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Fachgebiet Landschaftsplanung
und Landschaftsentwicklung

Vulnerability assessment for a protected area in Germany

– from theory into practice

Bachelor Thesis

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Outline

- Objective and approach
- Study area
- Vulnerability assessment
- Recommendations for adaptation
- Conclusions

Objective and approach

- Can vulnerability assessments be of practical relevance for the adaptation of management strategies in a protected area?

- Carry out a vulnerability assessment for a Natura 2000-site in Brandenburg Germany
  - Based on an analysis of the study area and literature review
  - Use of available / existing data and methods

Study area “Rambower Moor”

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Alkalic fen and surroundings (448 ha)

- Natura 2000-site with 8 protected habitat types and 5 species
- Within biosphere reserve “Flusslandschaft Elbe-Brandenburg”

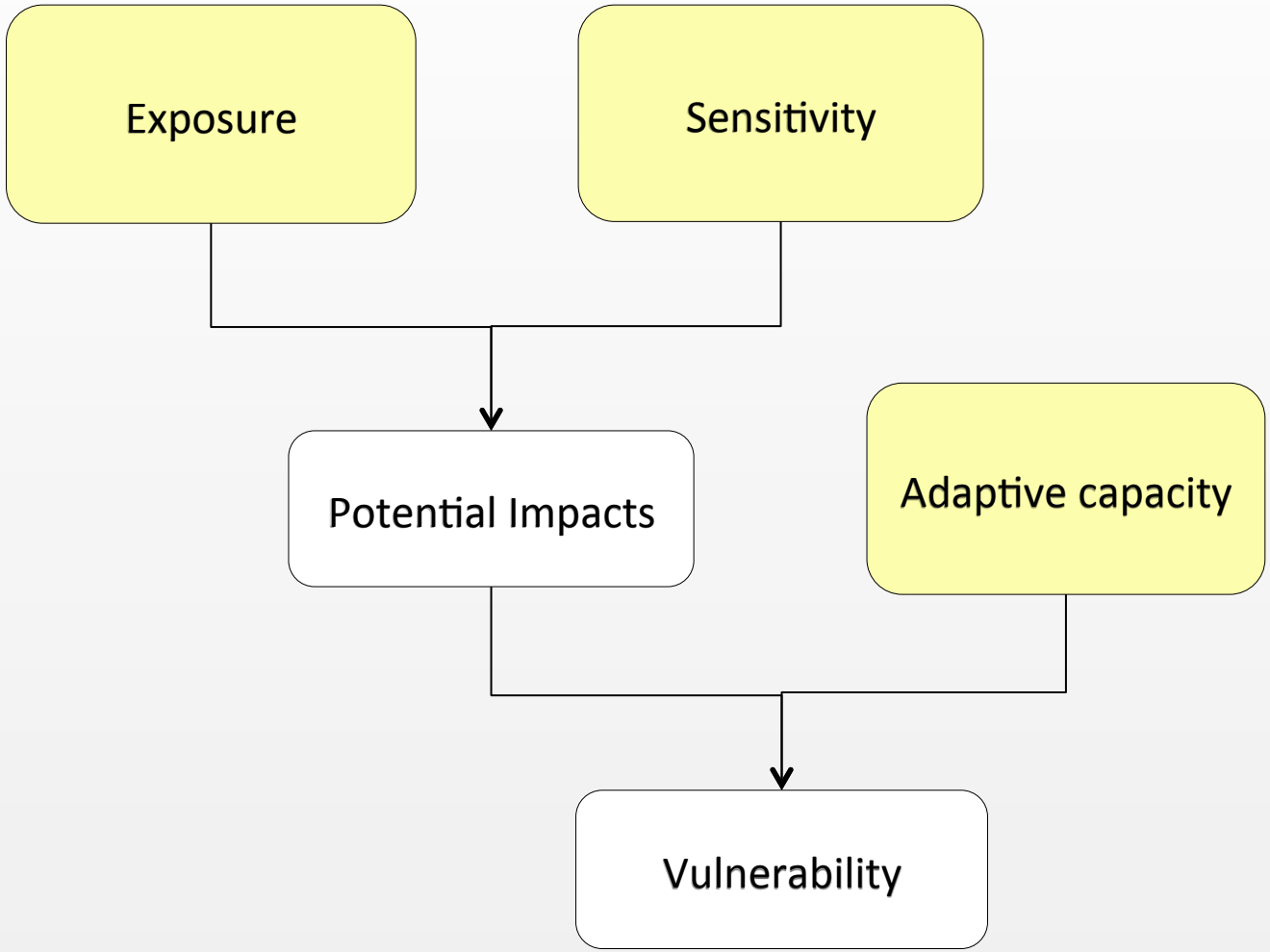
Ownership structure

- 50% under responsibility of the biosphere reserve
- 50% private landowners

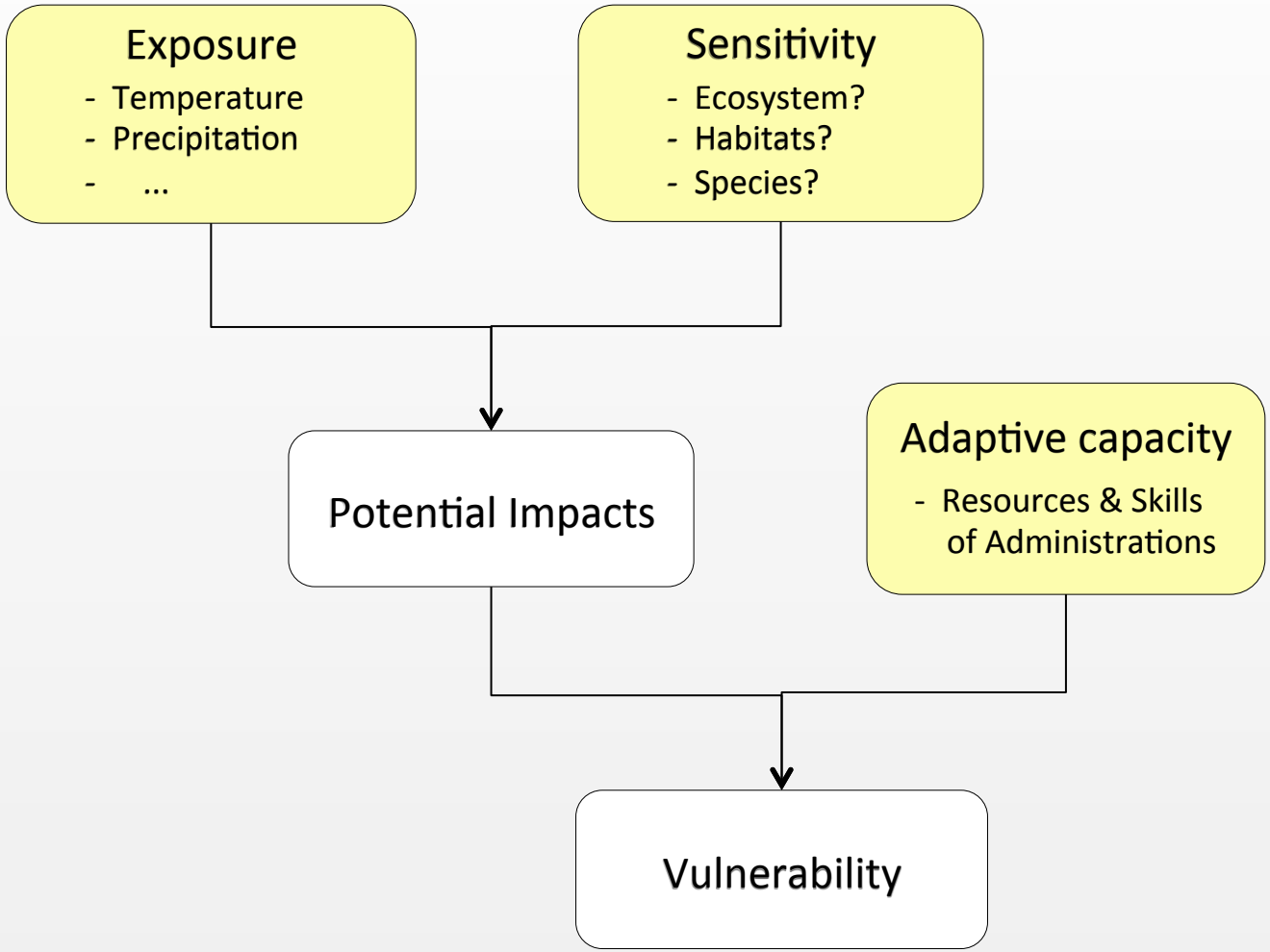
Threats

- Declining groundwater level → Peat mineralisation, eutrophication, scrub encroachment
- Impacts of agriculture: Drainage, abandonment and overgrazing

Vulnerability assessment – Components (IPCC 2001)



Vulnerability assessment – Suitable indicators

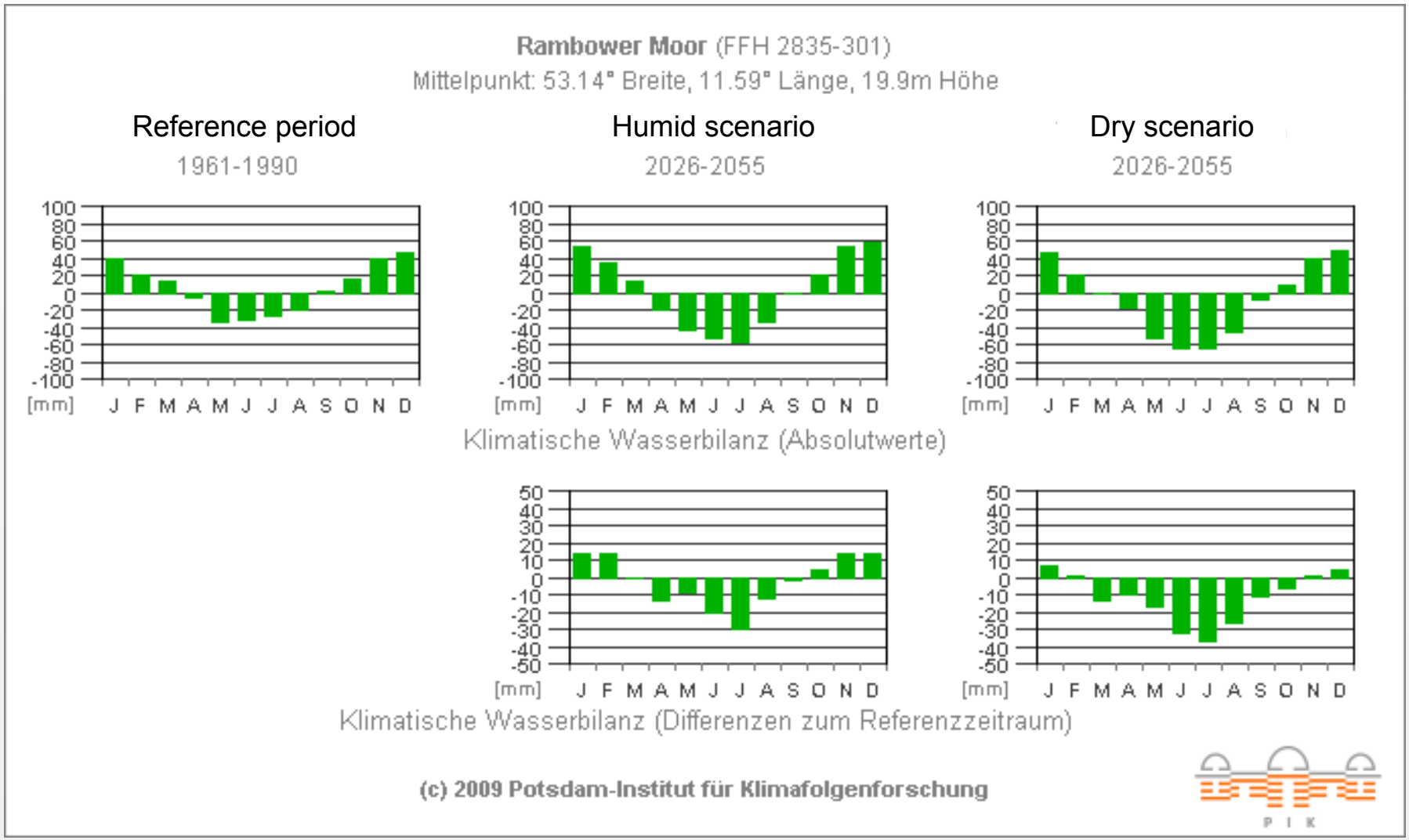


Exposure

Future exposure to climate change

- Assessment based on regional climate data published by PIK (2009) and Holsten et al. (2009)
- Climate model with 2 extreme scenarios (dry and humid) 2026-2055
- Available data:
  - Changes of temperature and precipitation
  - Climatic water balance
  - Soil water content

Climatic water balance



Sensitivity of habitat types – Ellenberg's Indicator values

- Approach of Schlumprecht et al. (2005), Holsten (2007)
- Temperature indicator values
  - 9-point scale, 1-4 → cool indicator plants
- Humidity indicator values
  - 12-point scale, 7-9 → humidity indicator plants
  - Water habitats and aquatic plants (10-12) can not be assessed
- Lack of data → "characteristic species"-lists by Federal State of Brandenburg

Carex remota
→ Temperature 5
→ Humidity 8

Habitat type Alluvial forests (91E0)

Sensitivity of habitat types – Ellenberg's Indicator values

Results

- High sensitivity towards dryness
  - 6 of 7 habitat types are highly sensitive towards dryer conditions (57-100% of all species are indicator species for humid sites)
- Low sensitivity towards warmer conditions
  - No or few cool indicator plants
  - Only „Alkaline fens“ (7230) include significant number of temperature-sensitive species (26%)

Adaptive capacity of the protected area

- Determine institutional adaptive capacity
- Interview with staff members of the biosphere reserve

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  - Knowledge about the study area

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- Determine institutional adaptive capacity

- Interview with staff members of the biosphere reserve
  - Awareness of climate change and willingness to deal with climate change in protected areas
  - Financial and personal capacities of the administration
  - Knowledge about the study area
  - Contact to stakeholders and ability to influence land use and water management in the study area

Vulnerability assessment

Results

- High exposure to climate change
- High sensitivity of water-dependent species and habitats
- Low capacities of the administration to adapt to climate change

→ High vulnerability

Vulnerability assessment

Results

- High exposure to climate change
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- Low capacities of the administration to adapt to climate change

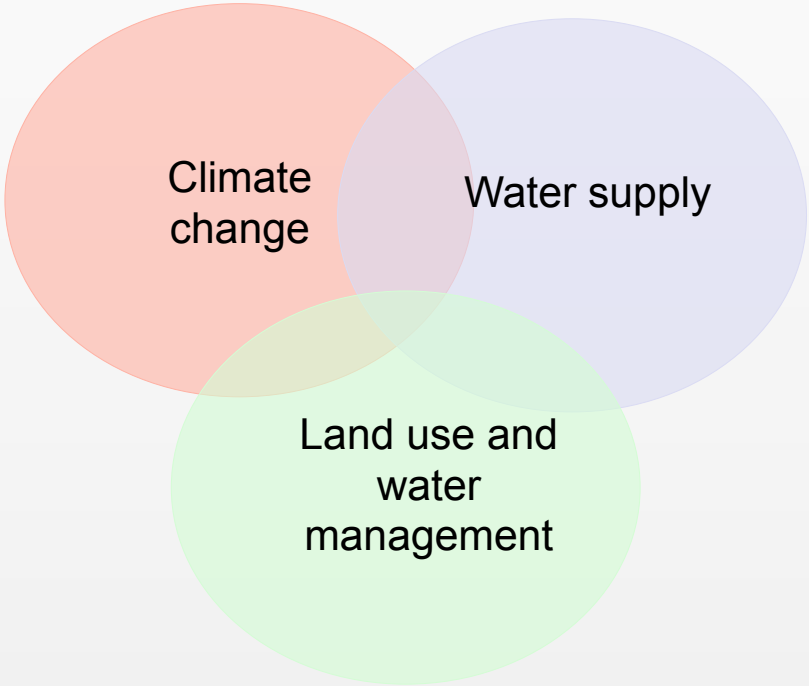
→ High vulnerability

Limitations

- Lack of up-to date data
- Uncertainty of local climate change impacts
- Lack of knowledge about complex interactions between climate and ecosystem

Vulnerability assessment – Relevance for management?

Management must deal with all impact factors:



Vulnerability assessment – Relevance for management?

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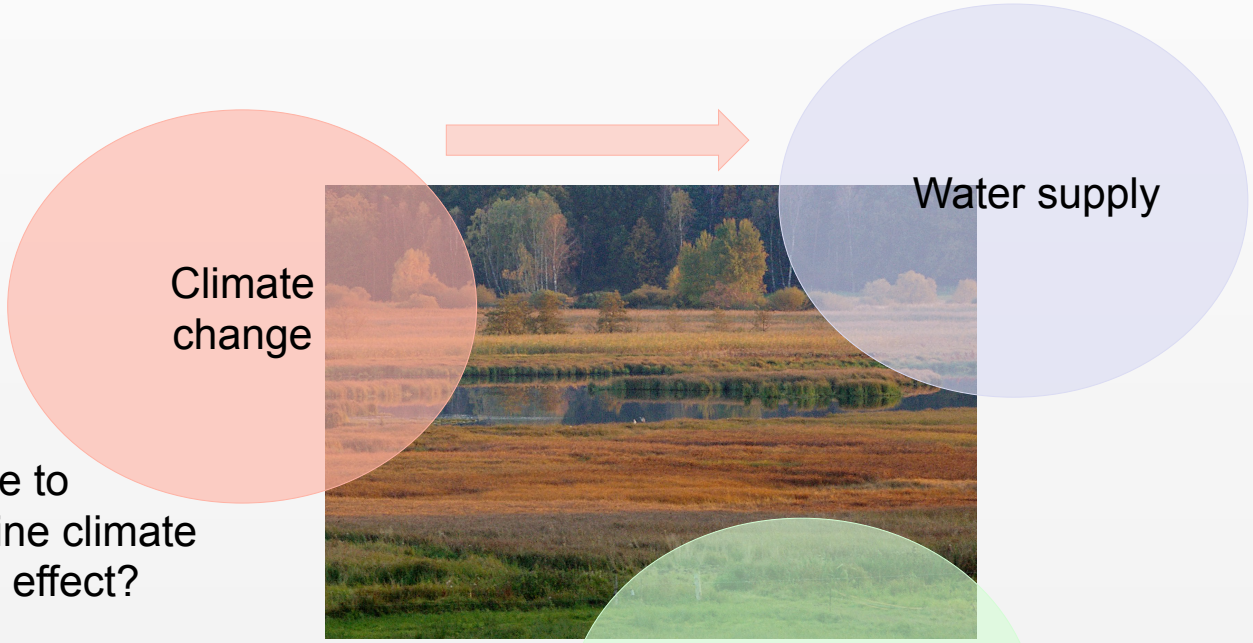

Crucial factor for existence of fen!

Possible to determine climate change effect?

Has changed the fen fundamentally over 200 years dewatering

Recommendations for adaptation of management

Most required actions:

- Collection of data
  - Species /habitats, groundwater level, soil / peat
- Improvement of stakeholder communication
- Water and land use management
  - Extensive use of grasslands
  - Increase of groundwater level
- Monitoring

Literature recommendations:

- Enable species migration
- Support of highly vulnerable species
- Adaptive management

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Literature recommendations:

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Gap between scientific approaches and practical advice for the adaptation of management

Conclusions

- Vulnerability assessment increases awareness of climate change impacts
- Lack of up-to date data and knowledge reduces validity of the vulnerability assessment
- Narrow focus on climate change doesn‘t meet management reality

Thank you!

Literature:

Ellenberg, H. (1979): Zeigerwerte von Pflanzen in Mitteleuropa. In: Scripta Geobotanica 9, 2. Auflage. Goltze, Göttingen.

Holsten, A. (2007): Ökologische Vulnerabilität von Schutzgebieten gegenüber Klimawandel – exemplarisch untersucht für Brandenburg. Diplomarbeit, Universität Tübingen, ausgeführt am Potsdam Institut für Klimafolgenforschung (PIK)

Holsten, A. et al. (2009): Impact of climate change on soil moisture dynamics in Brandenburg with a focus on nature conservation areas. In: Ecological modelling 220, Nr. 17

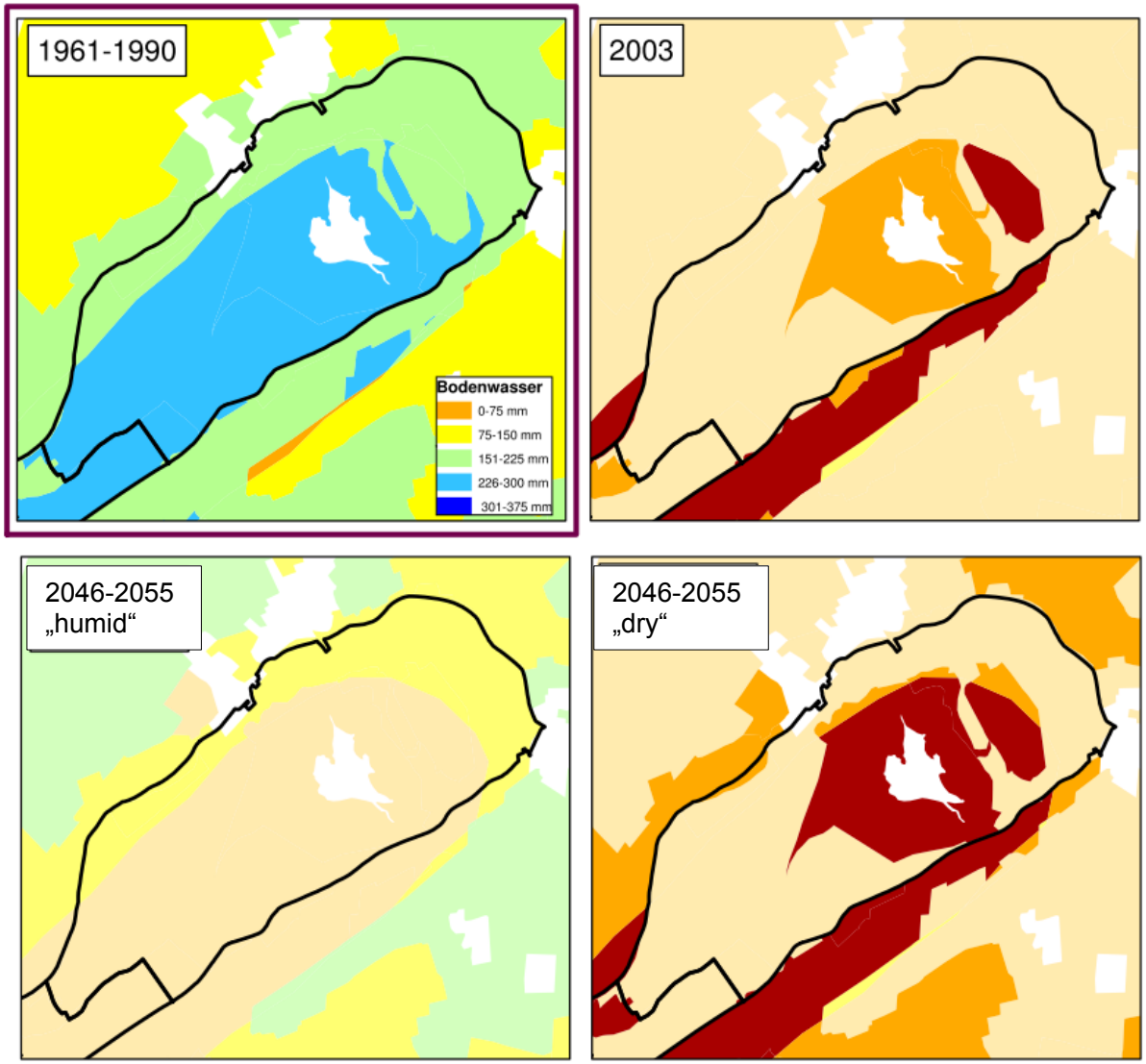
PIK (2009): Climate change and protected areas. www.pik-potsdam.de/services/infothek/klimawandel-und-schutzgebiete

Schlumprecht, H. et al. (2005): Folgewirkungen für Klimaänderungen für den Naturschutz – Ausgewählte Ökosysteme und Arten. Studie im Auftrag des LfUG. Chmenitz

Habitat types

Habitat type		Humidity	Tempe rature
6230	* Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	90 %	0 %
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	72 %	0 %
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	74 %	0 %
7210	* Calcareous fens with Cladium mariscus and species of the Caricion davallianae	100 %	0 %
7230	Alkaline fens	96 %	26 %
9190	Old acidophilous oak woods with Quercus robur on sandy plains	9 %	0 %
91E0	* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno- Padion, Alnion incanae, Salicion albae)	57 %	4 %

Soil water content



Soil water content

[mm]

- -70 - -35
- -35 - -25
- - 25 - -15
- - 15 - 5
- -5 - 5
- 5 - 20
- FFH-Gebiet

Daten von Anne Holsten, publiziert in Holsten et al. 2009 Ecological Modelling

Karte: 29.8.2011
Dr. Katrin Vohland

Sensitivity of habitat types - Petermann et al. (2007)

- Set of indicators for sensitivity of habitat types towards climate change, e.g.
  - Geographic range,
  - Restriction to mountainous areas,
  - Regenerability of ecosystem.
- Expert-based rating of every habitat type and aggregation to 3 sensitivity classes (high – medium – low or not sensitive)

Results

- 2 habitat types with high sensitivity (7230, 91E0)
- 6 habitat types with medium sensitivity against climate change

Sensitivity of habitat types - Comparison

- Rating of sensitivity of Petermann et al. (2007) is lower than Ellenberg values indicate
  - Rating of Petermann et al. must be seen in relation to all habitat types (equidistant distribution)

    → classification of high, medium and low sensitivity is not content-based
- „Dependency on groundwater-supply“ and humidity indicator value correlate

Adaptive capacity

Awareness

- Scepticism concerning regional climate models
- Other problems more urgent than climate change
  - development of wind farms
  - ploughing up grasslands

Financial capacities

- Very small budget
- Funding bound to designated purpose → low planning ability

Adaptive capacity

Knowledge of the protected area

- Lack of up-to-date data
- No monitoring, merely random observations

Stakeholder contact / Impact on land use and water management

- Construction of agricultural drainage channels without agreement
- Available funding hardly allows sustainable use of fens and marshlands