



IMPETUS

Development of Scenarios in GLOWA-IMPETUS

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Why scenarios?

- The future cannot be predicted precisely: With scenarios one can assess how current decision impact future development
- Scenarios helps increasing common understanding of problems, to test assumptions, and to identify useful problem-solving approaches
- with "intervention scenarios" derivation of specific aspects from general scenarios like subsidy of single crops can be assessed

What are scenarios?

- Consistent and plausible images of alternative futures
- Contain enough information to support decision making
- Show different societal, ecologic and technological aspects of the system under investigation

Advantages of the IMPETUS approach

- decoupling of climate and socio-economic scenarios amplify the possible spectra of future development
- detailed sub-regional information allows the development of adapted scenarios for three sub-regions per country
- socio-economic scenarios rely upon expert knowledge gained through close cooperation with local partners

Regional Socio-Economic Scenarios

Ouéme catchment, Benin

Characterisation of sub-regions

Upper Ouémé

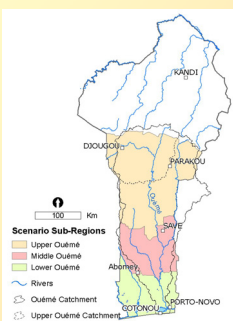
- rural region
- low population density
- one rainy period

Middle Ouémé

- rural region
- southern border of transhumance

Lower Ouémé

- well-developed infrastructure
- high rate of urbanisation
- high population density
- two rainy periods



Drâa catchment, Morocco

Characterisation of sub-regions

High Atlas

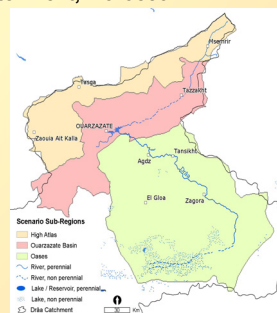
- marginalised region
- poor infrastructure
- good water availability

Ouarzazate Basin

- good infrastructure
- strong urban centres
- good water availability

Oases southern of Mansour Eddahbi Dam

- low water availability
- dependency on dam management



Scenario Benin 1

"Economic growth and consolidation of decentralisation"

- political stability and economic growth
- improvement of living conditions of the population
- decrease in the overall pressure of resource depletion due to technical innovations

Scenario Benin 2

"Economic stagnation and institutional insecurity"

- continuing and mutually influencing spiral of political destabilization and economic depression
- declining world market prices for the main export products
- negative overall economic development due to decreasing grants of donor assistance and declining rates of regional and local economic cooperation

Scenario Benin 3

"Business-as-usual"

- successful maintaining of political stability but fails in improving its position on the world markets and its overall competitiveness
- population growth continues to decline
- traditional power structures on the local level remain unchanged

Scenario Morocco 1

"Marginalization – non-support of the Drâa-Region"

- stagnation and marginalization in the industrial, agricultural, and tourist sectors
- productivity in the dominant agricultural sector remains low
- deterioration of living standards and increased migration

Scenario Morocco 2

"Rural development in the Drâa-Region through regional funds"

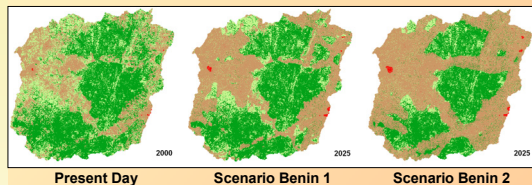
- increased productivity in the agricultural sector
- strong growth of tourism, a decrease of migration due to alternative income possibilities
- a more sustainable use of natural resources including water and pastures

Scenario Morocco 3

"Business-as-usual"

- low-level industrialization, tourism restricted to selected areas
- agriculture dominates the economy but expansion constrained by water scarcity
- high population growth in a few urbanized areas despite high rates of migration and childhood mortality

Projections of Regional Driving Forces

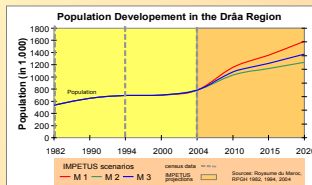


Example: Land-use changes

An increase in agricultural area and a high rate of deforestation is projected for the Upper Ouémé Valley until 2025. Land use conversions are observed near cities and along roads within natural vegetation.

(Research carried out by H.P. Thamm and M. Judex, Institute of Geography, University of Bonn)

Projections of Regional Driving Forces



Example: Demographic changes

The region's population is only slowly growing due to:

- high migration of the male active population
- decreasing fertility rate
- longer birth intervals
- higher first marriage ages
- higher life expectancy

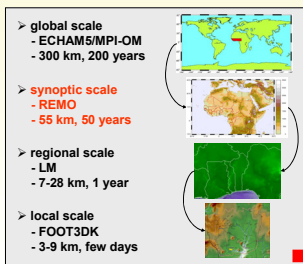
Scenarios for the target year 2020 show rather small total population differences, as the complex demographic processes are reacting only slowly to changes.

(Research carried out by H. Kirsch, C. Rademacher, and S. Platt, Institute of Cultural and Social Anthropology, University of Cologne)

Regional Climate Scenarios

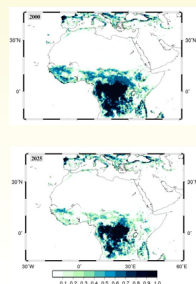
REMO IPCC-A1B Projections until 2050

Dynamical Downscaling



The IMPETUS model chain

Land-use change scenario



(Research carried out by K. Born et al., Institute of Geophysics and Meteorology, University of Cologne)

Scenarios for Benin and Morocco

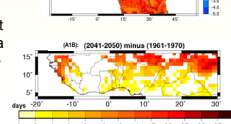
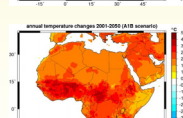
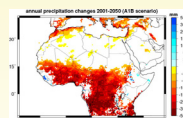
X: "Process understanding"

Process understanding lead to projections deviating from model forecasts. For example, slightly increasing annual rainfall is assumed for the Drâa Oases region due to more intense tropical-extratropical interactions.

Y: "Transient climate model predictions"

Ensemble model simulations driven by IPCC greenhouse gas emission scenarios A1B and B1 and by FAO-based land use changes (left figure) were performed using the IMPETUS model hierarchy (leftmost figure) to construct Y scenarios. This enables the simulation of a wide range of impacts, involving the application of numerical and expert models of other disciplines.

Z: "Persistence of recently observed trends (business-as-usual)"



Precipitation: Contrary to the IPCC assessment, the REMO simulates a substantial drying in West Africa of which 2/3 is due to the continental degradation of the land surface.

Temperature: Contrary to IPCC projections, temperature increase maximizes in the inner tropics due to reduced evaporation heat loss at the surface.

A substantial lengthening of dry spells in the wet season is projected.

(Research carried out by H. Paeth et al., Institute of Geography, University of Wuerzburg)

