conclusions for nature conservation**

Climate change scenarios

According to IPCC 2007:

During the last (20th) century, rise of global mean temperature by 0,7 °C, in Europe by 0,95 °C

Prognosis: Rise of global mean temperature 1990 - 2100



Change of average rainfall
Increasing intensity and seasonal variability

Climate change – some data and facts

Effects on species, habitats, landscapes

Conclusions for nature conservation

Climate change

Regionally differentiated effects

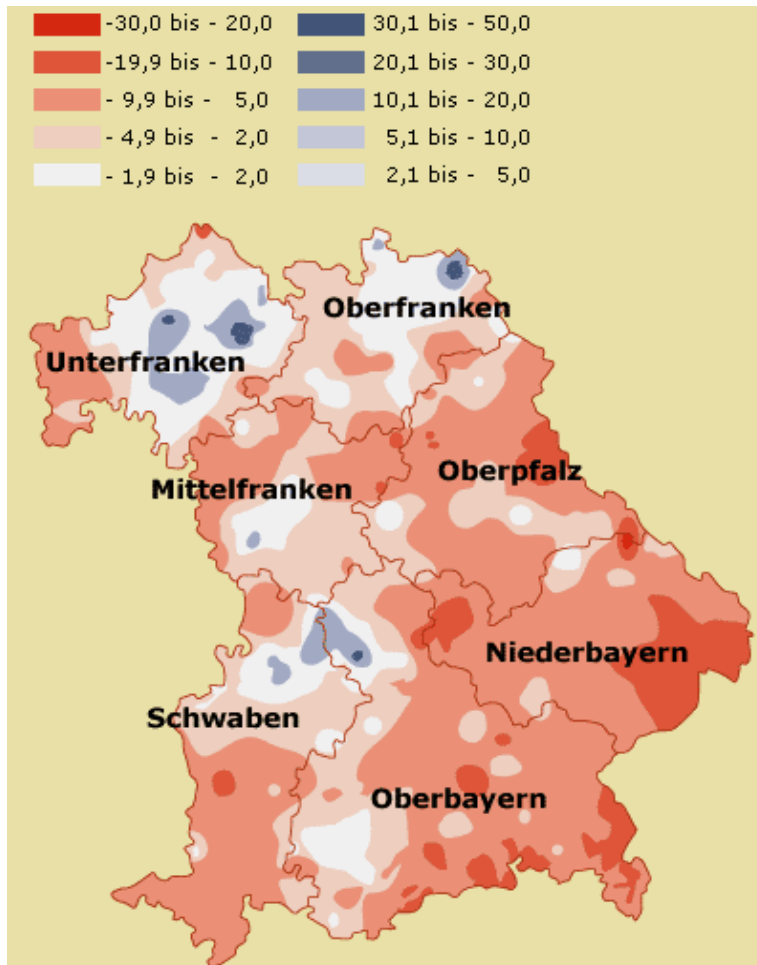
Example: Change in average rainfall

Climate change – some data and facts

Effects on species, habitats, landscapes

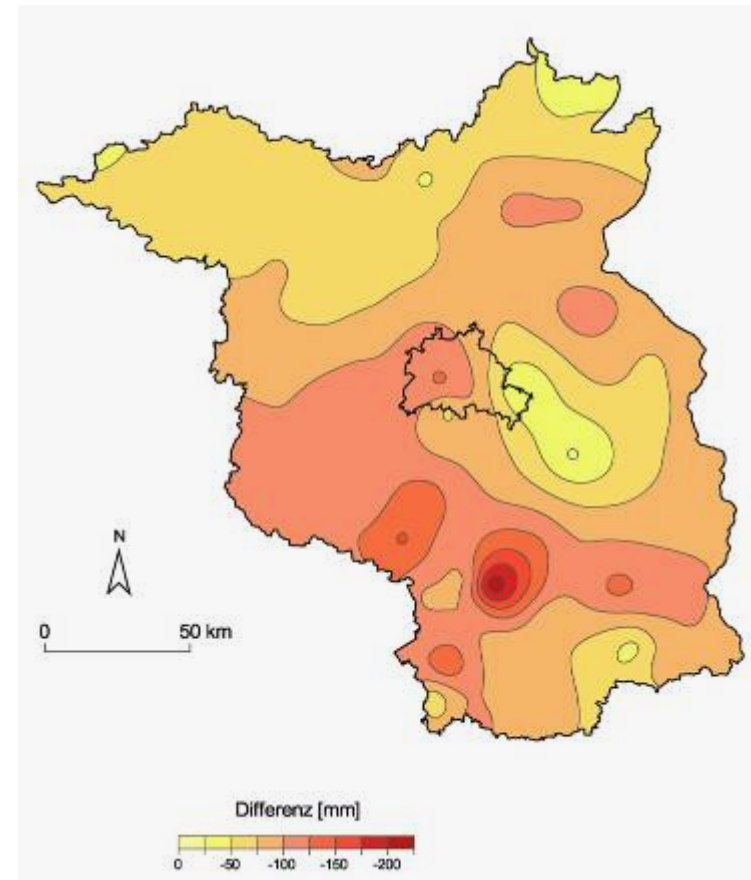
Conclusions for nature conservation

a) In Bavaria (in % 2021 to 2050)



[Reference: Bayerisches Landesamt für Wasserwirtschaft]

b) In Brandenburg (in mm, 2015/2000 to 2046 / 2050)



[Reference : Gerstengarbe et al. (2003): PIK-report No. 83, p. 21]

Climate change

Some changes are already noticeable

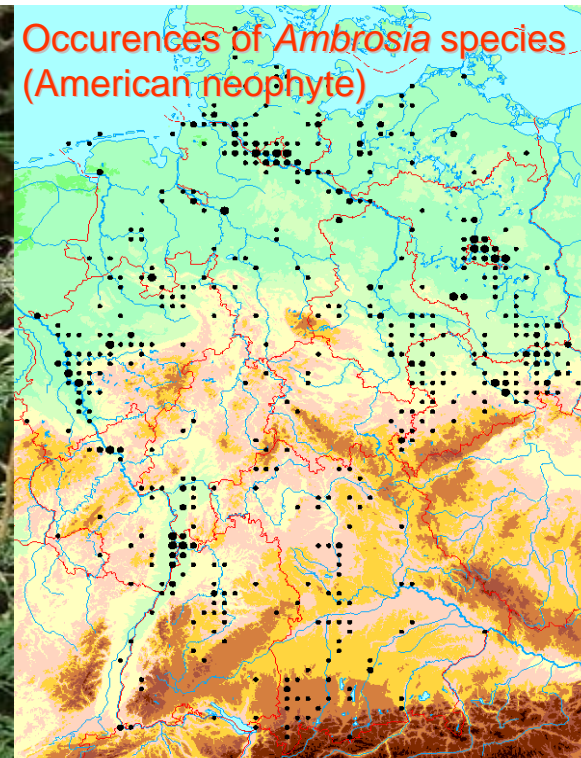
**Spread of *Ambrosia artemisiifolia*:
40 Mil. € annual costs caused by allergenic pollen**

=> „most expensive plant species of Germany“

Climate change – some data and facts

Effects on species, habitats, landscapes

Conclusions for nature conservation



Climate change

Some changes are already detectable

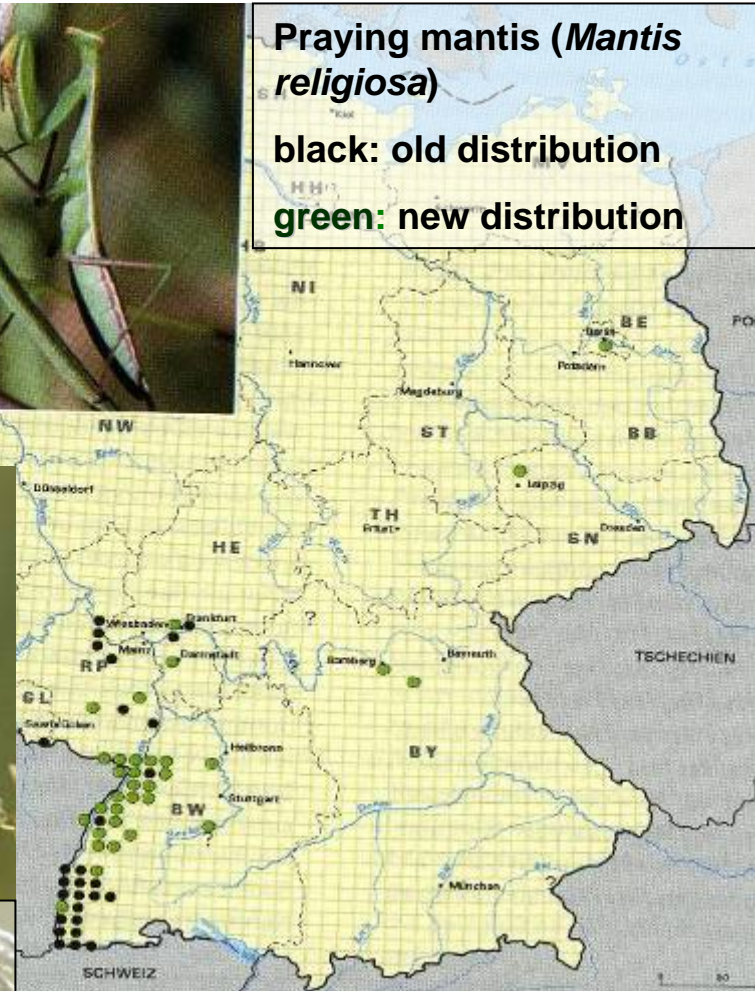
- Climate change – some data and facts
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Praying mantis (*Mantis religiosa*)

black: old distribution

green: new distribution

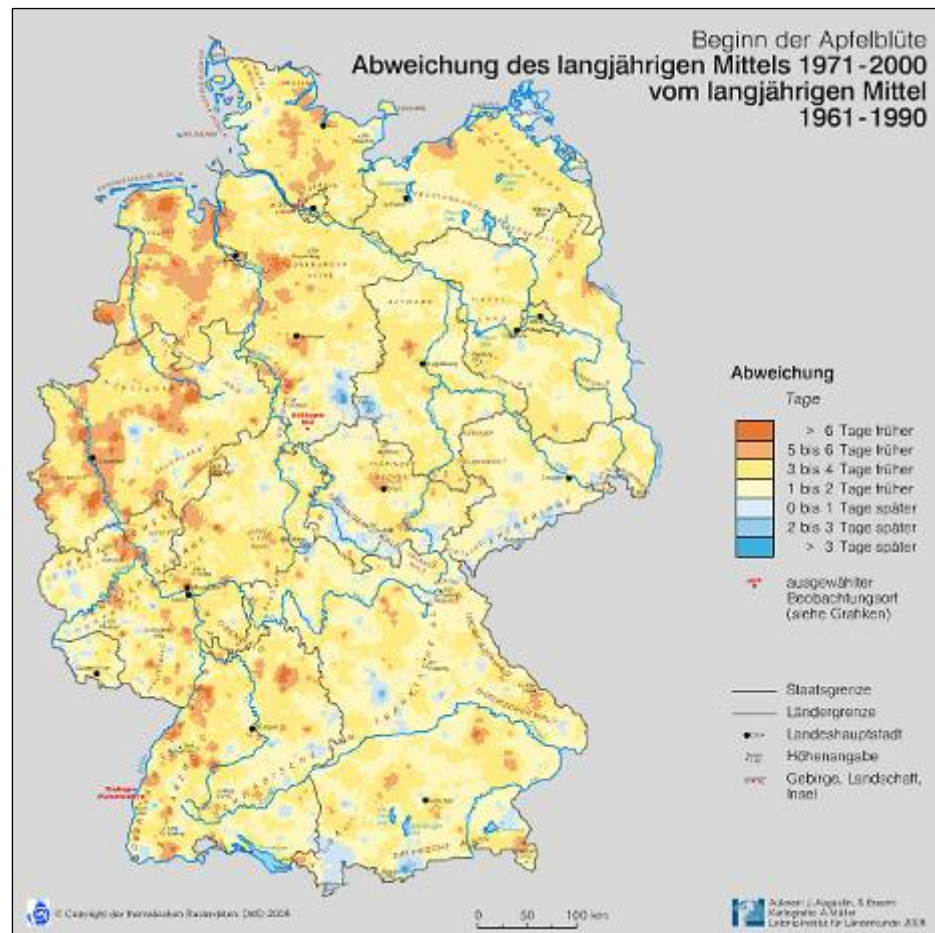


Bee-eater: recolonization up to South Sweden

„Visible“ effects of climate change

Start of the apple blossom; variation from the mean of 1971-2000 to the mean of 1961-1990

- Climate change – some data and facts
- Effects on species, habitats, landscapes
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Global threat of ecosystems and biodiversity

Climate change – some data and facts

Effects on species, habitats, landscapes

Conclusions for nature conservation



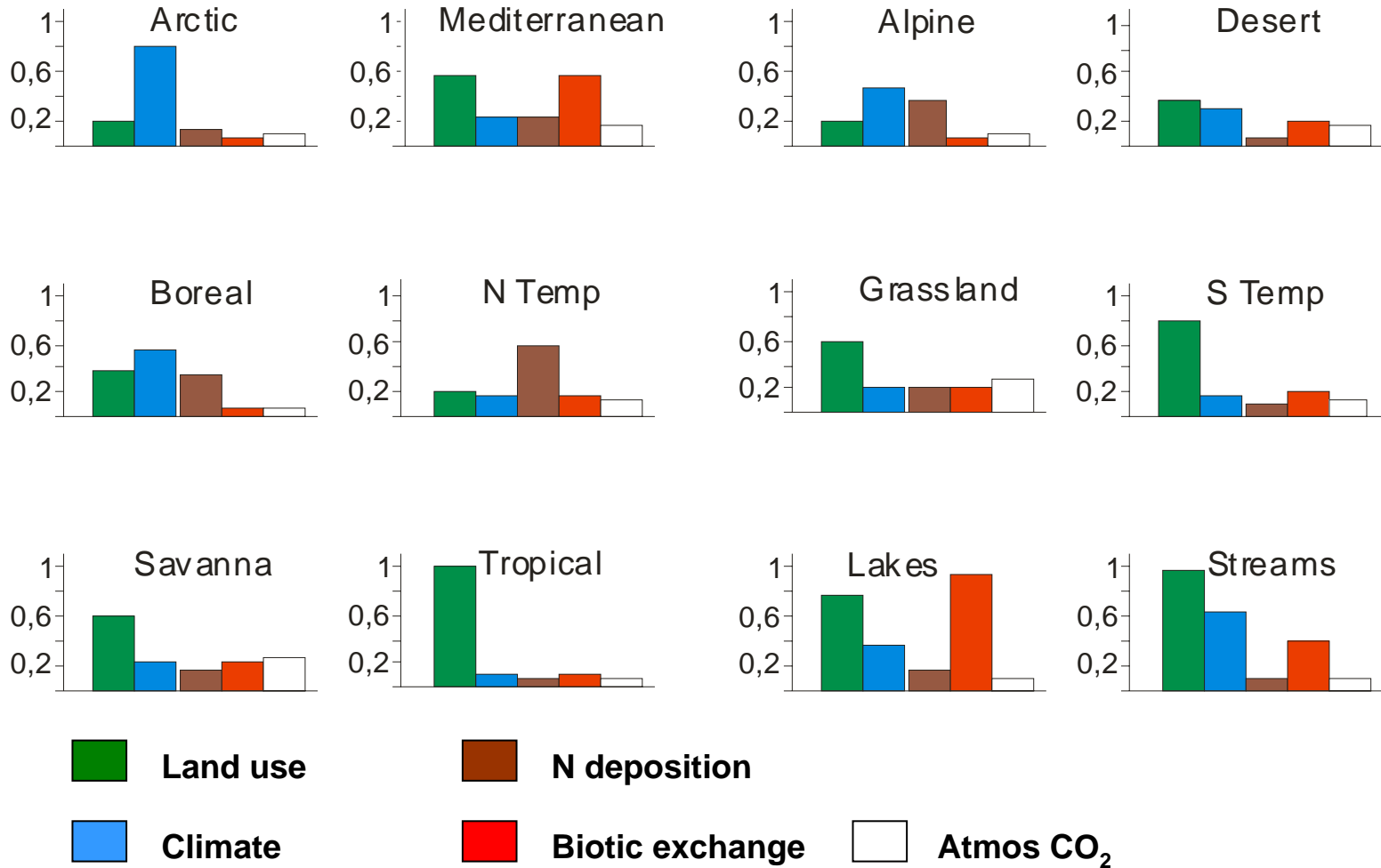
➤ Climate change is an important factor alongside others that affect biodiversity

Biome-specific effects on biodiversity

• **Climate change – some data and facts**

• **Effects on species, habitats, landscapes**

• **Conclusions for nature conservation**



I. Direct effects on biodiversity

- Climate change – some data and facts
- Effects on species, habitats, landscapes
- Conclusions for nature conservation

5%-30% of native species could disappear from Middle Europe

Immigration of new species as a desired process of adaptation

Spread of invasive alien species



I. Direct effects on biodiversity

Shift of distribution ranges – immigration and emigration of species

Example: Overwintering waterbirds

- range borders increasingly shift towards Northeast

- Climate change – some data and facts

- Effects on species, habitats, landscapes

- Conclusions for nature conservation



+ **Northern shoveler:**
Increase of the n° of individuals resting in Germany at decreasing or stable breeding numbers in most European countries



www.natur-lexikon.com

- **Mallard:**
Continuing **decline** of resting numbers in Germany due to shortening of migration routes

I. Direct effects on biodiversity

Effects on land uses

- Climate change – some data and facts
- Effects on species, habitats, landscapes
- Conclusions for nature conservation

Decrease in summer rainfall

Reduction of water supply and availability

Elevated temperatures

Increase in climate variability

Spread of pest organisms

Increase of yield potential:

Corn
sugar-beet
millet

Decrease of yield potential:

Wheat



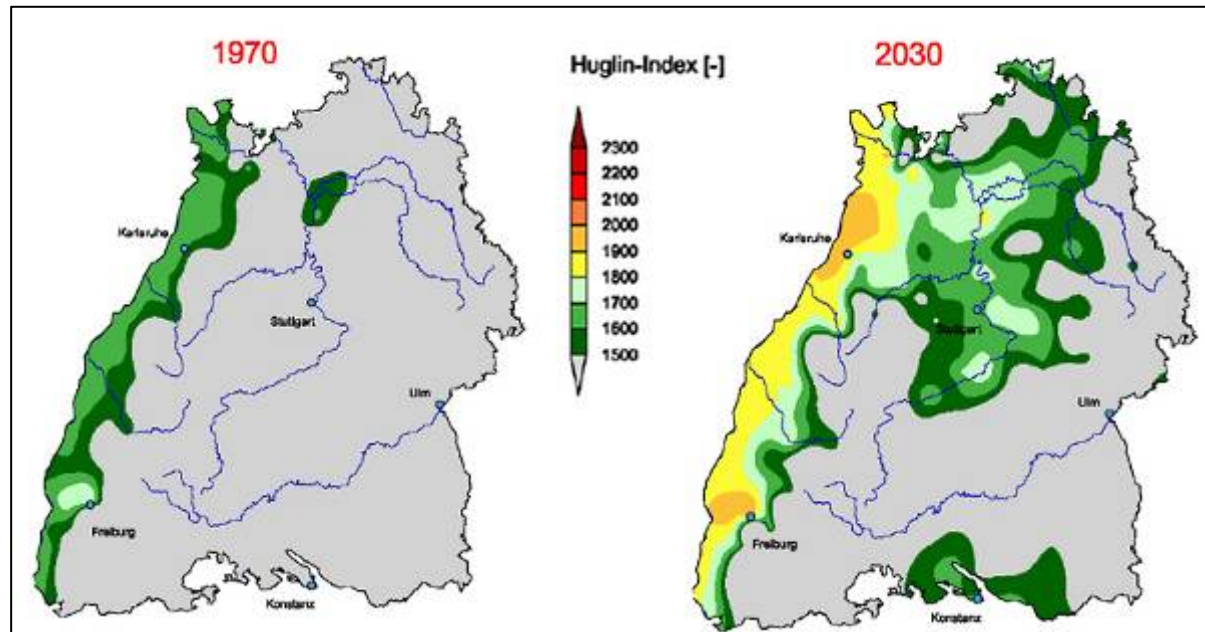
Change of land uses/land use patterns and characteristic landscapes

I. Direct effects on biodiversity

Effects on land uses

Example: expansion of wine-growing areas

- Climate change – some data and facts
- Effects on species, habitats, landscapes
- Conclusions for nature conservation

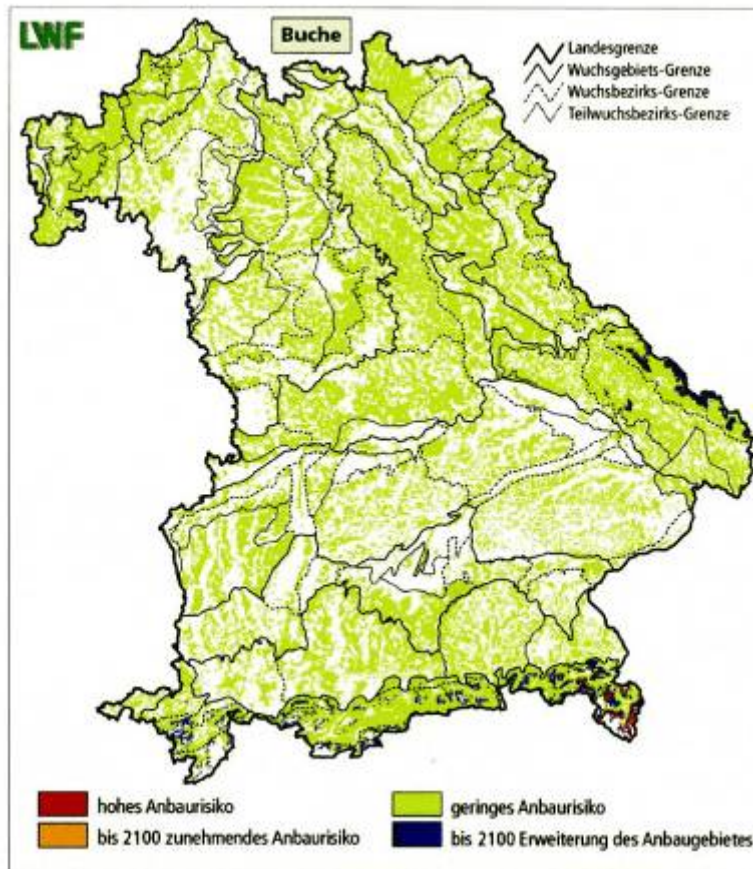


Huglin-Index for Baden-Württemberg. 10-year moving average for the decade 1961 to 1970 (left) and 2021-2030 (right)

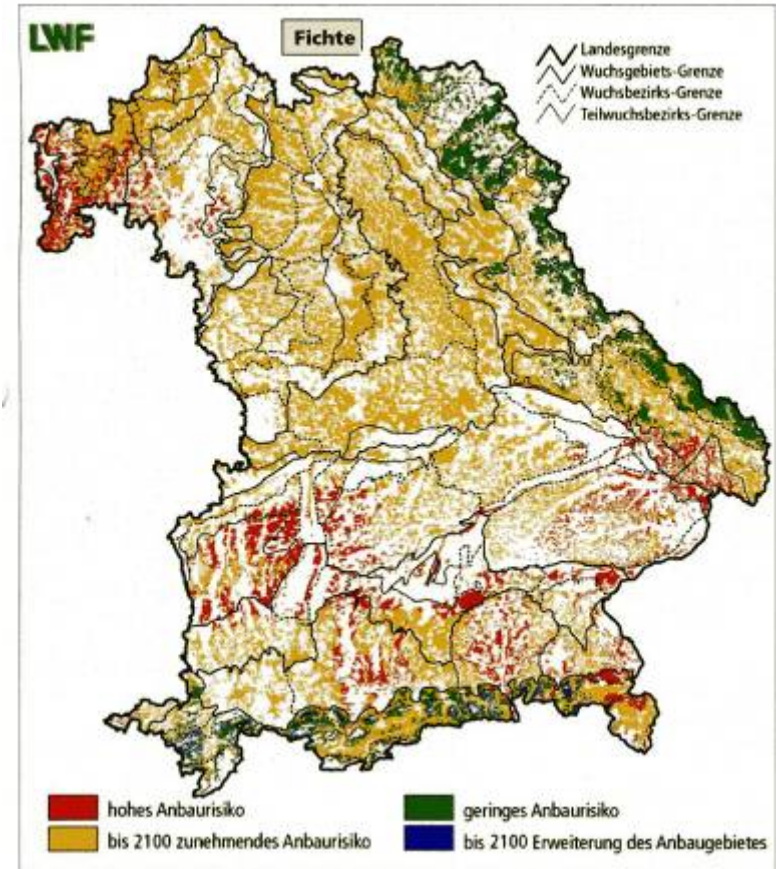
I. Direct effects on biodiversity:

Change of characteristic landscape and forest sceneries

Expected development of risk of forestation for beech (left) and spruce (right) in Bavaria (Scenario + 1,8 ° C and – 40 mm; Kölling, Zimmermann & Walentowski 2007)



Expected development of risk of forestation for beech in Bavaria (Scenario + 1,8°C and - 40 mm)



Expected development of risk of forestation for spruce in Bavaria (Scenario + 1,8°C and - 40 mm)

II. Indirect effects

Adaptations in other sectors

- Climate change – some data and facts
- Effects on species, habitats, landscapes
- Conclusions for nature conservation

Adaptations in agriculture and forestry, protection measures against extreme events (floods)



Substitution of energy source material by renewable energies



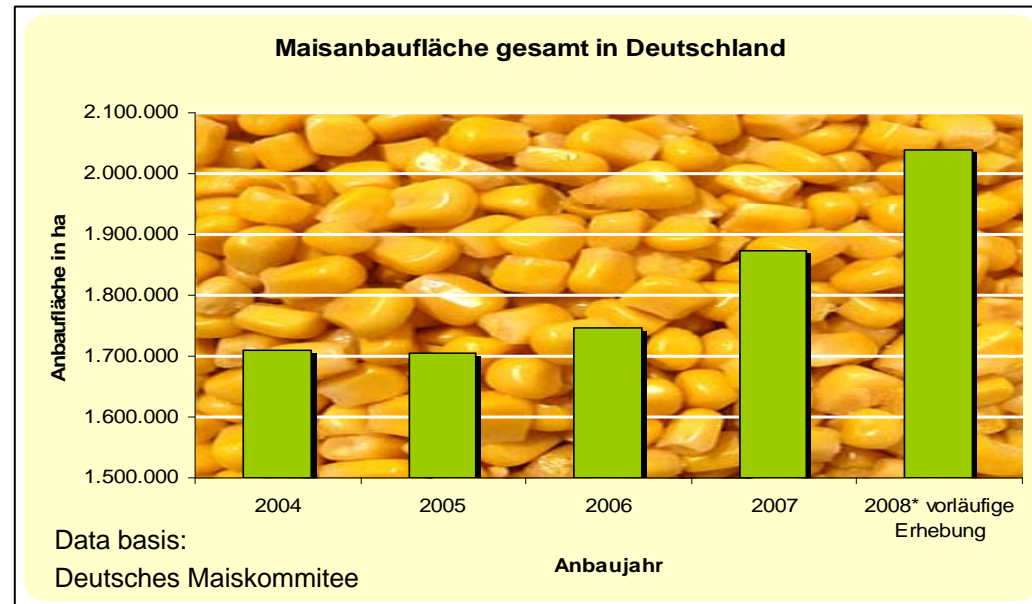
Foreseeable increasing space requirement and competition



II. Indirect effects

Space competition by increasing use of bio-energy

Surface area with corn cultivation in Germany



Climate change – some data and facts

Effects on species, habitats, landscapes

Conclusions for nature conservation

Other possible effects of bio-energy use:

- narrowing crop rotations
- reduced rate of groundwater formation
- Deficits in Humus balances
- Change of cultural landscapes

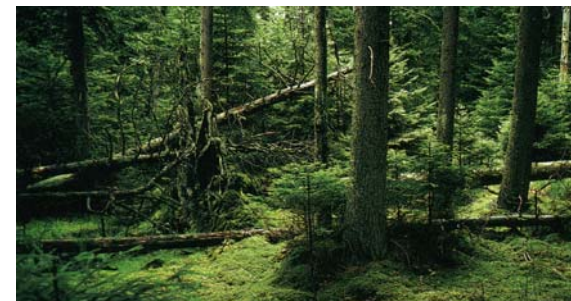
III. Contributions of ecosystems in mitigating climate change effects

- Climate change – some data and facts
- Effects on species, habitats, landscapes
- Conclusions for nature conservation

Mobilization of the sink function of carbon-rich ecosystems (esp. peatlands, wetlands, old forests)



Consideration of climate protection aspects and greenhouse gas balances in land use and cultivation



Some conclusions for nature conservation strategies



Ways to conserve diversity in a changing climate

Thinking in multiple dimensions

- Climate change – some data and facts
- Effects on species, habitats, landscapes
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➤ Protected Areas

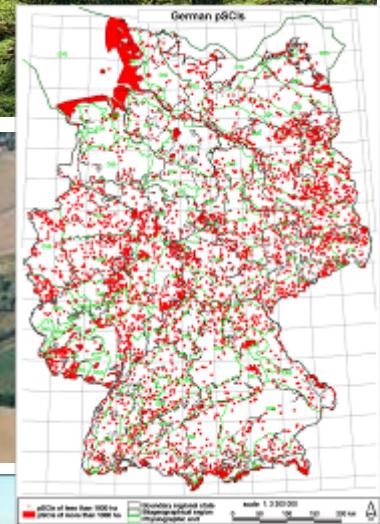
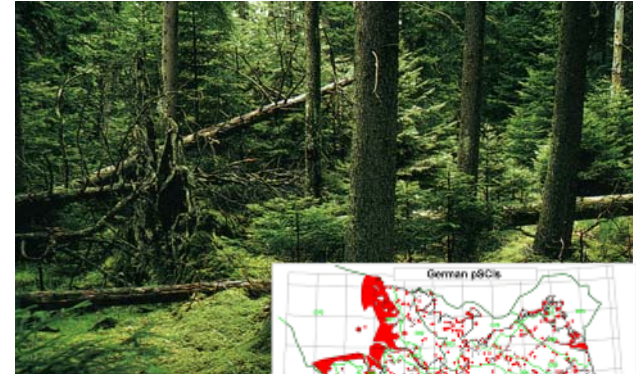
-big enough to provide for durable and viable populations
- sometimes need to adopt the conservation objectives

➤ Connectivity

-establishing networks of protected areas
- e.g. European Network NATURA 2000

➤ Sustainable, site-specific land use

-to allow species to migrate



Climate change

Strategies of nature conservation need to change as well

Future challenges to nature conservation

(according to Boye and Klingenstein 2006, completed)

Climate change – some data and facts

Effects on species, habitats, landscapes

Conclusions for nature conservation

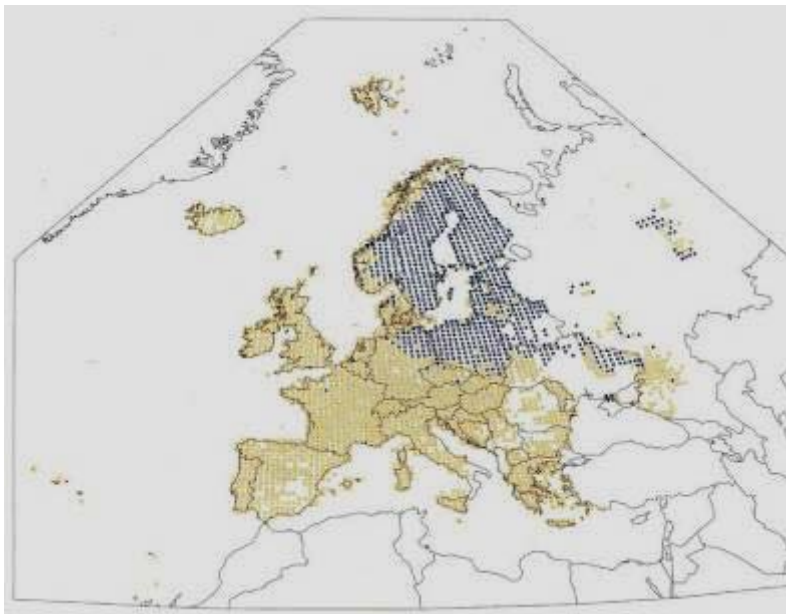
- **Theory loss in nature conservation** (breakup of previous systematics and common classifications due to introduction of neophytes etc.)
- **Relativization of naturalness** (which climax is used for orientation, e.g. with regard to the spread of thermophile species?)
- **Function of conservation efforts** (some species, e.g. postglacial relicts, cannot, for climate reasons, be preserved in some regions)
- **Dynamization of targets** (from static concepts to dynamic developments; conservation of development potentials rather than of current conditions)
- **Increasing need of manipulation** (higher need for costly conservation and management measures for habitats)
- **Higher frustration potential** (increasing risk of disturbances and disastrous impacts on species and habitats)
- **Increase of competition for land** (new orientation of land uses may make areas less available for nature conservation)
- **Change of perspectives of consideration** (from local to more large-scale perspectives)

Change of perspectives of consideration

Climate change and distribution shift

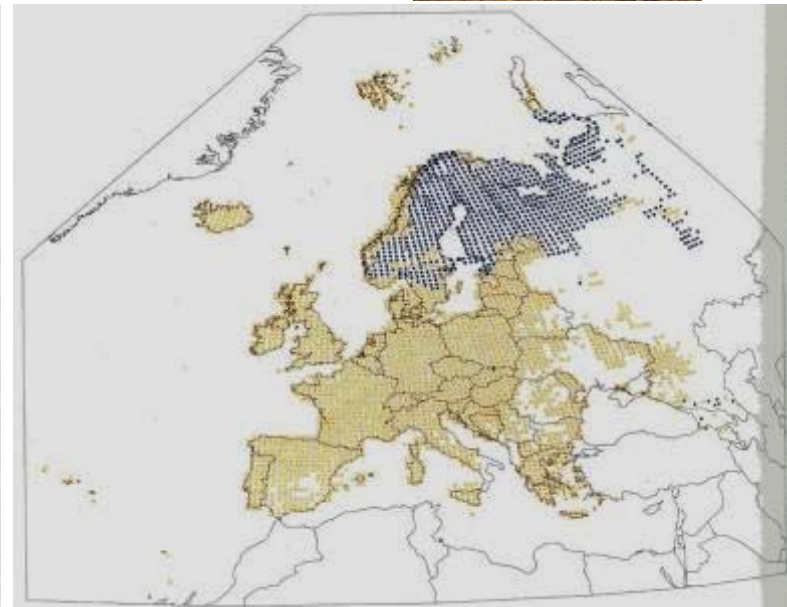
- Climate change – some data and facts
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Eurasian Crane (*Grus grus*)



Current distribution (according to EBCC)

Reference: Huntley et al. (2007)



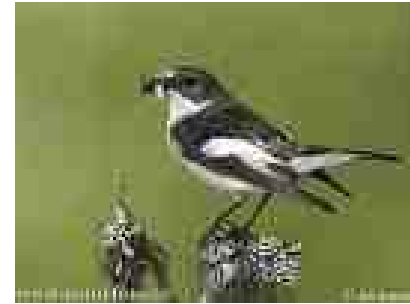
Distribution at the end of the 21th century (Simulation)

Change of perspectives of consideration

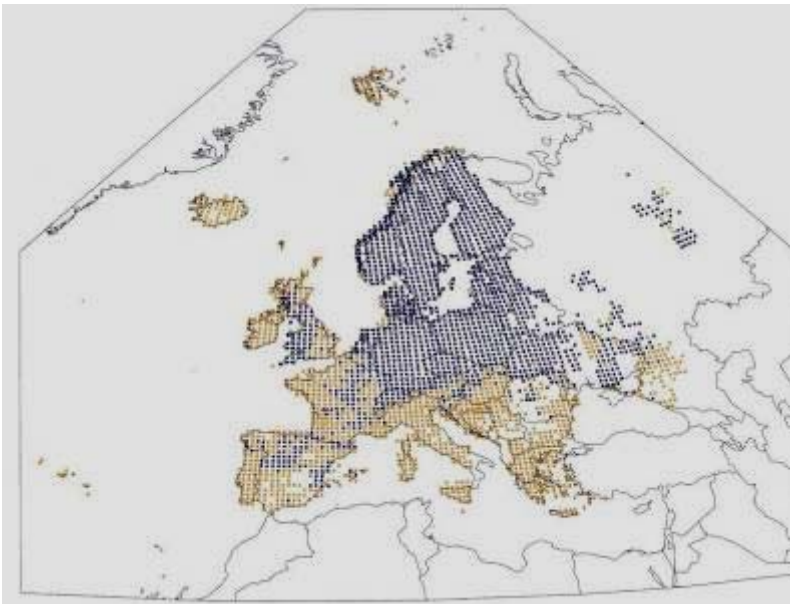
Climate change and distribution shift

European pied flycatcher

(*Ficedula hypoleuca*)

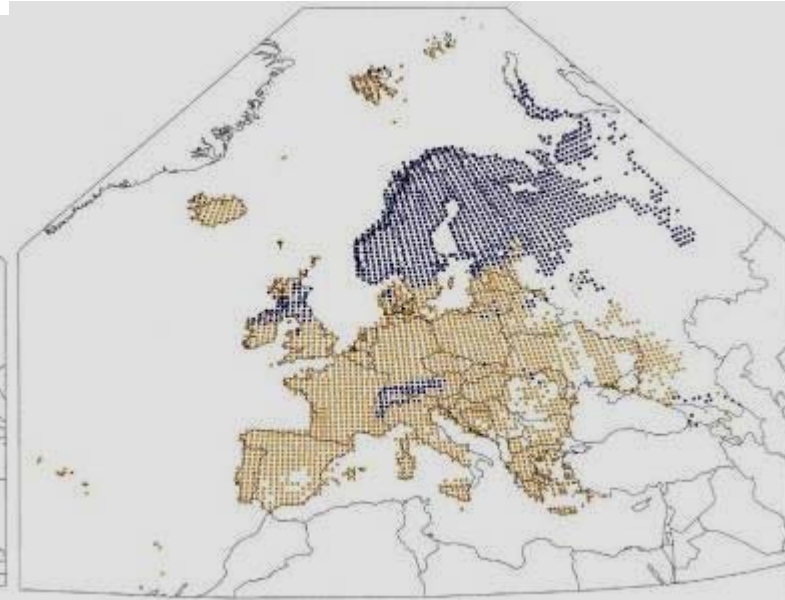


- Climate change – some data and facts
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Current distribution (according to EBCC)

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Distribution at the end of the 21th century (Simulation)

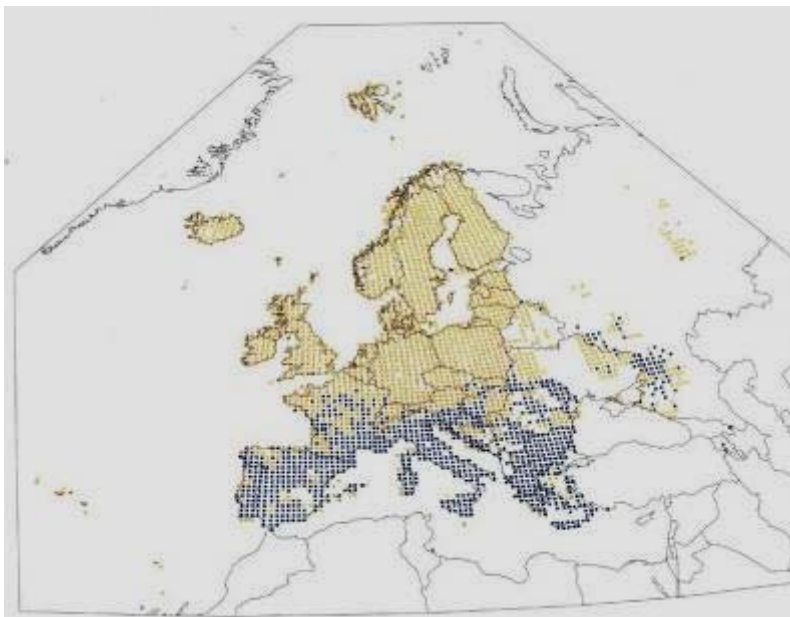
Change of perspectives of consideration

Climate change and distribution shift

Scops Owl (*Otus scops*)

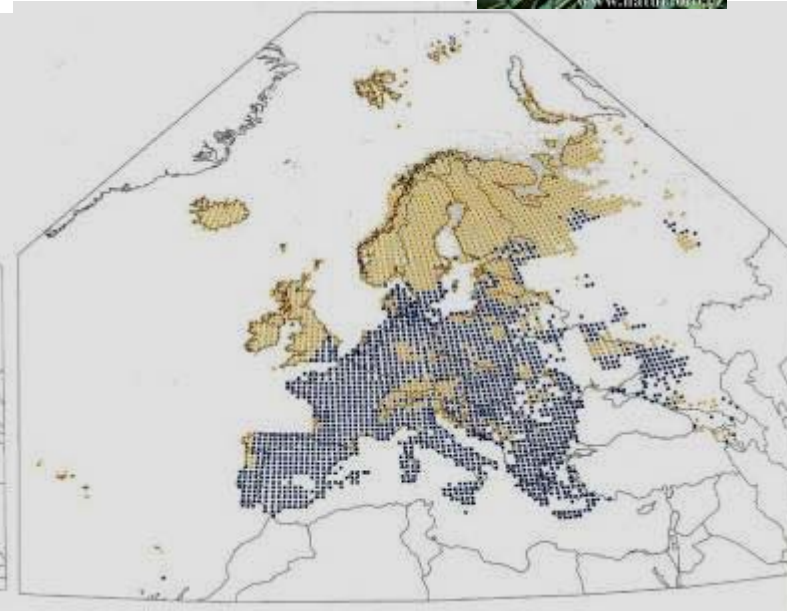


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Current distribution (according to EBCC)

Reference: Huntley et al. (2007)



Distribution at the end of the 21th century (Simulation)

Adaptation in land use

Agricultural GhG emissions in Germany

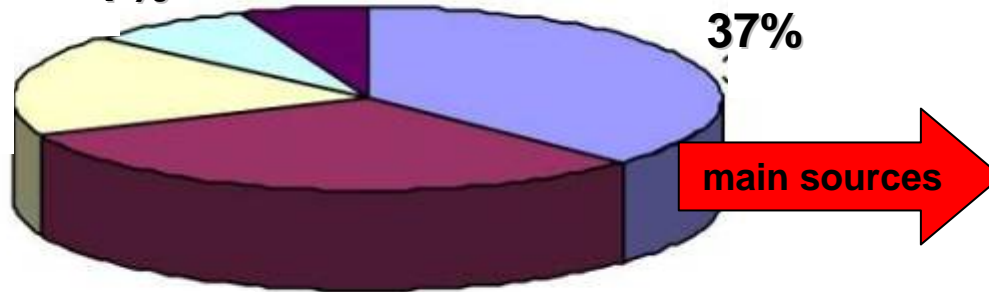
in % (as of 2004)

Management of farm-produced fertilizer

Animal digestion
18%

Energy emission
6%

Land use/ Land use change
37%



Agricultural soil use
32%

- Agricultural use of peatlands => CO₂, N₂O
- Modified use of mineral soils (forest, grassland, fallow to acre) => CO₂, N₂O

➤ **Developing options for integrating agriculture (and forestry) into carbon emission trade.**

- Direct N₂O emissions from the use of mineral and farm-produced fertilizer
- Indirect N₂O emissions (Elution and deposition)

(Saathoff 2008, changed according to: Wegener et al. 2006; Data basis UBA 2005, 2006; Dämmgen 2006)

Ecosystems as carbon sinks

➤ Integrating carbon sinks
into nature conservation and management

Climate change – some data and facts

Effects on species, habitats, landscapes

Conclusions for nature conservation

C-reserves of ecosystem soils (t C ha⁻¹, U-Tiefe: 0 - 0,3 m)

Study	Wetlands	Greenlands	>	Forest	>	Acre
Neufeldt 2005	73 – 245*	93 - 103	?	-	>	58
Del Gado et al. 2003	-	71	>	56	>	49

* hydromorphous soils (meadow soil < Pseudogley < Gley < Moorland soil)

Ecosystems as carbon sinks

➤ Developing new land use options

- Climate change – some data and facts
- Effects on species, habitats, landscapes
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**emission:
24 t CO₂
per ha and
year**

**climate
protection at
budget price:
0 – 4 €
per t CO₂**

**agreement:
1 t CO₂
per ha and
year**



**intensively-used
grassland on peat soil**

**rewetting
+
development to
Black Alder
forest**

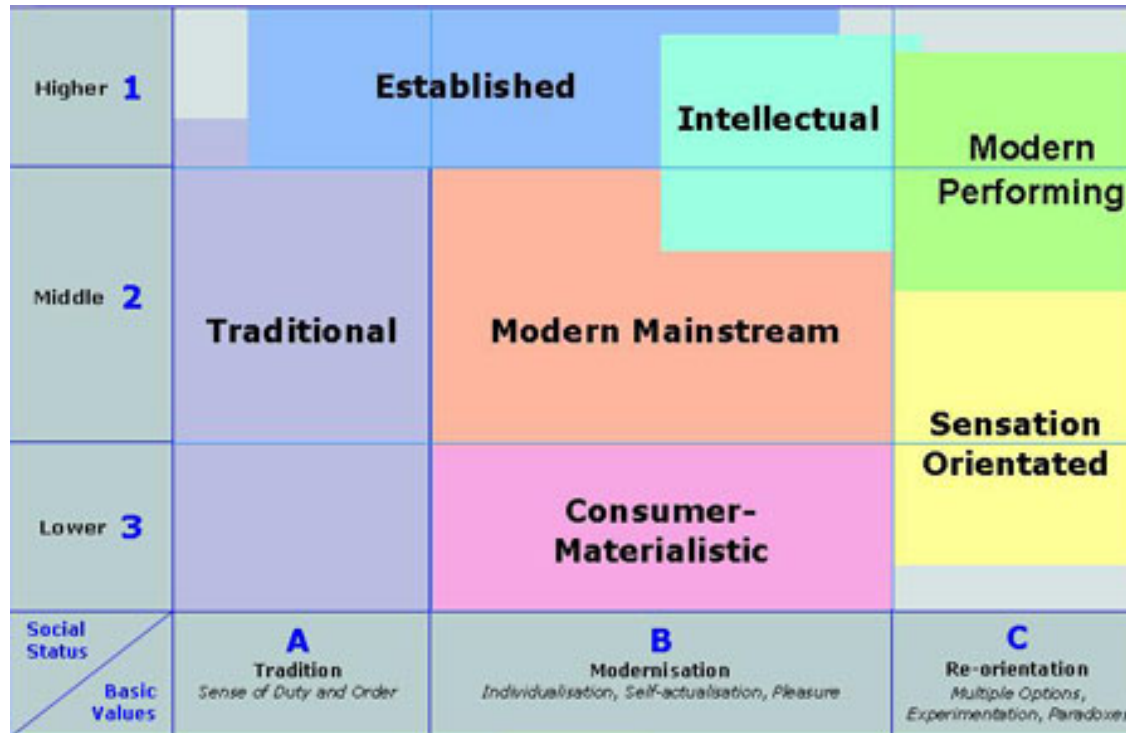


**Rewetted peatland
with occurrence of
Black Alder**

Climate change and social change

Does communication work?

- Climate change – some data and facts
- Effects on species, habitats, landscapes
- Conclusions for nature conservation



Sinus Sociovision GmbH (www.sinus-sociovision.de)

„Whom do I reach, where, by which means and with which effects?“

Develop new ways of communicating the challenge of climate change according to different target groups and lifestyles

Thank you!

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President of the German Federal Agency for Nature Conservation

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