



University of Natural Resources
and Applied Life Sciences, Vienna
Department of Forest- and Soil Sciences

ENVIRONMENTAL POLICIES AND SOCIAL IMPACTS WITH REGARD TO LAND AND SOIL MANAGEMENT

by

Winfried E. H. Blum

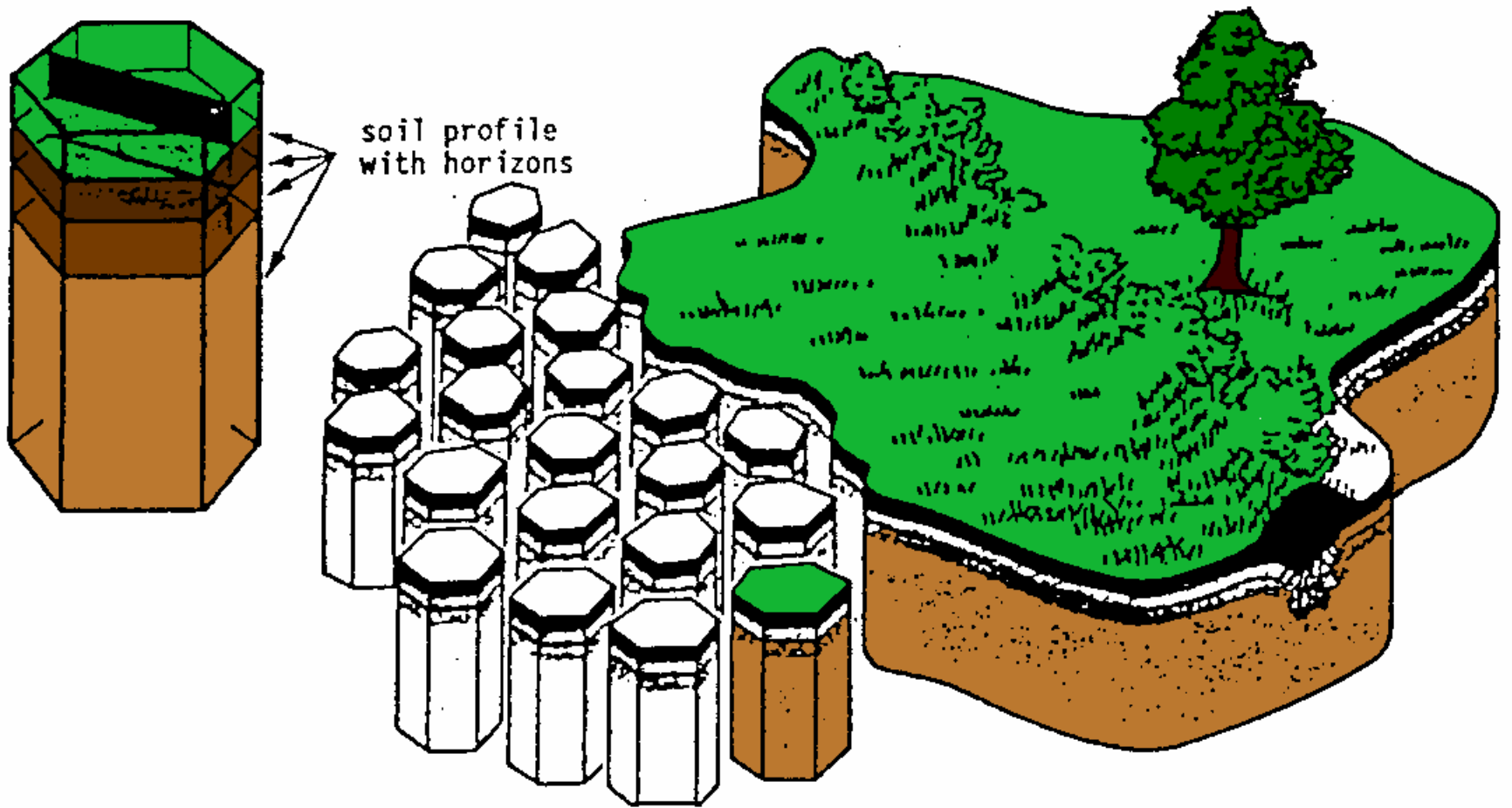
Institute of Soil Research, Department of Forest and Soil
Sciences, University of Natural Resources and Applied Life
Sciences (BOKU), Vienna



University of Natural Resources
and Applied Life Sciences, Vienna
Department of Forest- and Soil Sciences

WHAT IS LAND AND SOIL MANAGEMENT?



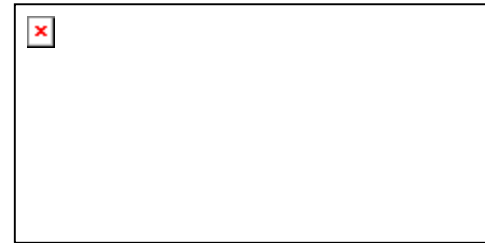




University of Natural Resources
and Applied Life Sciences, Vienna
Department of Forest- and Soil Sciences

THERE ARE 6 MAIN USES OF LAND AND SOIL





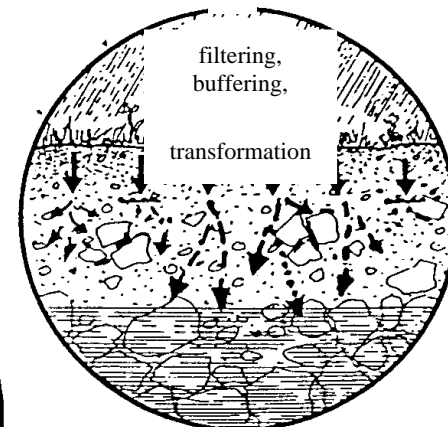
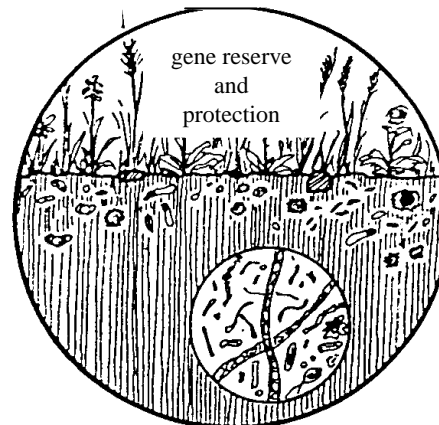
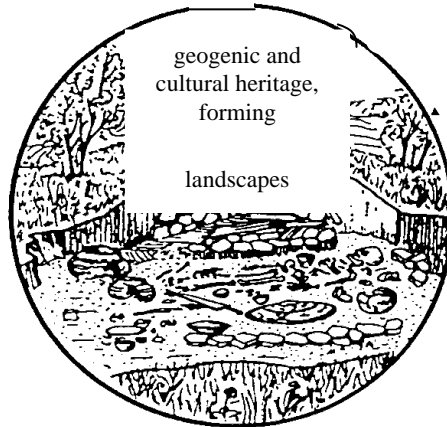
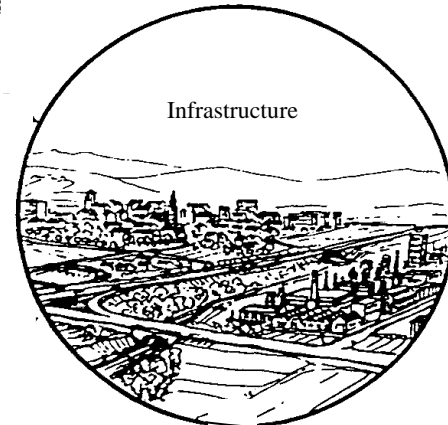
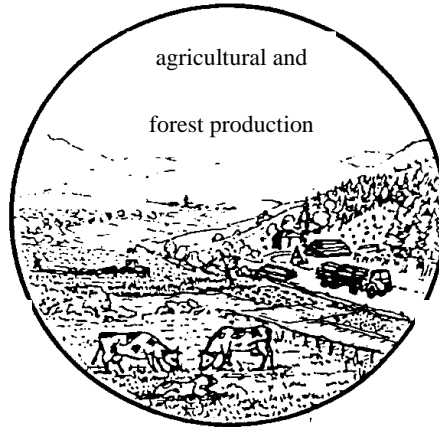
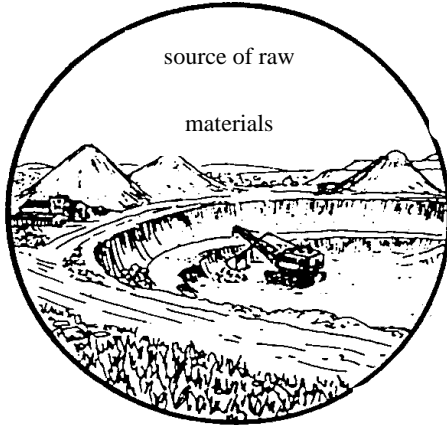
3 ECOLOGICAL FUNCTIONS AND USES:

1. PRODUCTION OF BIOMASS, ensuring food, fodder, renewable energy and raw materials
2. FILTERING, BUFFERING, and TRANSFORMATION between atmosphere, groundwater and plant cover protecting the environment
3. BIOLOGICAL HABITAT AND GENE RESERVE

3 TECHNICAL, INDUSTRIAL AND SOCIO-ECONOMIC FUNCTIONS AND USES:

1. PHYSICAL BASE FOR TECHNICAL, INDUSTRIAL AND SOCIO-ECONOMIC STRUCTURES AND THEIR DEVELOPMENT, e.g. industry, housing, transport, sports, recreation, dumping of refuse etc.
2. SOURCE OF RAW MATERIALS, WATER AND GEOGENIC ENERGY
3. GEOGENIC AND CULTURAL HERITAGE, forming an essential part of the landscape and concealing aleontological and archaeological treasures

THE SIX MAIN USES OF LAND AND SOIL



WHAT ARE SOCIAL IMPACTS?

Social impacts can be caused by:

- **Natural** environmental processes, e.g. natural disasters, such as forest fires, extreme meteorological events, causing inundations and landslides, etc.
- **Human induced** environmental processes, such as depletion of natural resources, especially of soil and water, loss of biodiversity, sealing of land by urbanisation, industrialisation, tourism and climate change.

Social impacts caused by these processes are mostly complex, with environmental, technical, social, economic and even cultural implications.

Two dimensions are of paramount importance:

- the dimension of space =
the spatial scale of processes;
- the dimension of time =
the time scale (pace, velocity)
of processes

In the following, we aim at social impacts caused by

- land degradation and desertification,
- water scarcity.

Land degradation and desertification are mainly caused by two types of unsuitable land use:

- competition in space and time between the six main uses of land and soil,
- unsustainable use of single soil functions . e.g. biomass production by agriculture.

COMPETITION BETWEEN THE SIX MAIN USES OF SOIL AND LAND

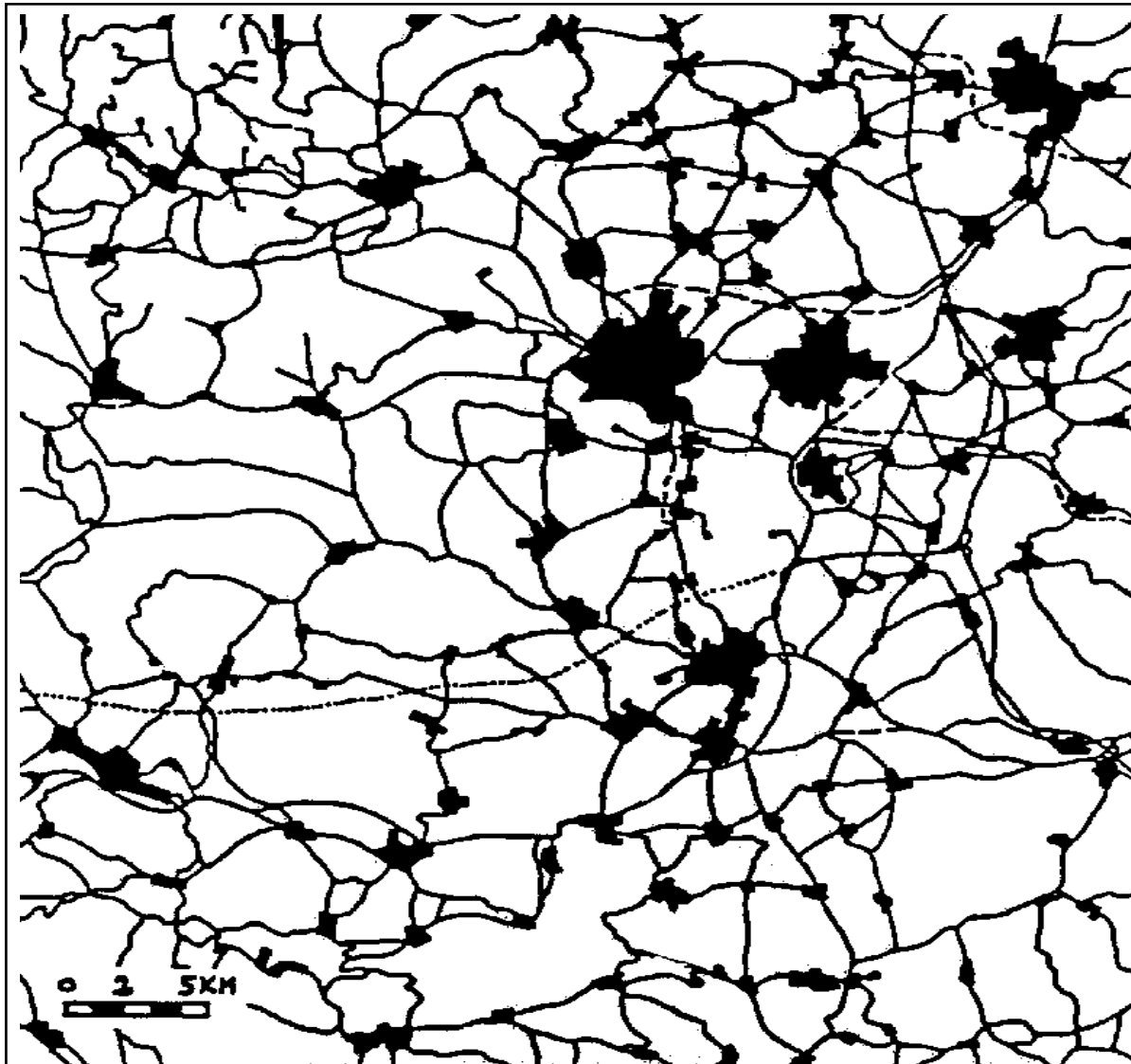
- Exclusive competition between the use of land for infrastructure, source of raw materials and geogenic and cultural heritage on the one hand and the agricultural and forest production, filtering, buffering and transformation activities as well as the soil as a gene reserve on the other;
- Intensive interactions between infrastructural land use and its development and agriculture and forestry, filtering, buffering and transformation as well as soil as a gene reserve;
- Intensive competition between the three ecological soil and land uses themselves.



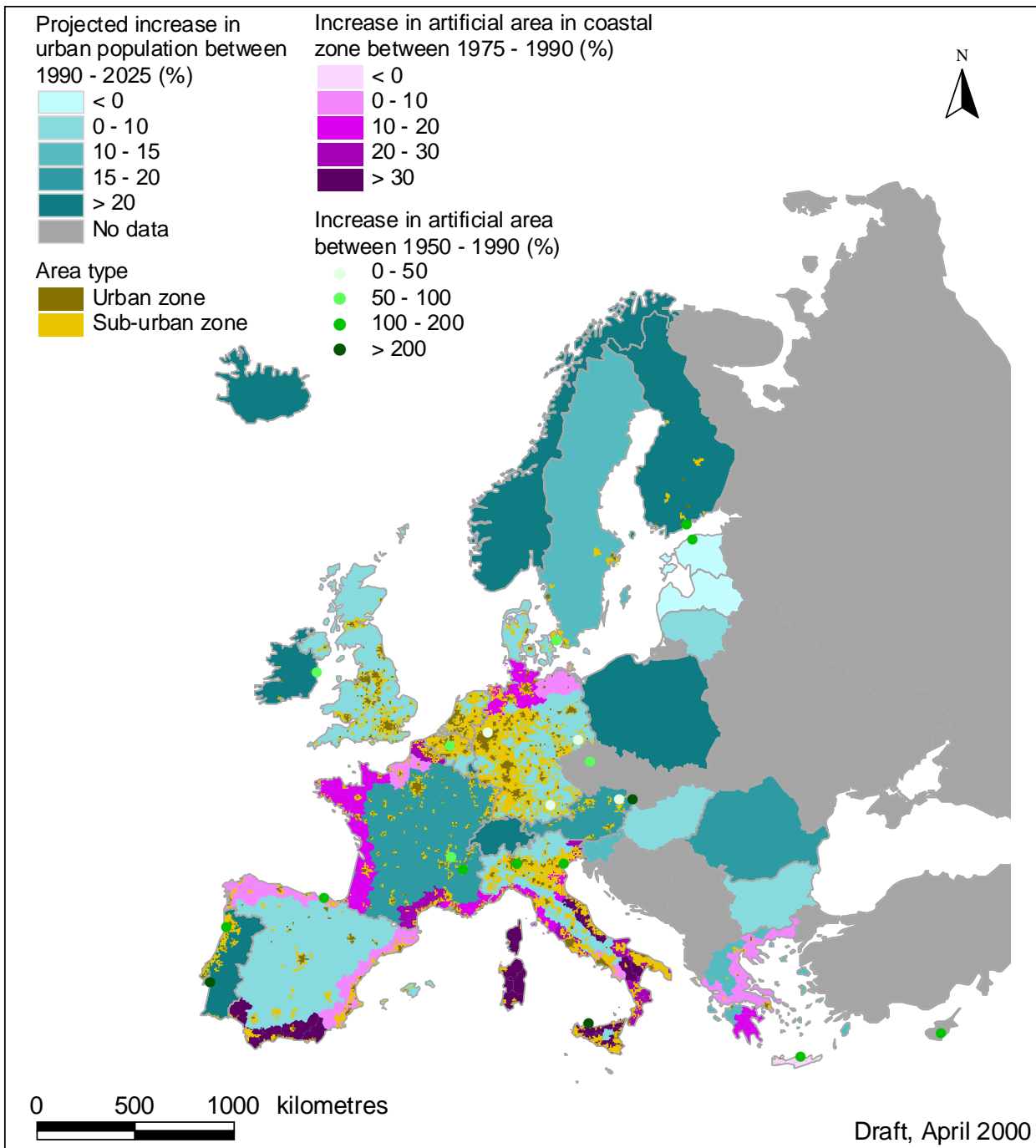
European natural resources



Europe's built environment



Sealing of soils and landscapes by settlements and roads
(Example: south-western part of Baden-Württemberg, Germany)





SOCIAL IMPACTS CAUSED BY SEALING = URBANISATION, INDUSTRIALISATION AND TOURISM

1. Ecological-technical problems:

- no rainwater infiltration, only surface runoff (danger of flooding);
- high evaporation and water losses to the atmosphere;
- increased temperature levels through storage of radiation energy and reflection;
- loss of natural landscapes and biodiversity;

**CONTRIBUTING
TO
DESERTIFICATION**

URBANISATION contd.

- production and accumulation of refuse and emission of dust and gases
- high demand of water in competition with other uses, e.g. agriculture, etc.

2. Social, economic and cultural constraints:

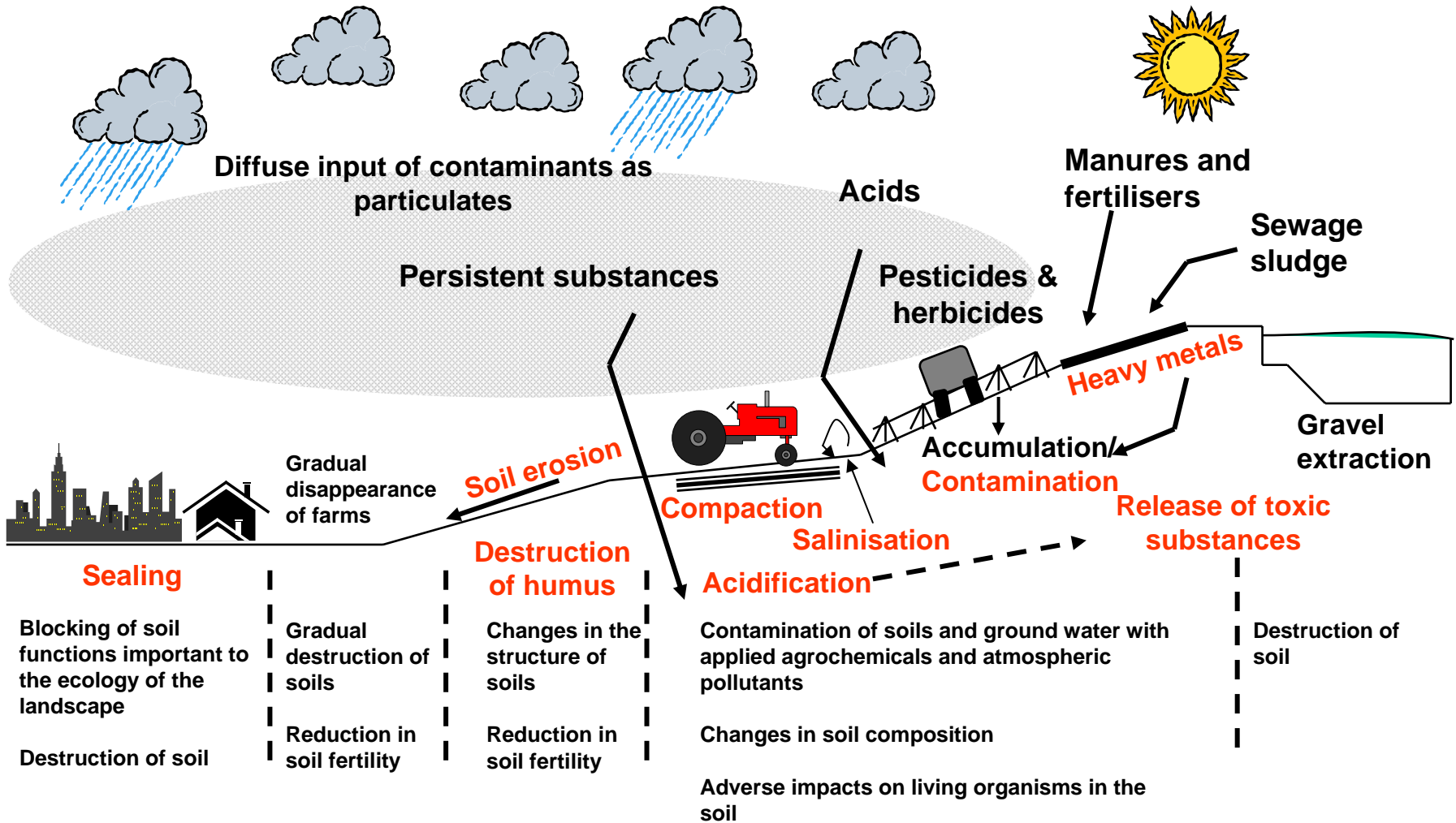
- loss of livelihood through loss of crop and pasture land
- emergence of new social groups
- competition between local population and tourists in water use and the use of terrestrial and aquatic landscapes etc.



University of Natural Resources
and Applied Life Sciences, Vienna
Department of Forest- and Soil Sciences

IMPACTS OF UNSUSTAINABLE AGRICULTURAL LAND USE

The impact of human activities on soil









CONFLICTS THROUGH THE DEMAND OF WATER FOR DIFFERENT AGRICULTURAL PRODUCTION LINES:

- FOOD AND FODDER
(FOOD SECURITY)
- BIOFUELS (ETHANOL
AND BIODIESEL)

Competition for water, example water use in Spain (D. Barcelo 2008):

for 1 kg maize = 770 l water

for 3 kg maize = 2.3 m³ water

3 kg maize = 1 l ethanol

1 m³ water = 0.4 €

2.3 m³ water = ~ 1 €

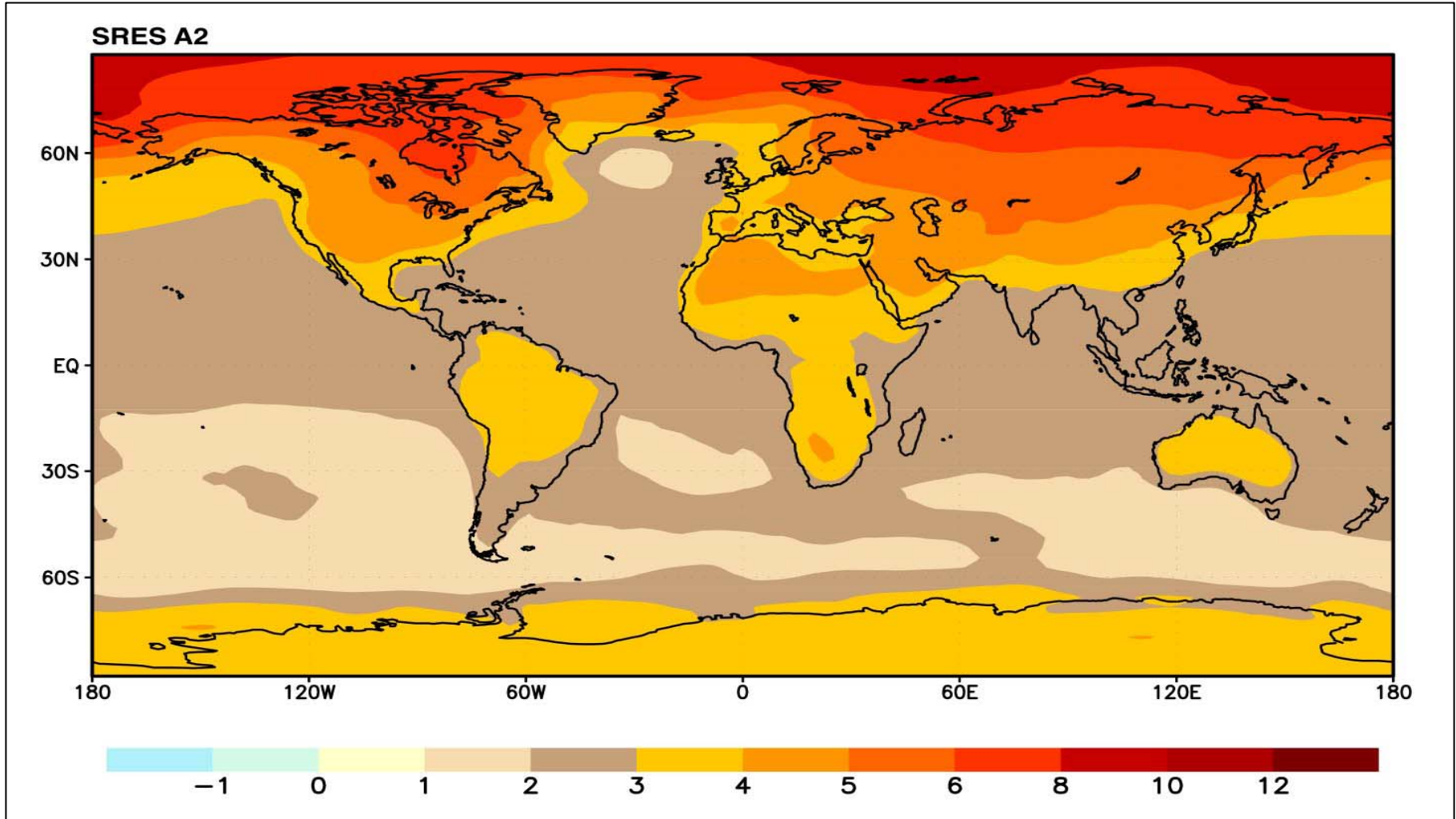
1 l ethanol = 1 € for water use only!

1 tank SUV = 100 l ethanol = 300 kg maize

300 kg maize = nutrition of 1 person/year

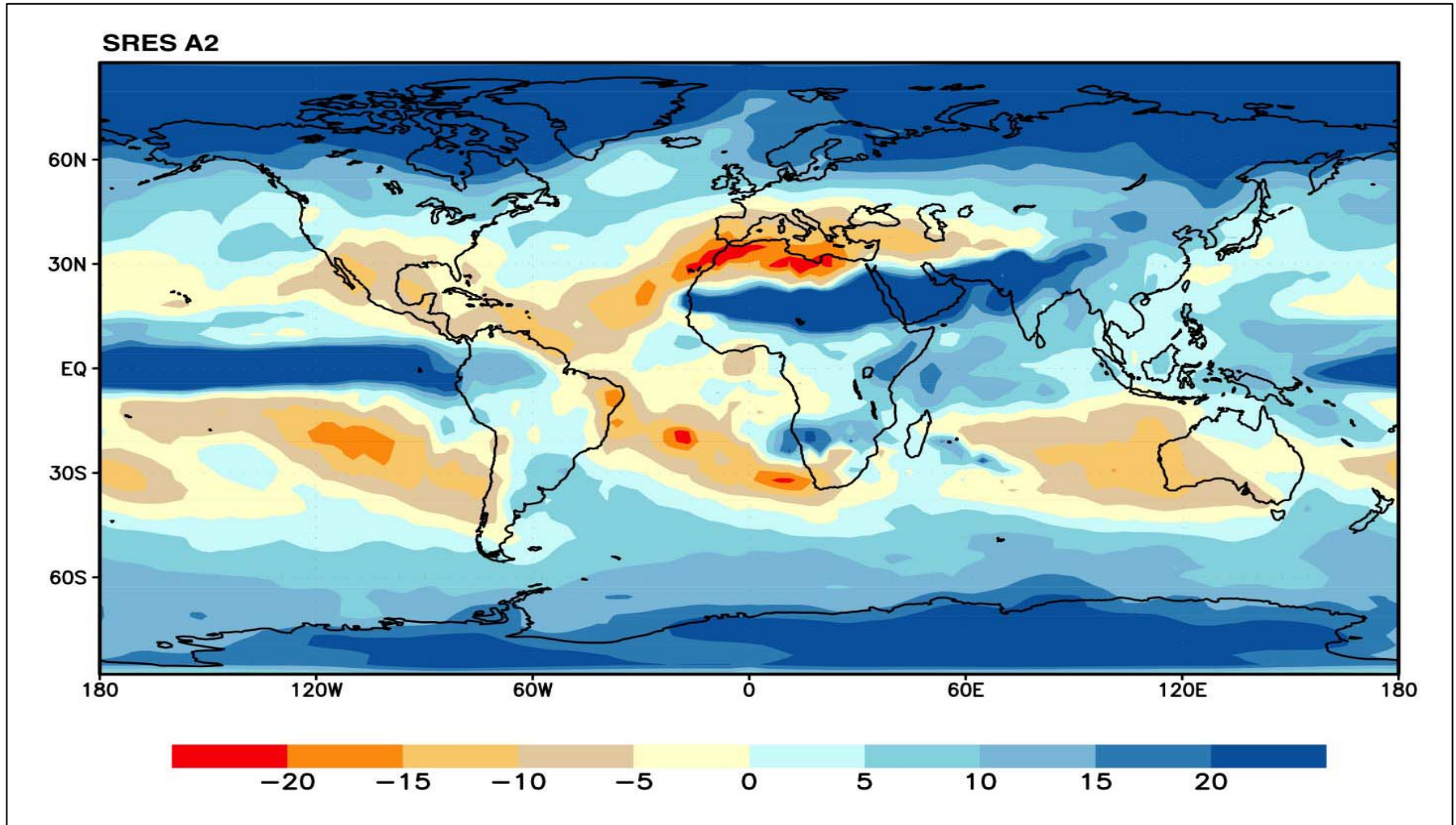
Water scarcity – land and soil management under climate change conditions

Annual mean temperature change: 2071 to 2100 relative to 1990



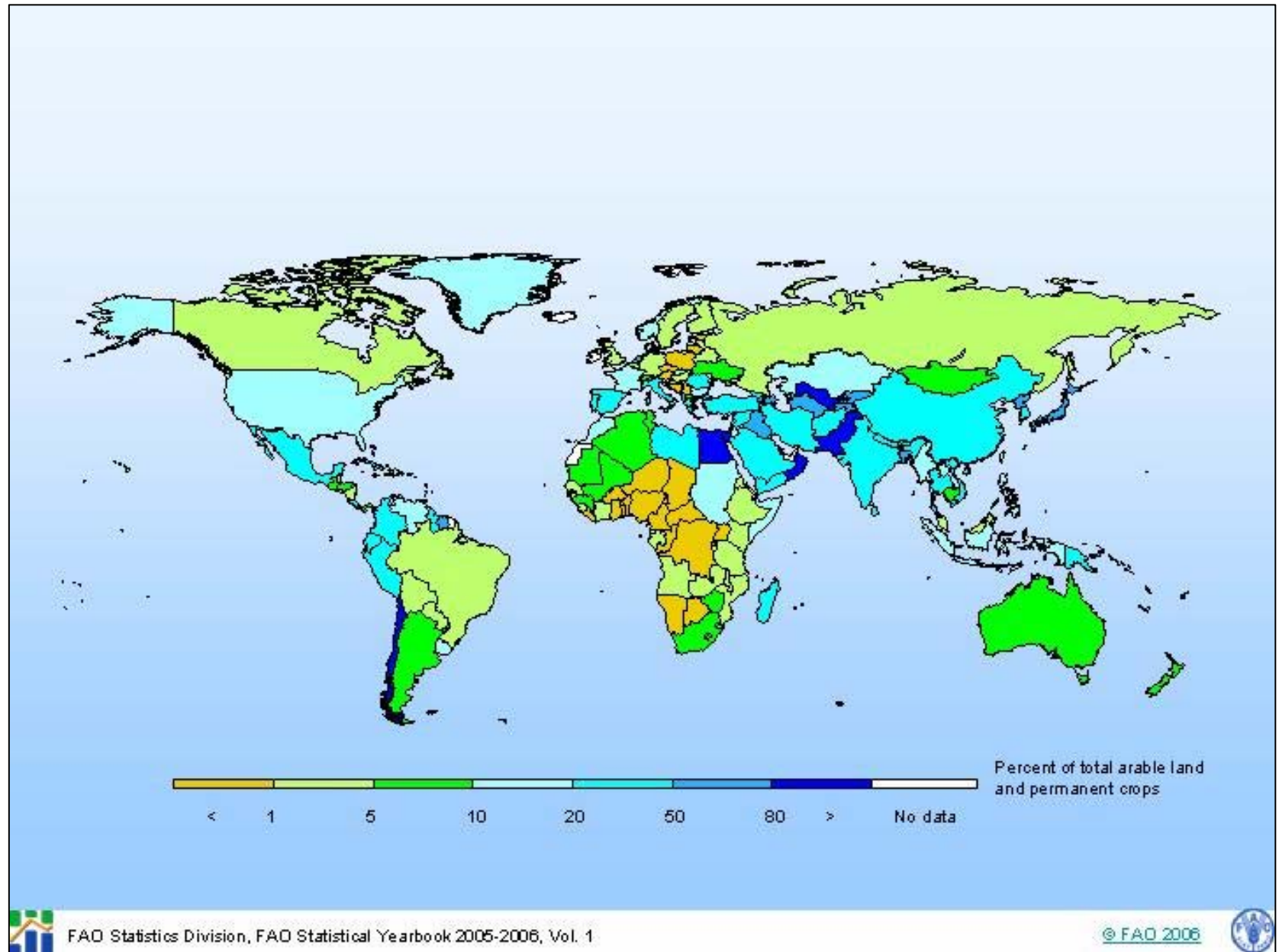
Source: IPCC, 2001.

Annual mean precipitation change: 2071 to 2100 relative to 1990 (Hadley Center)



Source: IPCC, 2001.

Share of Irrigated Land in Arable Land (2003)



CLASSIFICATION OF IMPACTS IN ORDER OF URGENCY

1. IRREVERSIBLE*) DAMAGE/THREAT:

- water scarcity
- soil loss through sealing, extraction of materials, mining and erosion (by water/wind);
- intensive pollution by heavy metals, xenobiotics, radioactive compounds;
- advanced acidification or salinisation;
- deep-reaching compaction.

2. REVERSIBLE*) DAMAGE/THREAT:

- soil pollution by biodegradable organic compounds (mineralization, metabolisation);
- compacting, glazing and other deterioration of top soil structure.

*) Definition of reversibility/irreversibility based on the time span of 100 years (~ 4 human generations).

How to implement environmental policies?

Sustainable use of land resources means spatial and/or temporal harmonisation of all land uses in a given area, avoiding or minimising irreversible impacts.

This is not a scientific but a political issue (top down - bottom up decisions).



University of Natural Resources
and Applied Life Sciences, Vienna
Department of Forest- and Soil Sciences

INDICATORS = INFORMATION
for understanding and managing complex systems.

Indicators can be cultural, social, economic, ecological
or technical information.

INDICATORS FOR SUSTAINABLE LAND USE AND ENVIRONMENT PROTECTION

- **Direct and indirect ecological, technical, socio-economic and cultural indicators can be distinguished.**
- **Examples:**
 - **ecological:** soil quality, groundwater quality, biodiversity, human health
 - **technical:** access to the land, availability of tools
 - **socio-economic:** economic wealth, access to social resources
 - **cultural:** educational level

CRITERIA FOR INDICATORS

- policy relevant, focussing on real demand and less on the supply of data;
- analytically sound, based on science and revealing a clear cause-response relationship;
- easy to interpret and understandable for farmers at the grass-root level (stakeholders), as well as for decision makers and politicians;
- easily measurable and therefore feasible and cost effective in data collection, processing and dissemination.

CONCLUSIONS AND OUTLOOK

1. Unsustainable land use is causing social impacts through:
 - unbalanced use of land through severe competition between different uses in space and time;
 - unsustainable use of specific land functions, both with irreversible impacts.
2. Social impacts are complex and have ecological, technical, social, economic and cultural implications.
3. Often, it is not the dimension of space but the dimension of time = the pace of processes, which triggers social impacts.
4. In order to alleviate social impacts, bridging between science and decision making should be improved, transferring information from those who have it to those who need it.
5. Information in the form of indicators can contribute to the mitigation of social impacts, allowing for the formulation of environmental policies.

THANK YOU

