



# Regional Scenarios for the Ouémé River Catchment

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Bundesministerium  
für Bildung  
und Forschung

universität**bonn**

Atmosphere

Hydrosphere

Anthroposphere

Biosphere

# the IMPETUS method

Problem clusters

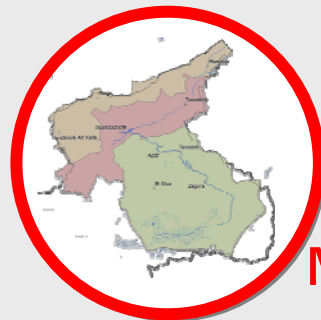
Models & Scenarios



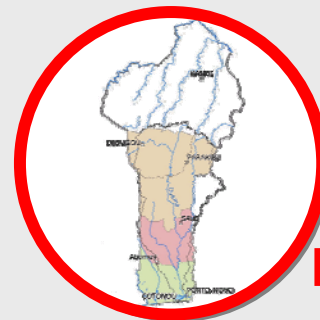
(Spatial) Decision Support Systems

# Why Scenarios ?

- **Future** cannot be **predicted** precisely
- Scenarios are contradiction-free **projections** of the present state of a system into the future
- Assessment of **alternative** development paths
- Estimation of the **uncertainty** of likely future development
- Analysis of the long-term effect of political decisions



Morocco



Bénin

# Characteristics of three sub-regions



## *Upper Ouémé*

- rural region
- low population density
- one rain period

## *Middle Ouémé*

- rural region
- Southern border of transhumance

## *Lower Ouémé*

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



# Socio-economic scenarios



<b>B1:</b> <b>Economic growth and consolidation of decentralization</b>	<b>B2:</b> <b>Economic stagnation and institutional instability</b>	<b>B3:</b> <b>Business as usual</b>
<b><i>Development of main economic framework conditions</i></b>		
<ul style="list-style-type: none"> <li>• Constant growth</li> <li>• Growing importance of industry</li> <li>• Consolidation of the role as a transit country</li> </ul>	<ul style="list-style-type: none"> <li>• Economic stagnation</li> <li>• Decreasing incomes</li> <li>• Loss of the role as an important transit country</li> </ul>	<ul style="list-style-type: none"> <li>• Strong informal and weak formal economic integration</li> <li>• Low competitiveness on world markets</li> </ul>
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<ul style="list-style-type: none"> <li>• Increasing rate of innovations</li> <li>• <b>Expansion of agriculture areas</b></li> <li>• Increases in exports</li> </ul>	<ul style="list-style-type: none"> <li>• Missing innovations</li> <li>• Stagnation of productivity</li> <li>• Increase of subsistence farming</li> </ul>	<ul style="list-style-type: none"> <li>• Low rate of innovations</li> <li>• Expansion of agriculture areas and livestock farming</li> </ul>
<b><i>Development of demographic framework conditions / living quality</i></b>		
<ul style="list-style-type: none"> <li>• Decline of population growth accelerates</li> <li>• Improvement of living conditions</li> <li>• Rise in overall level of education</li> </ul>	<ul style="list-style-type: none"> <li>• Slow decline of population growth</li> <li>• Deterioration of living conditions</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Continued decline of population growth</b></li> <li>• Slight improvement regarding the coverage of basic needs</li> </ul>
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# Developments within the agriculture sector

B3: Business as usual

B2: Economic stagnation and

**B1: Economic growth and consolidation of decentralization**

- Increasing rate of innovations
- Expansion of agriculture areas
- Increases in exports



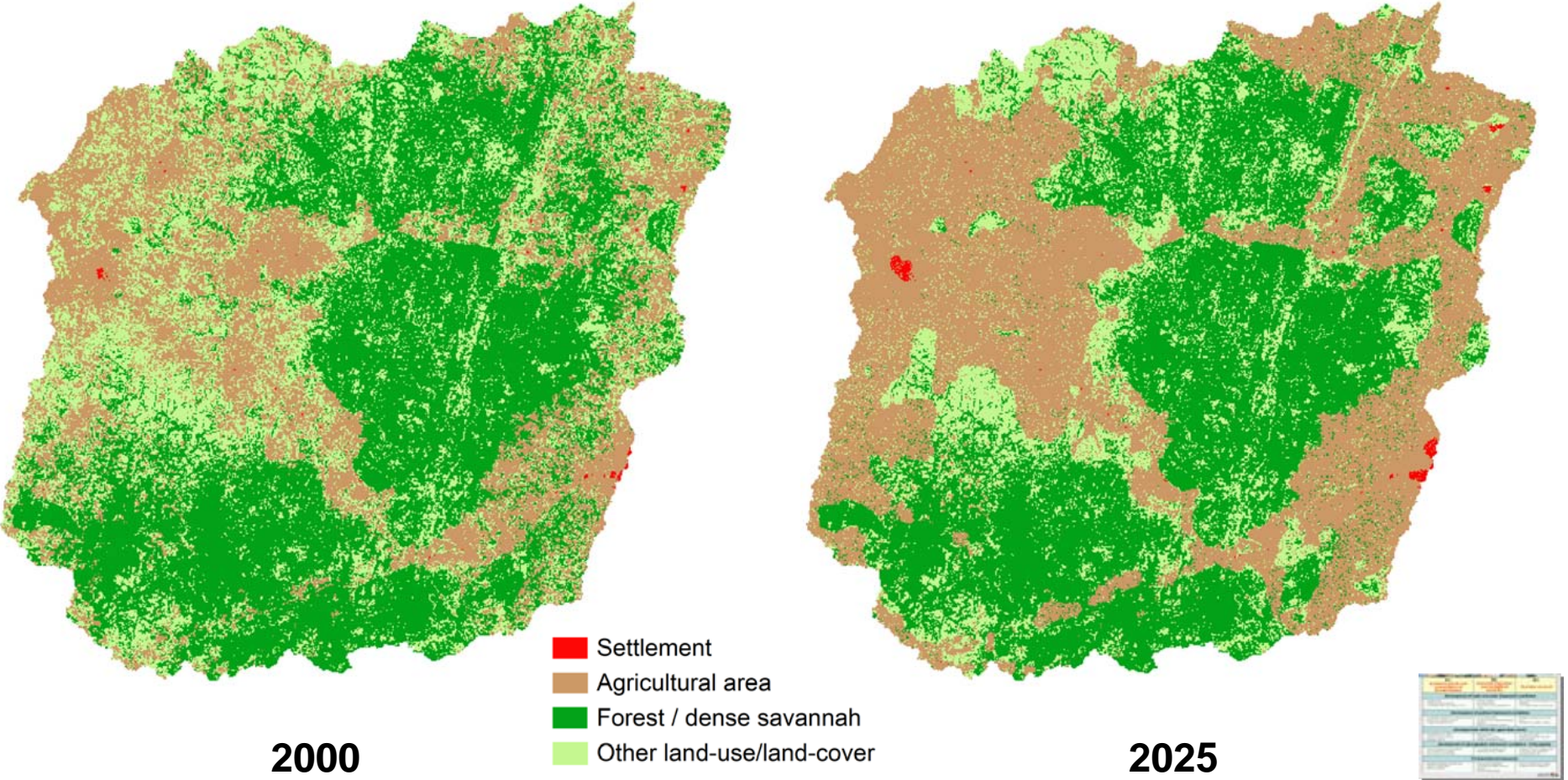
Year	Value	Value	Value
2008	100	100	100
2009	100	100	100
2010	100	100	100
2011	100	100	100
2012	100	100	100
2013	100	100	100
2014	100	100	100
2015	100	100	100
2016	100	100	100
2017	100	100	100
2018	100	100	100
2019	100	100	100
2020	100	100	100
2021	100	100	100
2022	100	100	100
2023	100	100	100
2024	100	100	100
2025	100	100	100
2026	100	100	100
2027	100	100	100
2028	100	100	100
2029	100	100	100
2030	100	100	100





# Land-use and land-cover change in the Ouémé-Catchment

## Scenario B1 – “Economic Growth”

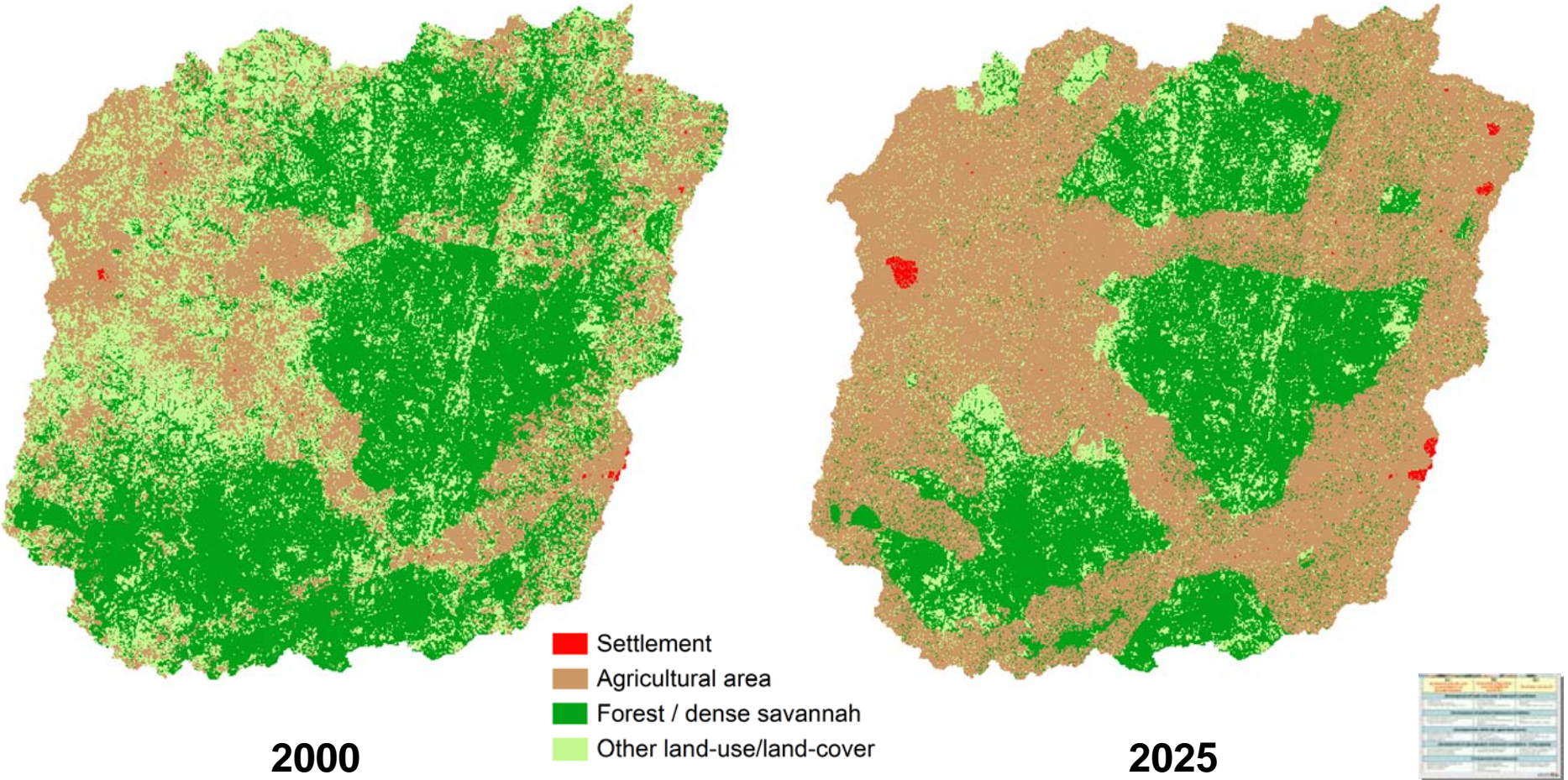


Source: M. Judex - IMPETUS



# Land-use and land-cover change in the Ouémé-Catchment

## Scenario B2 – “Economic Stagnation”



2000

2025

- Settlement
- Agricultural area
- Forest / dense savannah
- Other land-use/land-cover



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# Environment and resources

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B2: **Economic stagnation and**

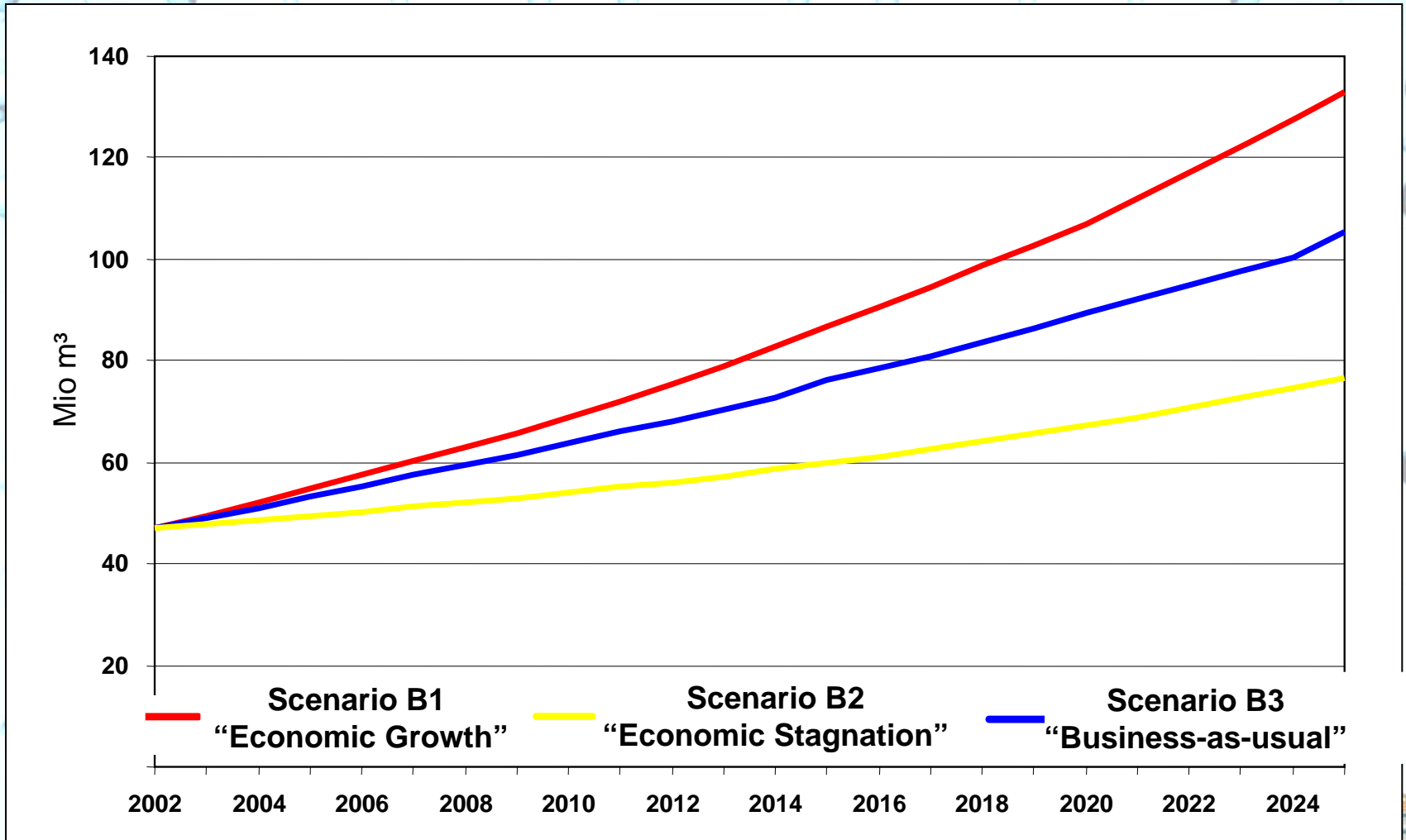
**B1: Economic growth and consolidation of decentralization**

- Management strategies are implemented
- Resource conflicts decline
- Water use increases

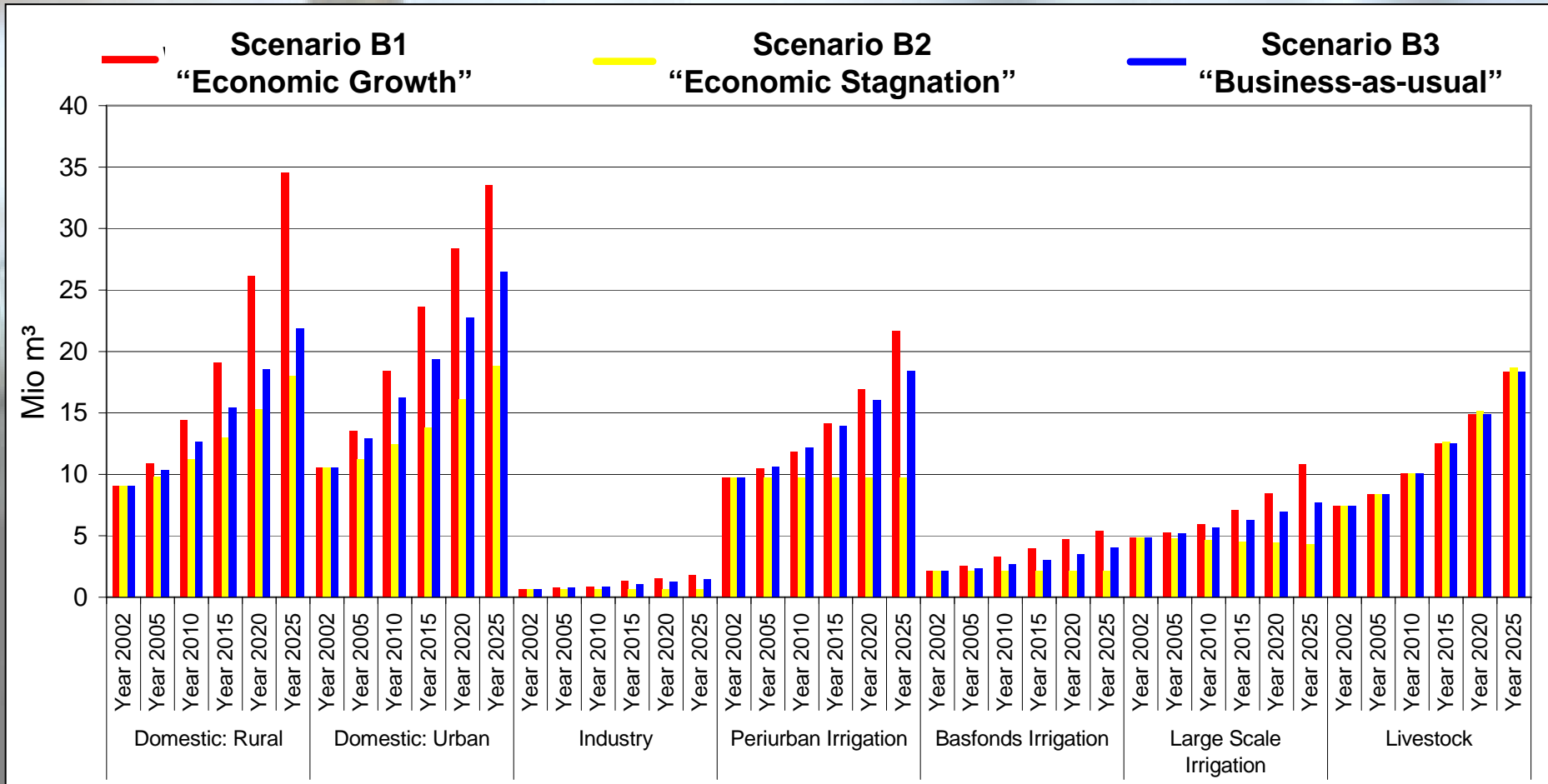


Category	Item	Value
Water	...	...
...	...	...
...	...	...
...	...	...
...	...	...

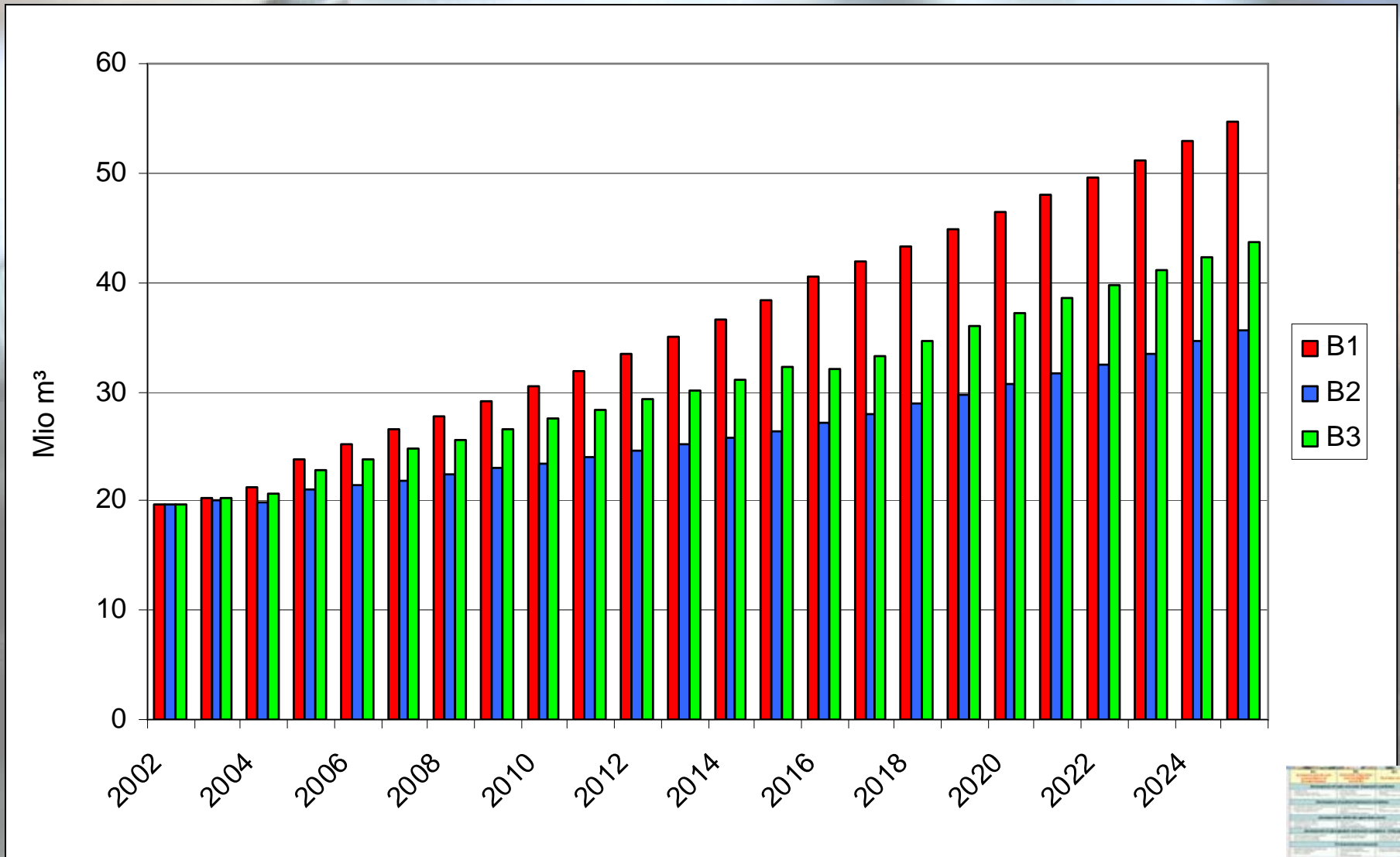
# Total Water demand in the Ouémé catchment



# Water demand for different user groups in the Ouémé catchment



# Household water demand in the Ouémé catchment





# Climate scenarios





# Climate scenarios for Benin



	Benin		
	Upper Ouémé	Middle Ouémé	Lower Ouémé
<b>Scenario X</b> (process-oriented)	<ul style="list-style-type: none"> <li>-strong reduction in annual rainfall due to stronger wind convergence at the coast and land degradation</li> <li>- substantial warming</li> <li>- stronger climate extremes</li> </ul>	<ul style="list-style-type: none"> <li>-moderate weakening of the hydrological cycle due to less evapotranspiration upstream (enhanced land use)</li> <li>- considerable warming</li> <li>- stronger climate extremes</li> </ul>	<ul style="list-style-type: none"> <li>- enhanced precipitation due to an intensified summer monsoon circulation and latent heat fluxes over the Gulf of Guinea</li> <li>- moderate warming</li> </ul>
<b>Scenario Y</b> (model-oriented)	<ul style="list-style-type: none"> <li>-strong reduction in annual rainfall</li> <li>- less heavy rain events</li> <li>- delayed monsoon onset</li> <li>- remarkable warming, particularly in summer</li> </ul>	<ul style="list-style-type: none"> <li>-slightly enhanced hydrological cycle</li> <li>- slightly enhanced seasonality</li> <li>- strong warming</li> </ul>	<ul style="list-style-type: none"> <li>-strong reduction in annual rainfall and delayed onset</li> <li>- less heavy rain events</li> <li>- reduced climate seasonality and earlier onset</li> <li>- strong warming</li> </ul>
<b>Scenario Z</b> (business-as-usual)	<ul style="list-style-type: none"> <li>-land degradation and warmer surface temperatures in the Indian Ocean maintain the below-normal precipitation anomalies</li> <li>- warming of 0.2°C/decade</li> </ul>	<ul style="list-style-type: none"> <li>-land degradation and warmer surface temperatures in the Indian Ocean maintain the below-normal precipitation anomalies</li> <li>- warming of 0.2°C/decade</li> </ul>	<ul style="list-style-type: none"> <li>-land degradation and warmer surface temperatures in the Indian Ocean maintain the below-normal precipitation anomalies</li> <li>- warming of 0.2°C/decade</li> </ul>



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# Benin – Upper Ouémé

## Scenario Z – Business as usual

### Scenario Y – model oriented

- Scenario X – climate oriented**
- strong reduction in annual rainfall
  - less heavy rain events
  - delayed monsoon onset
  - remarkable warming, particularly in summer
- Scenario Y – model oriented**
- strong reduction in annual rainfall
  - less heavy rain events
  - delayed monsoon onset
  - remarkable warming, particularly in summer
- Scenario Z – Business as usual**
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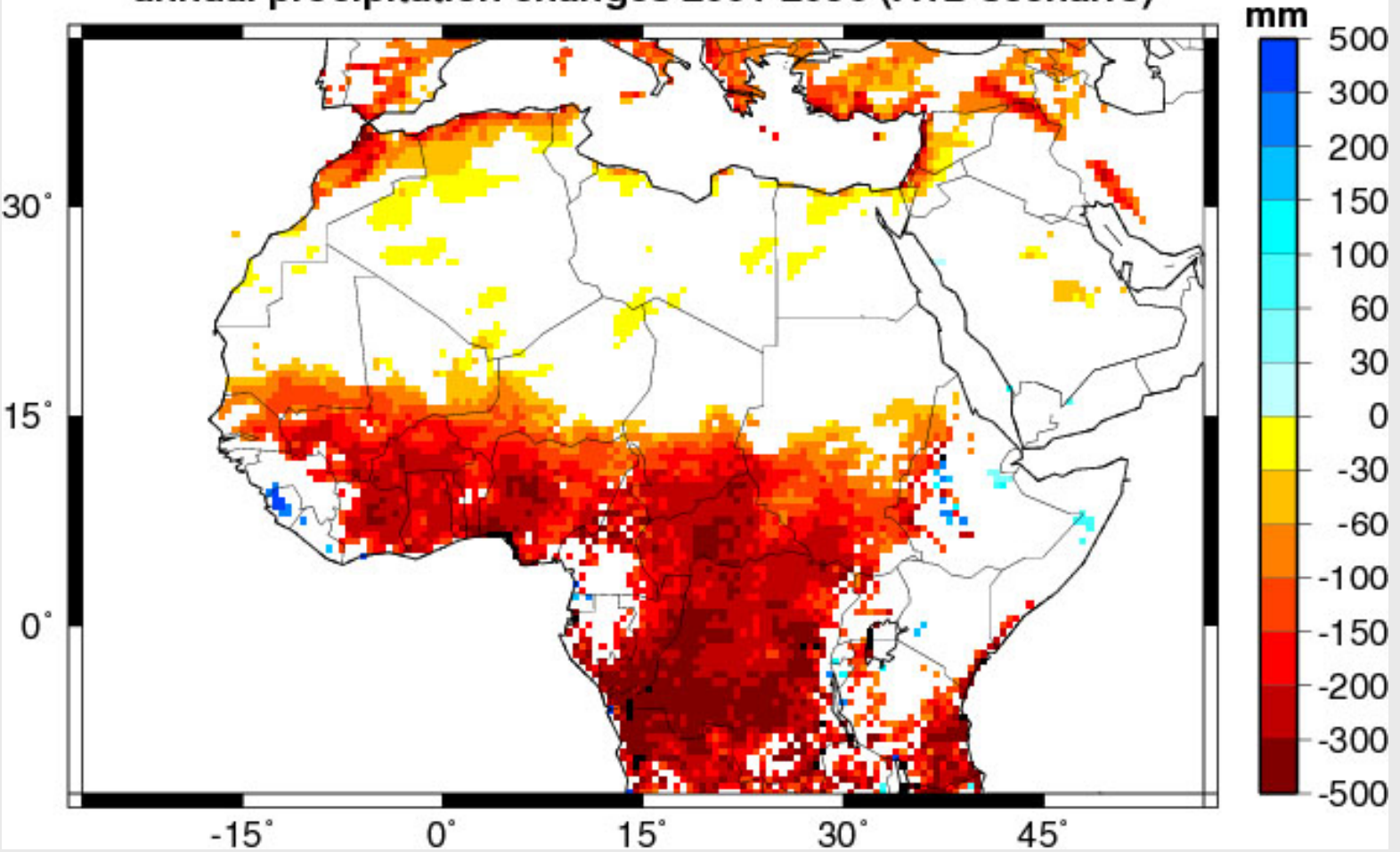
face  
tation



	Scenario X	Scenario Y	Scenario Z
Annual Rainfall	Low	Low	Low
Heavy Rain Events	Low	Low	Low
Monsoon Onset	Delayed	Delayed	Delayed
Summer Warming	High	High	High

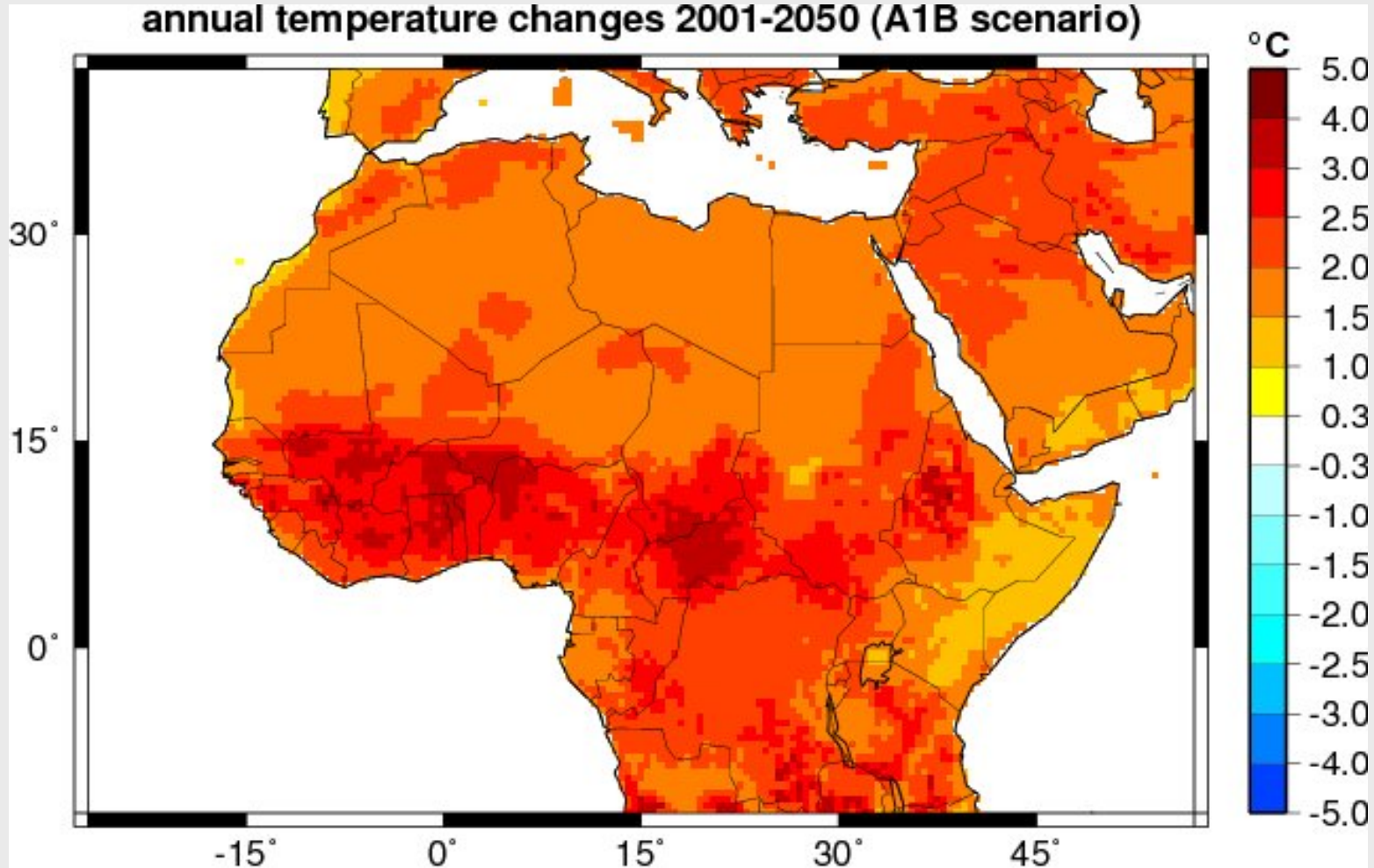
# Strong reduction in annual rainfall

annual precipitation changes 2001-2050 (A1B scenario)



# Remarkable warming, particularly in summer

annual temperature changes 2001-2050 (A1B scenario)

A small table with multiple columns and rows, likely a legend or data summary. The table is partially obscured and difficult to read, but it appears to contain numerical data and possibly labels for different temperature change ranges.

# Summary

- **Loosely coupled models**
- **→ Scenarios:**
  - socio-economic
  - climate
- **three alternative scenarios**
- **Driving forces** for models
- Also: **intervention scenarios**
- Adequate basis for the development of **management options**



**I M P E T U S**

