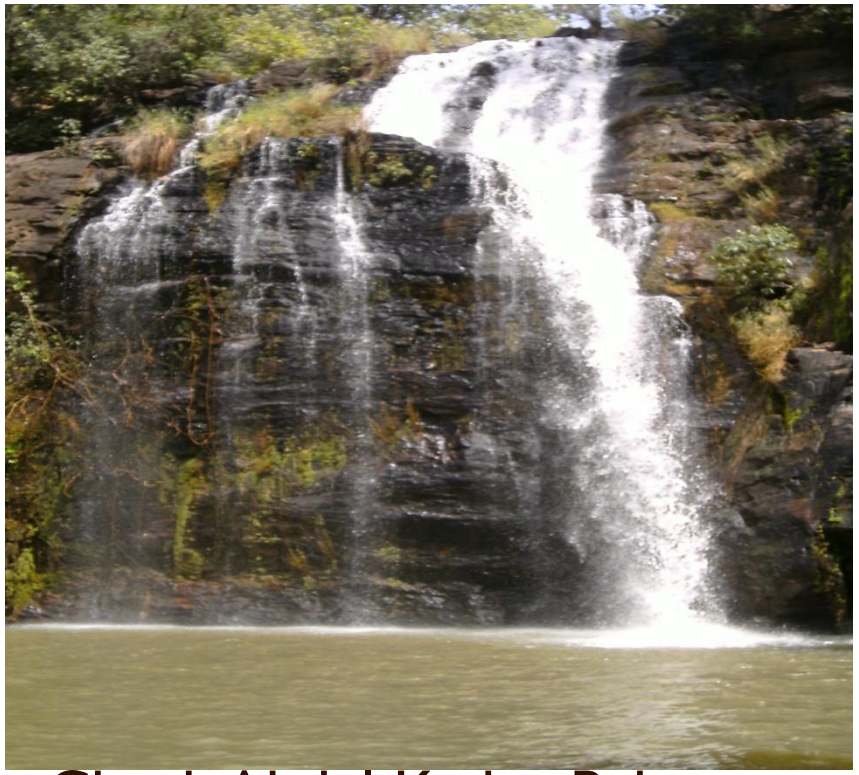
# CONSERVATION AND MULTIPLE PURPOSE DAMS MANAGEMENT: Challenges & Opportunities

**Case study of Okpara dam (north Benin)**



3rd DAAD WORKSHOP

Dubai, 27/11 - 02/12/12

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IIFFP/FEM/TU Dresden

# Outlines

- Introduction
- Research question and objectives
- Methodology
- Presentation of Okpara dam
- Current issues of Okpara dam
- Challenges and opportunities
- Conclusion
- references

# Introduction

- 300 millions people have no access to clean water in sub saharan Africa (Mérino, 2008)
- About 50% ... suffer from diseases associated with lack or poor quality of water.
- Dams construction policy in the 70s to face problems of water scarcity
- 250 dams (mostly hydro pastoral purposes) in Benin
- Half of them dry up by the end of dry season due to heavy sedimentation (Ibouraima, 2005)

- Nowadays, contradictory debate on the contribution of dams to sustainable development
- Aim: Present a case study of Okpara dam in north Benin

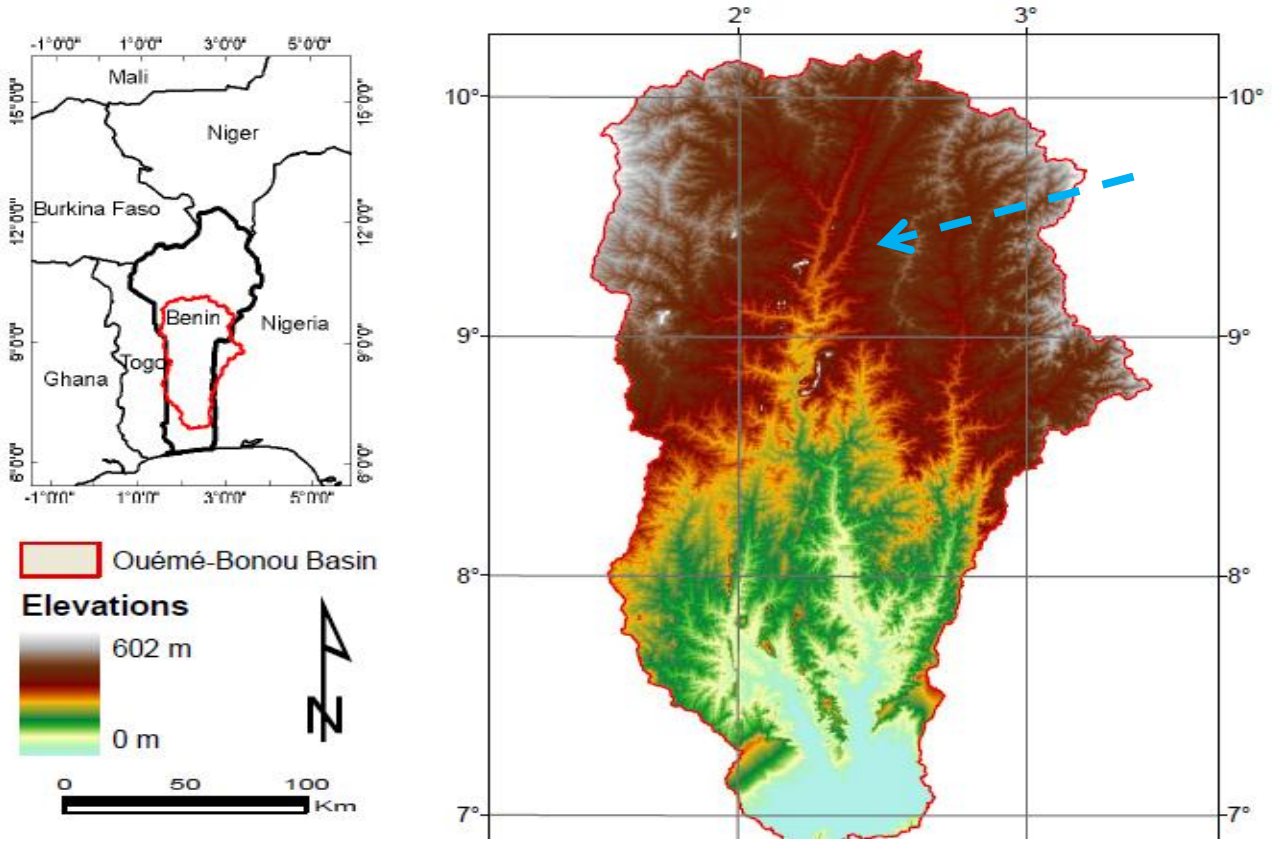



Figure 1: Ouéme river watershed and position of Okpara dam

Source: http://hss.ulb.uni-bonn.de/2012/2983/2983.pdf. Downloaded on 25.11.12

# Research question

- To what extend multiple purpose dams can provide sustainably ecosystem services without conflicting riparian stakeholders' tangible interests ?

# Objectives

- To describe and analyze major socio economic and ecological issues of Okpara dam
- To identify challenges and opportunities for a sustainable management of Okpara dam

# Methodology

- Literature review
- Interviews

# Presentation of Okpara dam

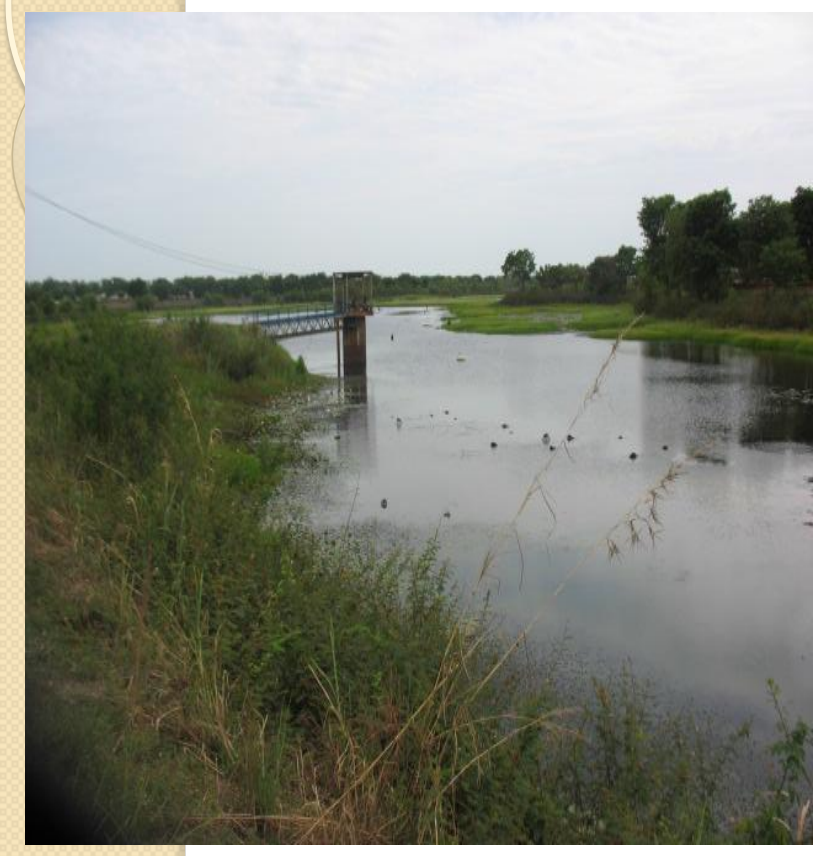


Figure 2: Okpara dam

- Constructed in 1969;
- Since 1975 → drinking water reservoir
- Type: Earthfill dam
- Dyke length: 480m
- Dyke height: 10m
- Basin area: 2070 km² and covers 5 communes.
- Init. Stor. vol.: 5 750 000 m³
- Curr. Stor. Vol.: 2,65 millions m³/a.
- Population: 266988 (2007)

Source: PNE-Bénin, DGEau, SONEB

# Categorization of stakeholders

| N° | Local level Stakeholders | Interests | Threats for ES provision |
|---|---|---|---|
| 1 | Herders | Water & pasture, NTFP; fuelwood | Degradation of soil et surrounding vegetation |
| 2 | Farmers | land, water, NTFP; fuelwood | Soil erosion, forest degradation, water pollution, Invasion of water body by aquatic plants |
| 3 | Vegetable producers | Water, land, NTFP | |
| 4 | Fishers | Fishes and other aquatic species | Aquatic biodiversity |
| 5 | Forest entrepreneurs | Timber | Biodiversity, soil damage… degradation |
| | Others | Cults | - |

# Various dams services

| N° | Territorial and national level Stakeholders | Interests | Threats for ES provision |
|---|---|---|---|
| 6 | Riparian communes | Local development<br>Revenues from fishing,<br>Taxes from vegetables farmers , … | Lack of ecological knowledge, poor technical skills and means and weak institutions |
| 7 | SONEB, DGEau, CeRPA | Drinking water provision,<br>Rice-growing, fishing | Withdrawal of water, constructions for water retention |
| 8 | NWP, sectoral ministries (Energy; Environment and Agriculture),<br>GWP and intern. NGOs | Protection of natural resources, provision of ES | Top down policies,<br>Lack of relevant institutions and insufficient inter sector coordination |

# RESULTS

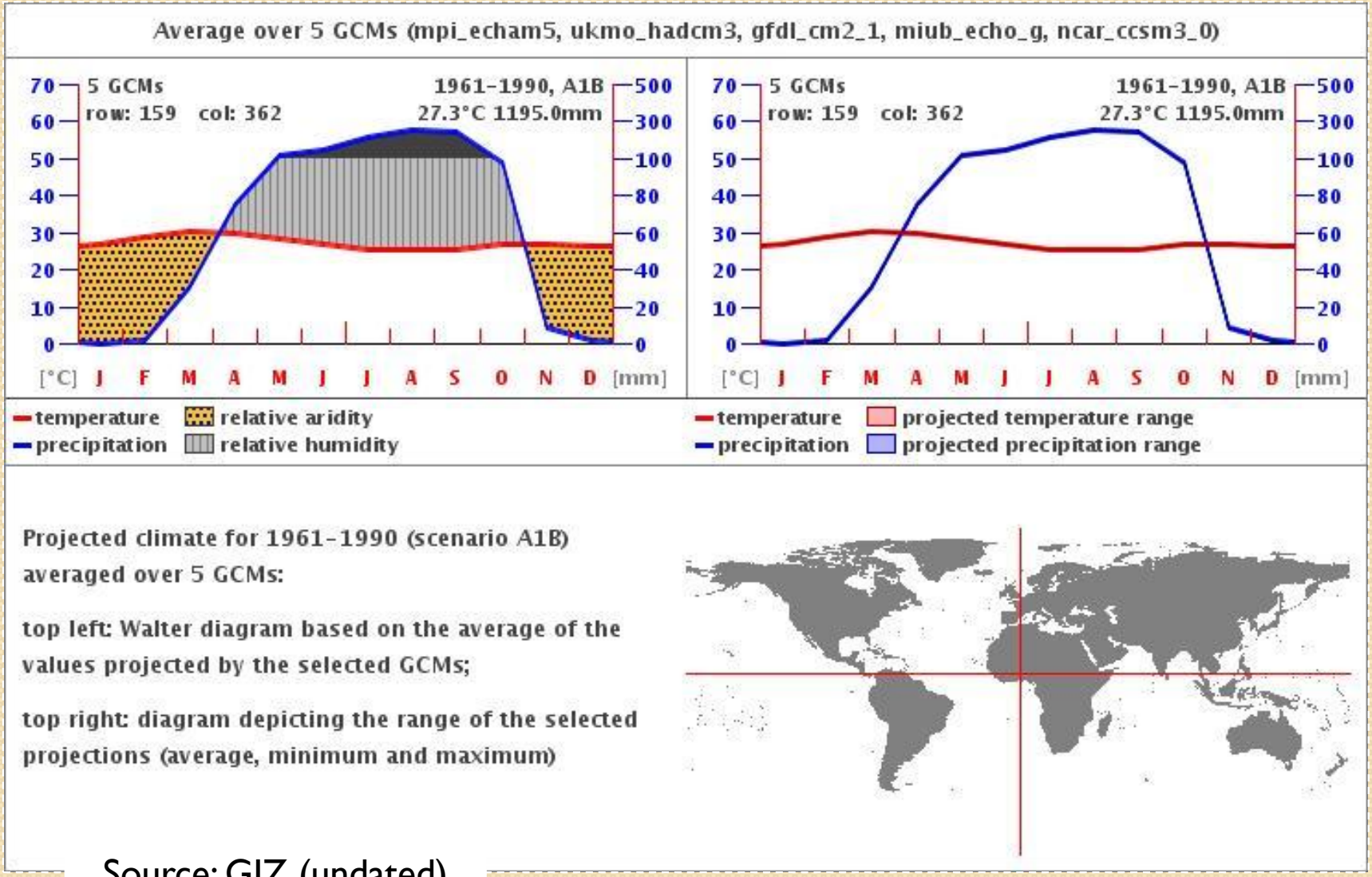
# RESULTS: Current issues and solutions

| N° | Problems | Causes | Axes for solutions |
|---|---|---|---|
| 1 | Filling up of the reservoir -> **Water quantity** | Sedimentation, watershed erosion | 1- Restoration of ecosystems dynamics<br>*Establishment of protection zones<br>*Restoration of forest galleries<br>*Identification and protection of fragile ecosystems<br>2- Strengthen of Institutional framework<br>*Initiative Okpara-GWP (lead by UGI and COS)<br>*TDOS (CAGC) |
| 2 | Threat on the **dam stability** | Lack of maintenance,<br>Lack of flow regulation | |
| 3 | Invasion of **aquatic plants** (90% of the water surface) | Use of fertilizers<br>Dejection of cattle<br>Domestic and other pollution sources | |
| 4 | **Water quality** | Lack of public sanitations, bad disposal of domestic waste and pollution sources | |

Figure 3 : lateral spillway eroded (source: PNE Benin, 2008)

# Challenges

## Challenge 1: Water quantity




Source: GIZ (undated)

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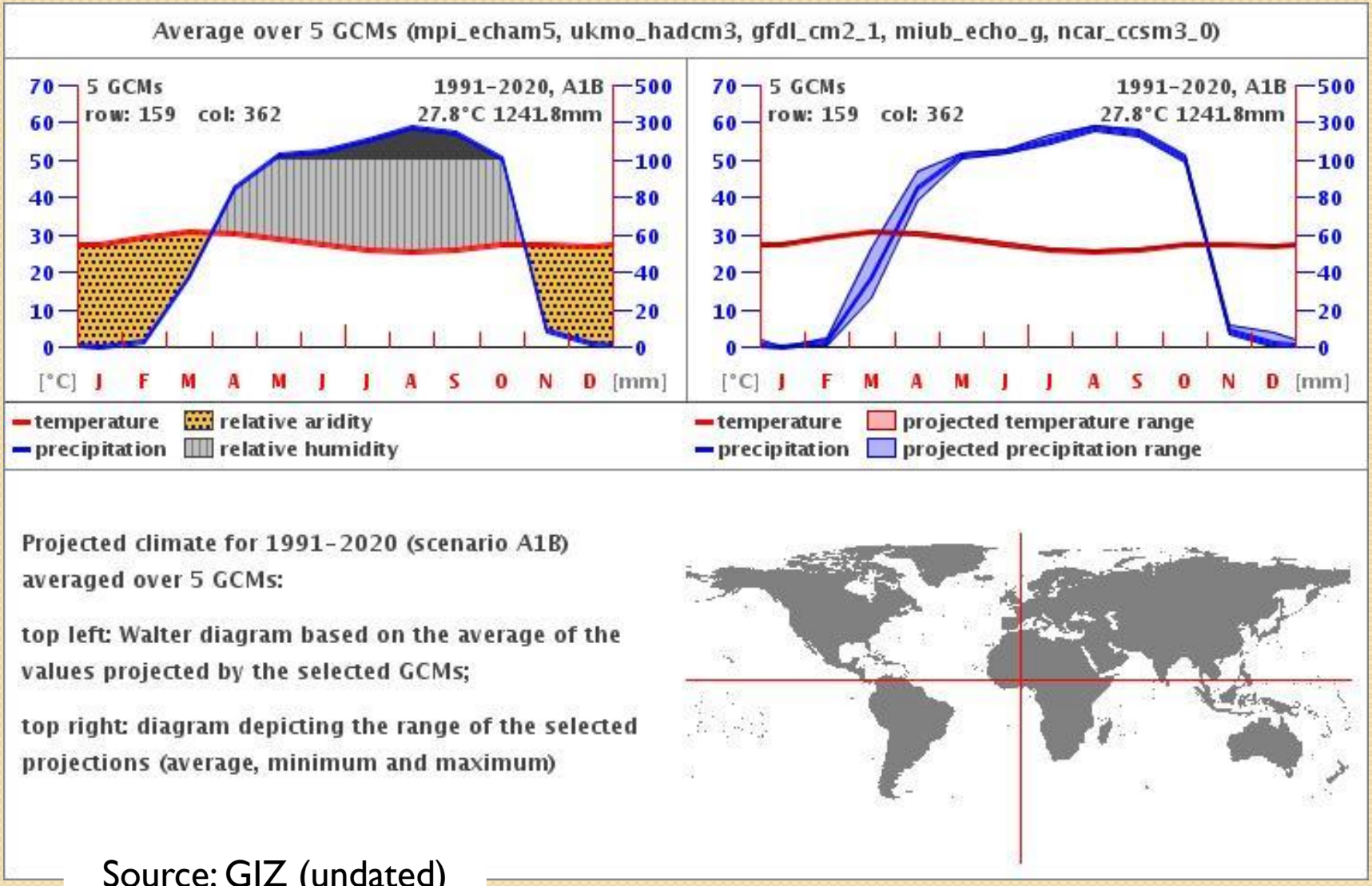


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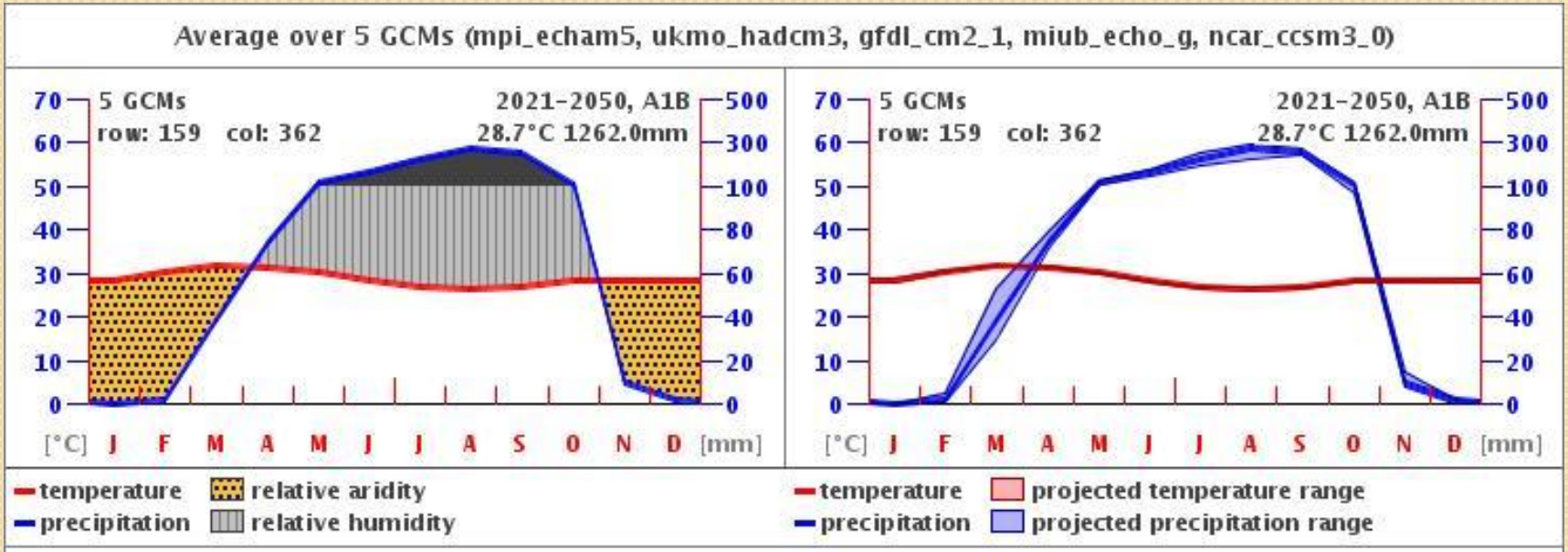
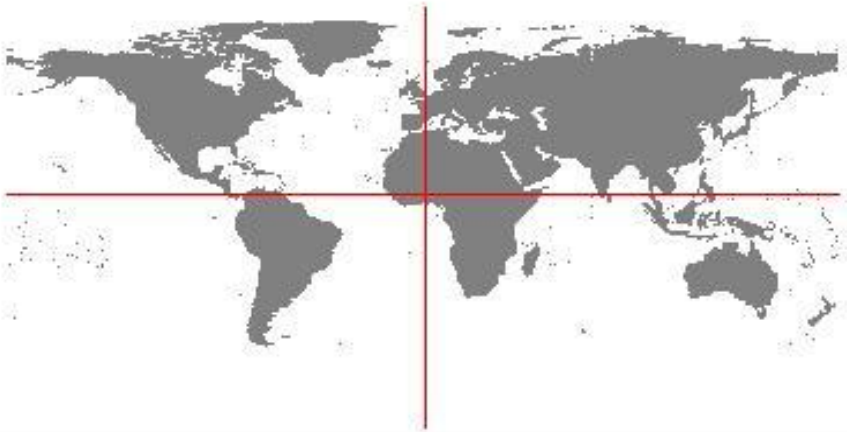



Projected climate for 2021-2050 (scenario A1B) averaged over 5 GCMs:

top left: Walter diagram based on the average of the values projected by the selected GCMs;

top right: diagram depicting the range of the selected projections (average, minimum and maximum)



Source: GIZ (undated)

# Result in terms of rainfall

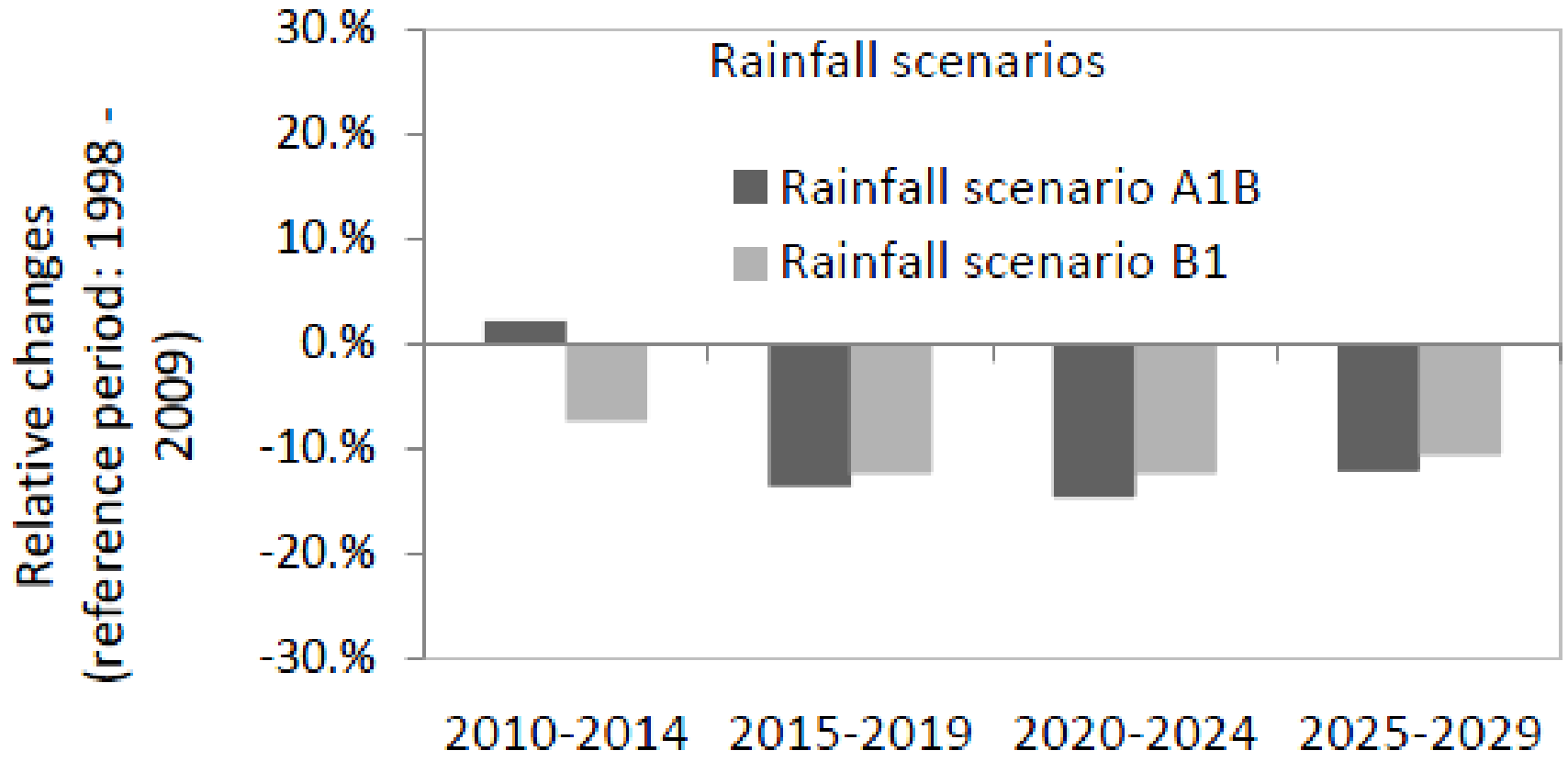



Figure 4: Relative change in future rainfall (ref. period 1998-2009) for Ouémé-Bonou catchment. (Source: Bossa, 2012)

**Note :** A1B: globalized world of rapid economic growth and comparatively low pop. growth
B1: future globalized world with low population growth

# Challenge 2: Sust. Management of Watershed

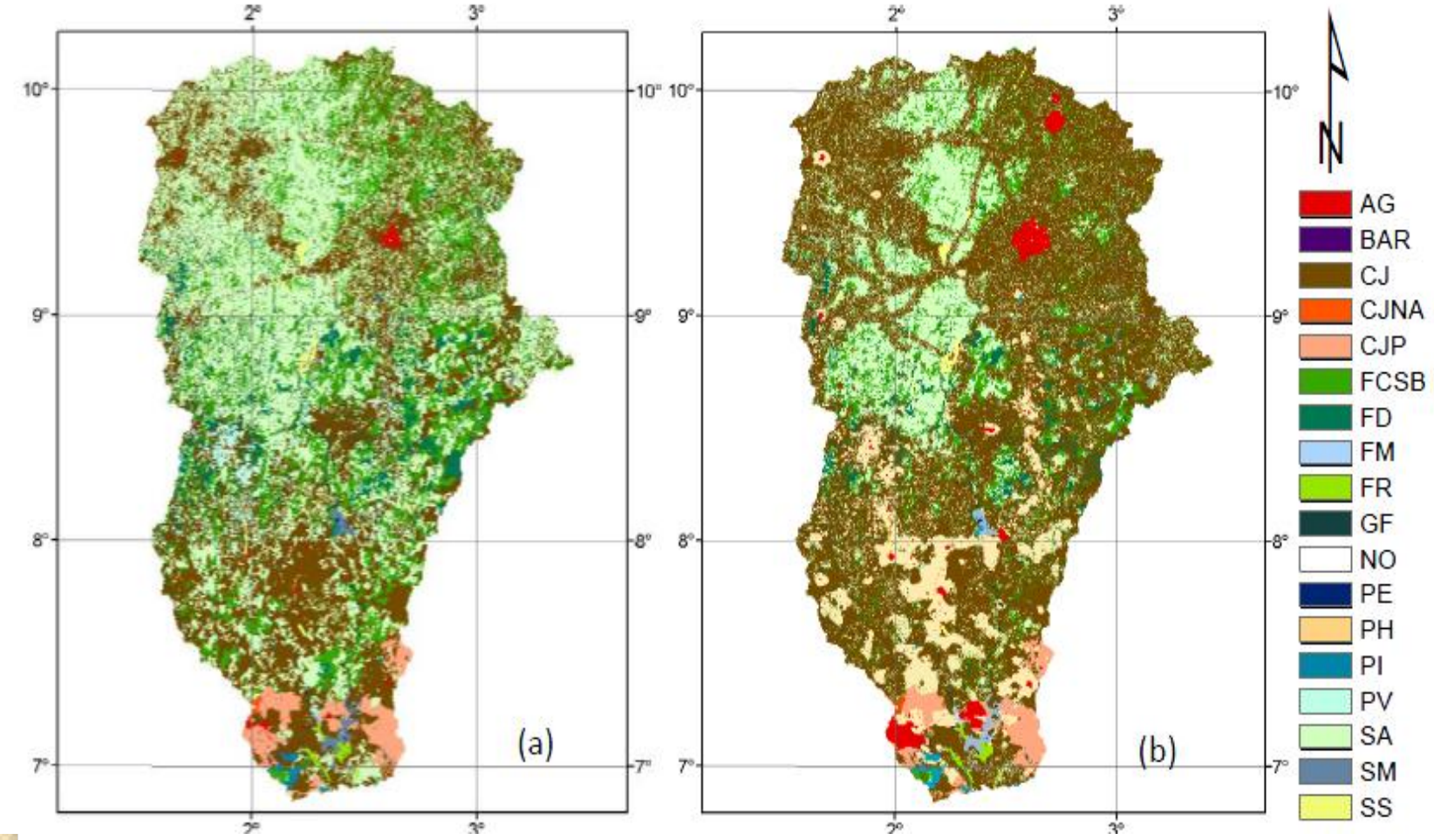



Figure 5: Land use/cover of the Ouémé watershed under Lb scenario (Bossa, 2012)

# Challenge 3: Water quality

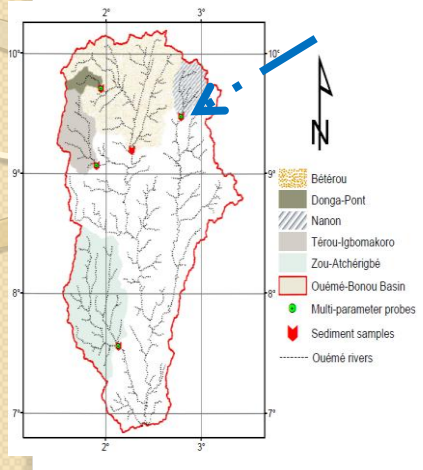
| | Large catch. Oueme | Meso scale |
|---|---|---|
| Organic Nitrogen | 1,2 to 1,7 ton/ha/a | 0,5 to 1ton/ha/a |
| Sediment yield | 0,32 to 0,45 ton/ha/a | 0,4 to 0,6 ton/ha/a |
| Source: Bossa, 2012 | | |

# Opportunities

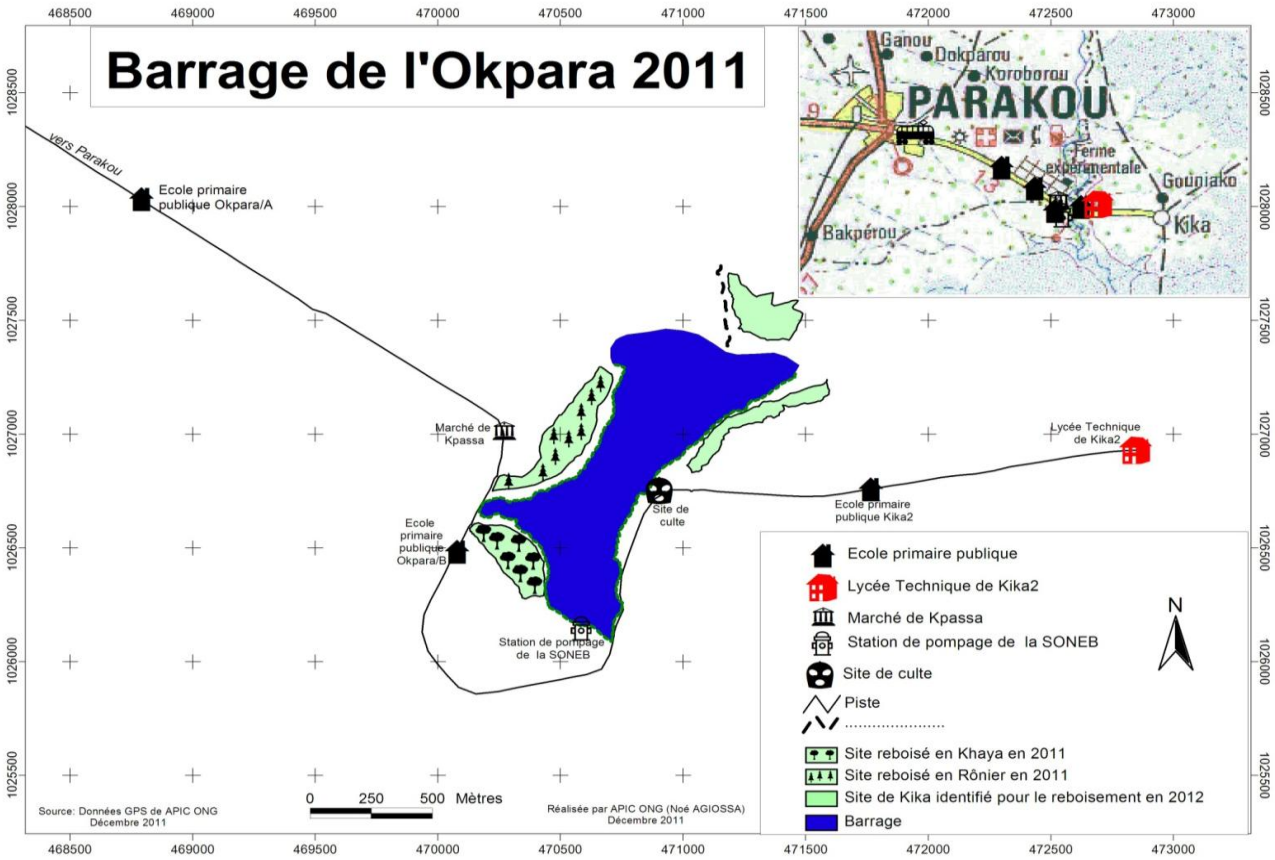
- **International scale**
- Network for learning processes and sharing of experiences (Tallis et al., 2008)
- More scientific knowledge on ecosystems dynamics, functions and provision of services (Turner and Daily, 2008)
- Commitment of donors to implement IWRM

- **National scale**
- Political will
- Institutional framework
- Willingness to pay drinking water services
- Possibility of compensation payment and pricing of water use
- Riparian communes commitment

# Reforestation of Okpara dam




Source: from Bossa, 2012




Map of Okpara dam and reforested areas in 2011

Source: APIC ONG, 2011

## Criteria

1. Species utility for people
2. Fast growing
3. Ecological adaptation
4. Ability to protect soil
5. Planting & maintenance cost
6. Species rusticity

## Selected species

- Borassus aethipium
- Khaya senegalensis
- Pseudocedrala ???
- Butyrospermum parkii
- Parkia biglobosa
- Mitragyna inermis

# Conclusion

- Riparian communes of Okpara dam will experience water scarcity by 2025 (PNE Bénin, 2008)
    1. Parakou and surrounding pop: 407024 inhbts
    2. Water needs : 7 233 003 $m^3$
    3. Reservoir storage volume: 2,65 millions $m^3/a$
- Among other driving factors, ecosystems degradation and weak institutions
- Drinking water as an umbrella ES is an opportunity to protect and promote forest ecosystems and further climate in local and regional scales
- Network for learning processes and sharing of knowledge and experiences supported by UN agencies and NGOs is a great opportunity.

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Vielen dank!