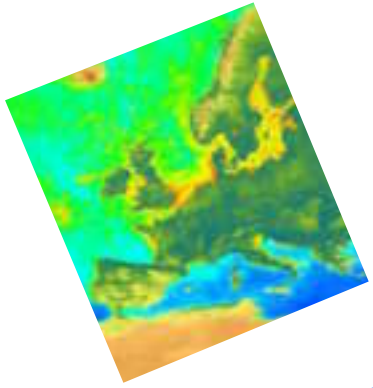
# Global change vulnerability – assessing the European human-environment system

Dagmar Schröter and the ATEAM consortium



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# Vulnerability

**Definition:** Vulnerability is the likelihood of a specific human-environment system to experience harm due to exposure to perturbations, accounting for the process of adaptation.

**Objective:** To inform the decision-making of stakeholders about options for adapting to the effects of global change

→ facilitate sustainable development

Schröter et al. 2004, Miti. Adapt. Glo. Cha., in press.

# Vulnerability

exposure

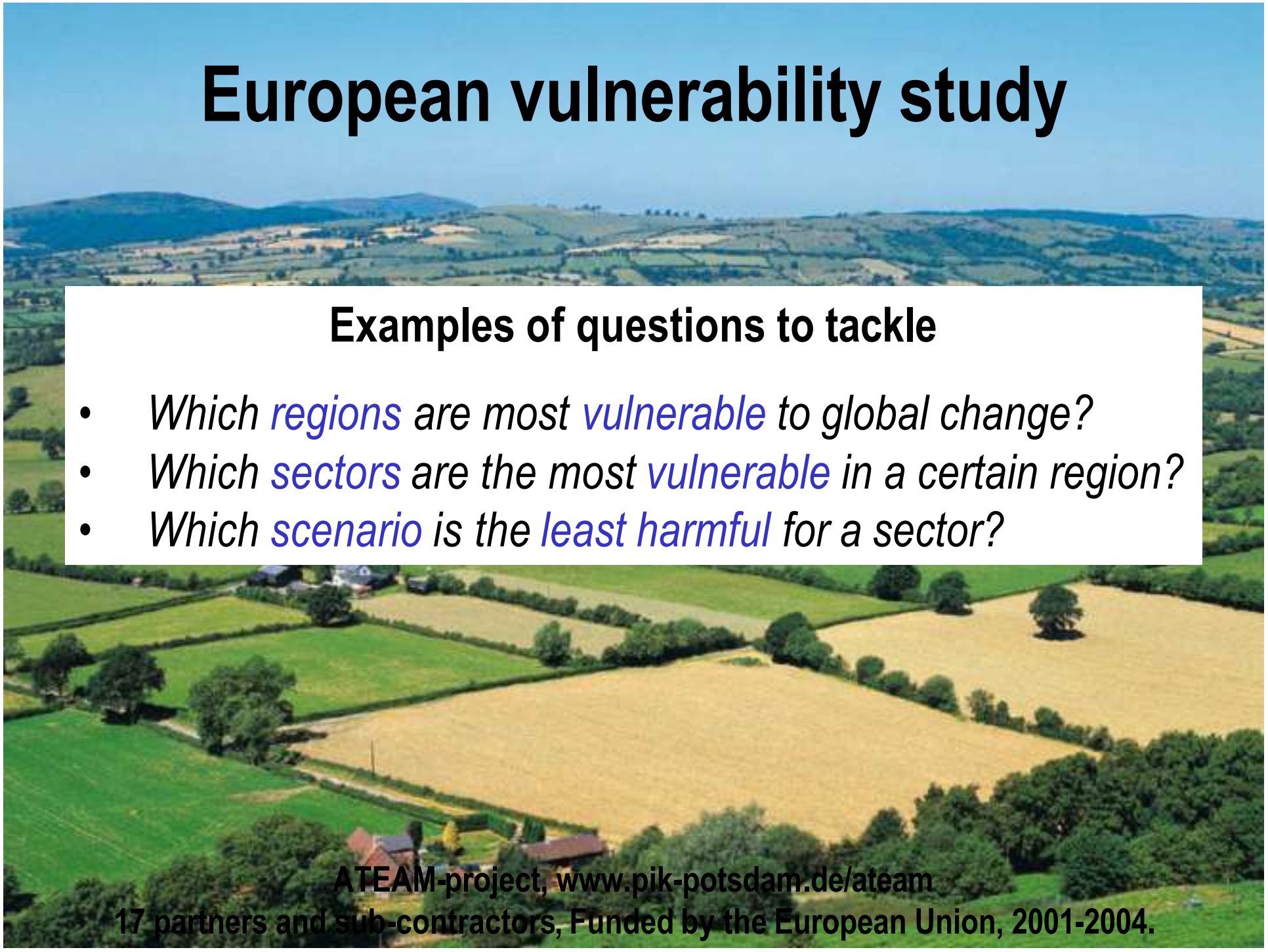
sensitivity

adaptive capacity

potential impact

vulnerability

# European vulnerability study



## Examples of questions to tackle

- *Which regions are most vulnerable to global change?*
- *Which sectors are the most vulnerable in a certain region?*
- *Which scenario is the least harmful for a sector?*

**ATEAM-project, www.pik-potsdam.de/ateam**
**17 partners and sub-contractors, Funded by the European Union, 2001-2004.**


food production


slope stability


fire prevention


water storage


fibre production


biodiversity


pollination

# The environmental dimension of vulnerability

- Ecosystems provide services that sustain and fulfill human life (see 1st MA book, Alcamo et al. 2003)
- To know the potential impacts of global change on ecosystem services within a specific region is to understand an essential part of this region's vulnerability.


fodder production


carbon sequestration


flood protection


tourist attraction


recreation


stabilising micro-climate

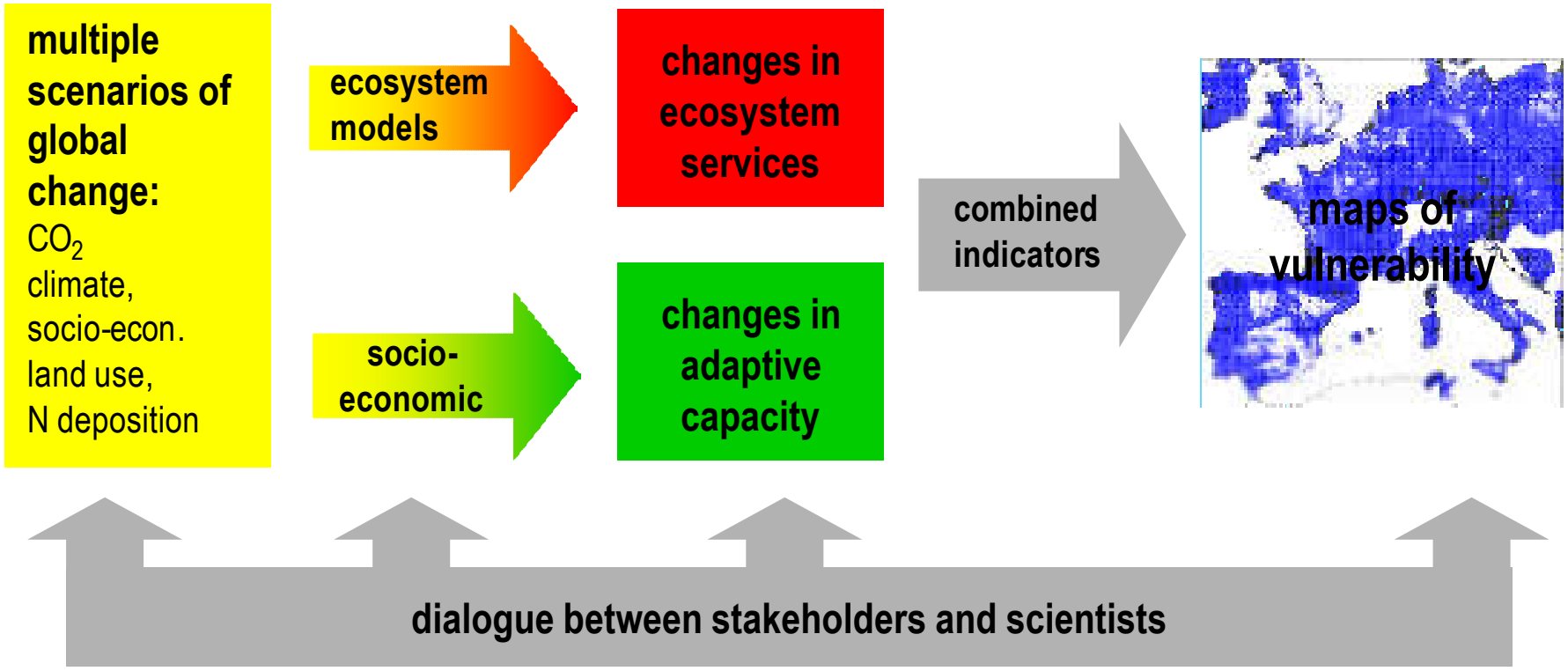

game reserve


shelter for life stock


beauty

# European Vulnerability Assessment

## Methodology



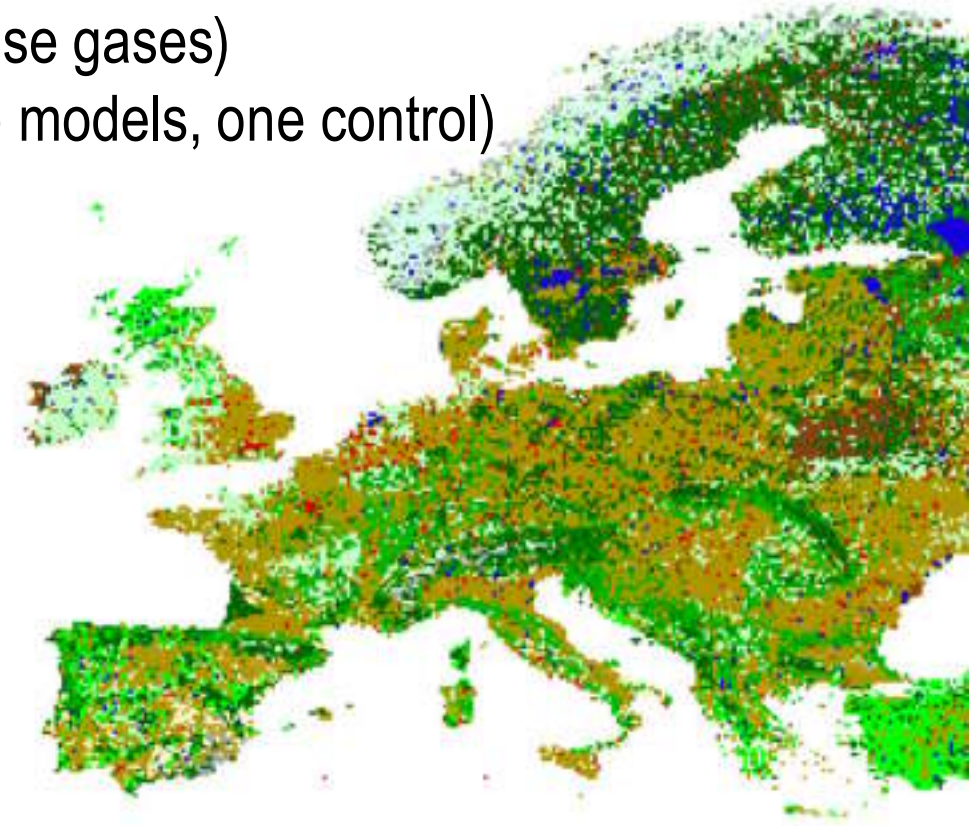

Metzger & Schröter 2004 (submitted).

# Consistent global change scenarios

As input to our ecosystem and adaptive capacity models.

- Spatially explicit: 10' x 10' (ca. 16 x 16 km)
- 4 time slices (1990, 2020, 2050, 2080)
- 4 Socio-Economic Scenarios
- 4 Emission Trajectories (greenhouse gases)
- 17 Climate Scenarios (four climate models, one control)
- 7 Land Use Scenarios
- 4 Nitrogen Deposition Scenarios

**Multiple drivers, multiple plausible scenarios.**



# Sectors, ecosystem services and modelled indicators

| Sectors | Services | | Indicators |
|---|---|---|---|
| **Agriculture** | Food & fibre production<br>Bioenergy production |  | • Agricultural land area (Farmer livelihood)<br>• Suitability of crops<br>• Biomass energy yield |
| **Forestry** | Wood production |  | • Tree productivity: growing stock & increment |
| **Carbon storage** | Climate protection |  | • Carbon storage in vegetation<br>• Carbon storage in soil |
| **Water** | Water supply (drinking, irrigation, hydropower)<br>Drought & flood prevention |  | • Runoff quantity<br>• Runoff seasonality |
| **Biodiversity** | Beauty<br>Life support processes (e.g. pollination) |  | • Species richness and turnover (plants, mammals, birds, reptiles, amphibian)<br>• Shifts in suitable habitats |
| **Mountains** | Tourism (e.g. winter sports)<br>Recreation |  | • Snow (elevation of snow line) |

Metzger & Schröter 2004 (submitted).

# Vulnerability

exposure

sensitivity

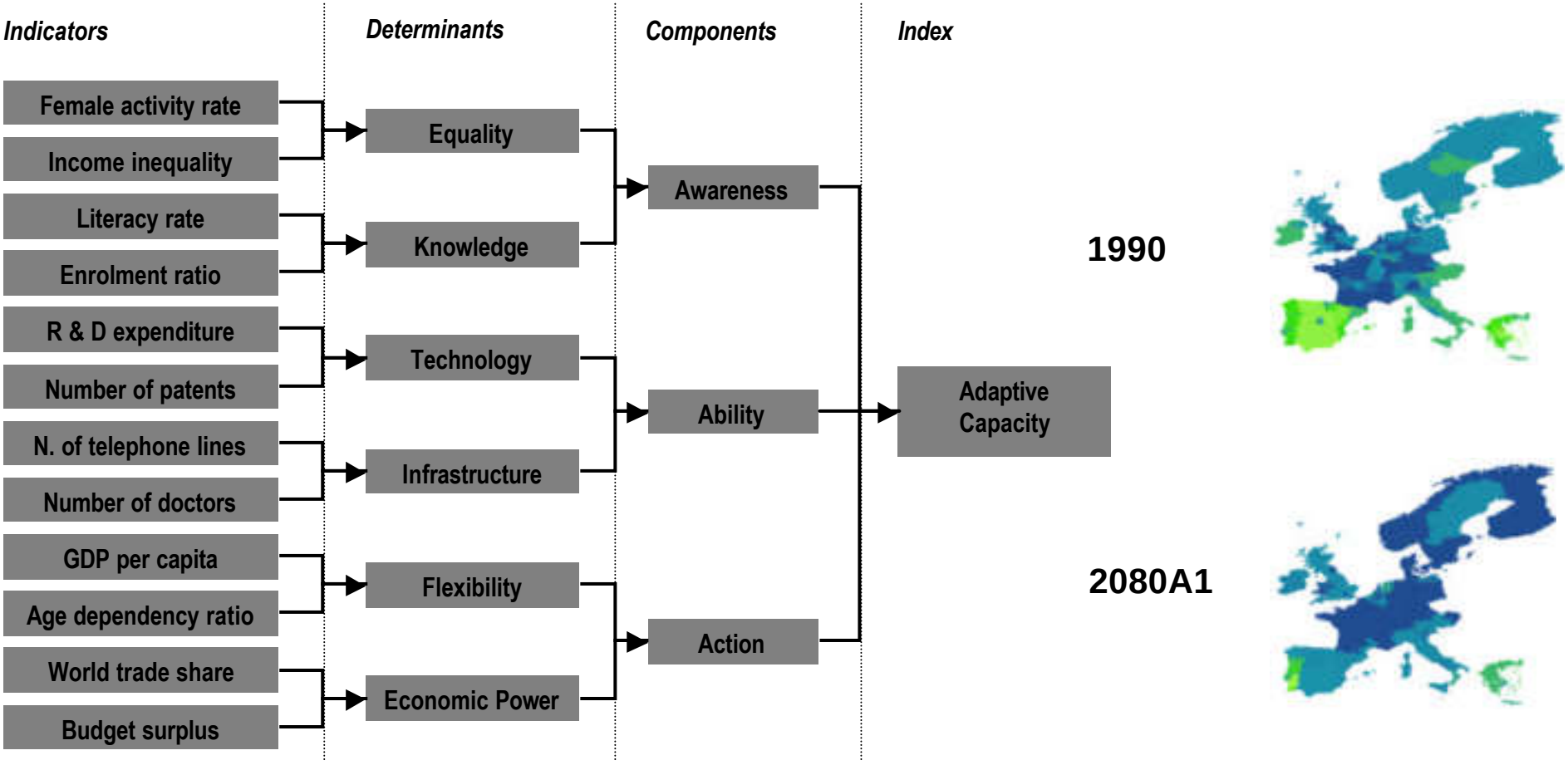
adaptive capacity

potential impact

vulnerability

# Adaptive Capacity

'the ability to implement planned adaptation measures' (based on IPCC TAR)

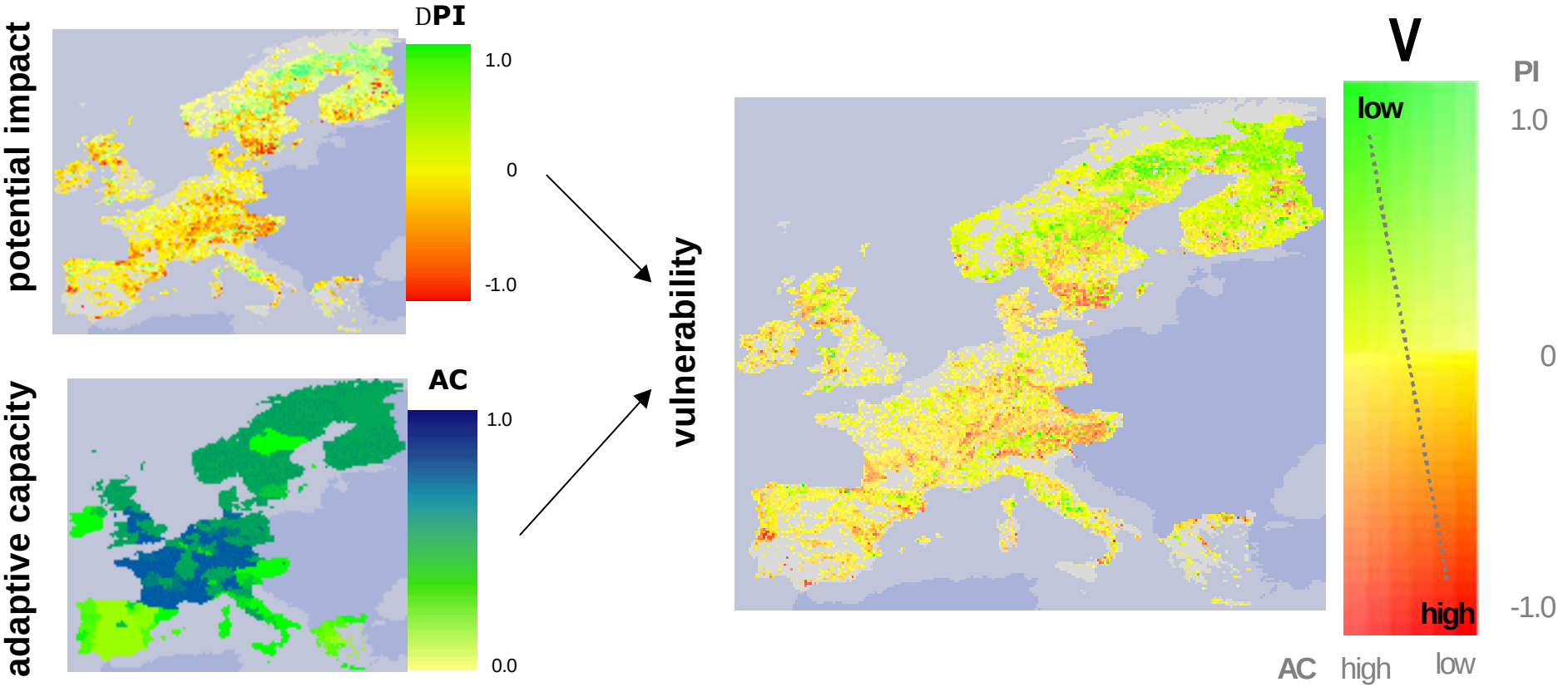


# Integration: Vulnerability

**2080A1**

## Visual overlay

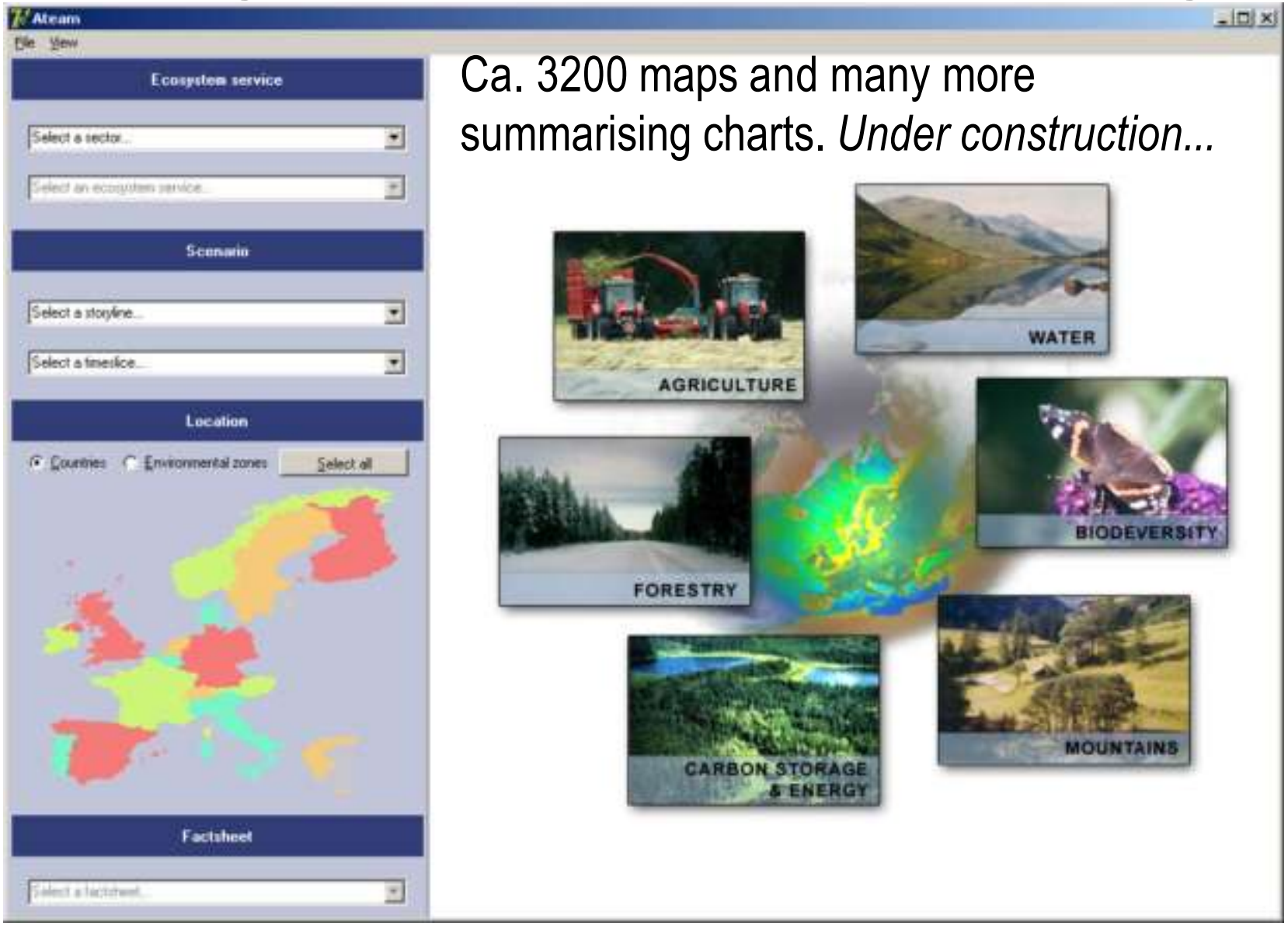
**Forestry: wood production**




V = f(PI, AC)

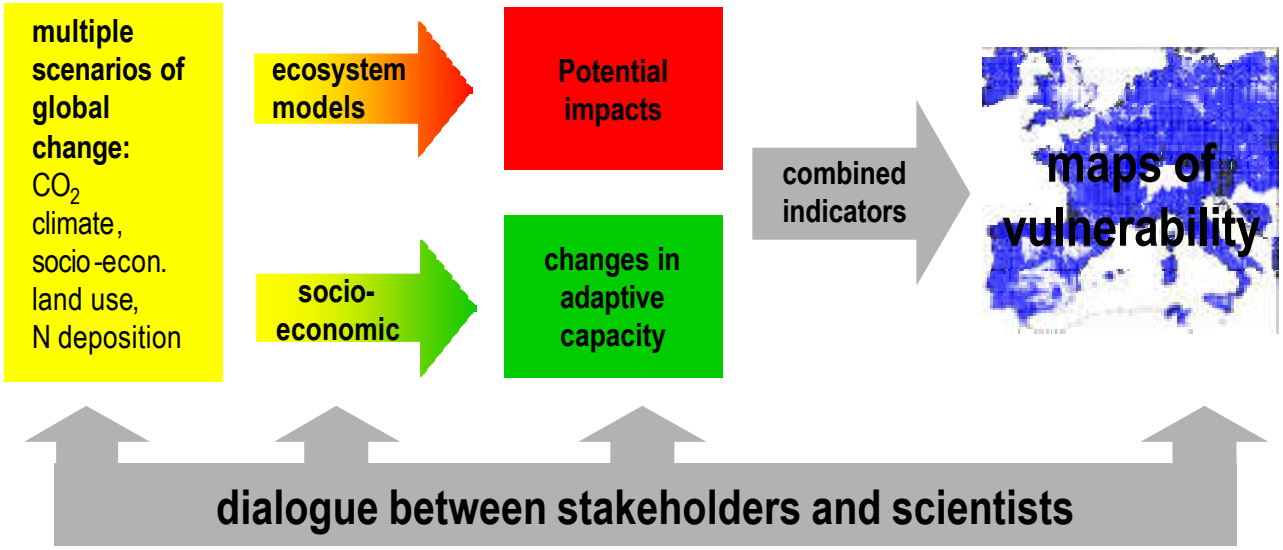
A relationship that is not specified beyond *high PI* and *low AC* → *high V*.

# … our digital atlas: ATEAM mapping tool



# ...which areas, and who is vulnerable to global change?

# How can we adapt?




Schröter et al. 2004 (in press), Metzger & Schröter 2004 (submitted).

# Conclusions: Vulnerability in Europe

- **Vulnerable region:** Mediterranean seems most vulnerable within Europe - **multiple potential impacts** [water, forestry, agriculture, tourism, carbon storage] *and* **low generic adaptive capacity**
- **Vulnerable sectors:**
  - Agriculture? Soil. **Extensification potential.** How do farmers decide? CAP...
  - Forestry? **Fire risk.** Biofuel potential. Shift to other species.
  - Carbon storage. Soil respiration and fire vs. plant growth: **declining sink 2050.**
  - Mountain tourism. **Reliable snowcover declines.** Risks and discomfort?
  - Water. Droughts, floods. **Seasonality changes**. Hydropower, storage capacity.
  - Biodiversity. Current debate. Syndrome of impoverishment? **Dynamic reserve management.**
- **Dialogue between science and stakeholders** is an important part of the results. Informed by best science, fair, focussed and sustained. **Coordination, moderation, social learning.**
- The **digital Atlas** developed with stakeholders is a useful communication tool in this dialogue.
  - Which results, scales, scenarios will be **most helpful** to stakeholders?