Impact Assessment of Climate and Land Use Changes in Inland Valleys Agricultural Systems and Overview of Adaptation Strategies in Dano, Burkina Faso

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Introduction

Inland valleys in West Africa provide advantageous features for agricultural use compared to surrounding areas in terms of accumulating runoff and favorable soil characteristics. Thus they have a high potential for irrigation which is a key point to support adaptation strategies to climate change for agriculture. Yet, inland valleys are fragile ecosystems and part of complex hydrological systems. Consequently, their potential might be affected under different climate conditions. Also, changes in using inland valleys for intensive agriculture might have far reaching impacts on ecosystems and downstream water users. Therefore, it is of utmost importance to carefully assess the impact of CC on existing agricultural systems and look for strategies to improve both the current management of inland valleys and their integration into future adaptation policies, while taking the impacts on downstream users and ecosystems under consideration.

Objective

The present study aims to assess the management of inland valleys under current conditions and to predict their evolution with climate change scenarios in order to evaluate the best adaptation strategies.

Fig.1: Vegetable gardening in Moutori during the dry season.

Materials and methods

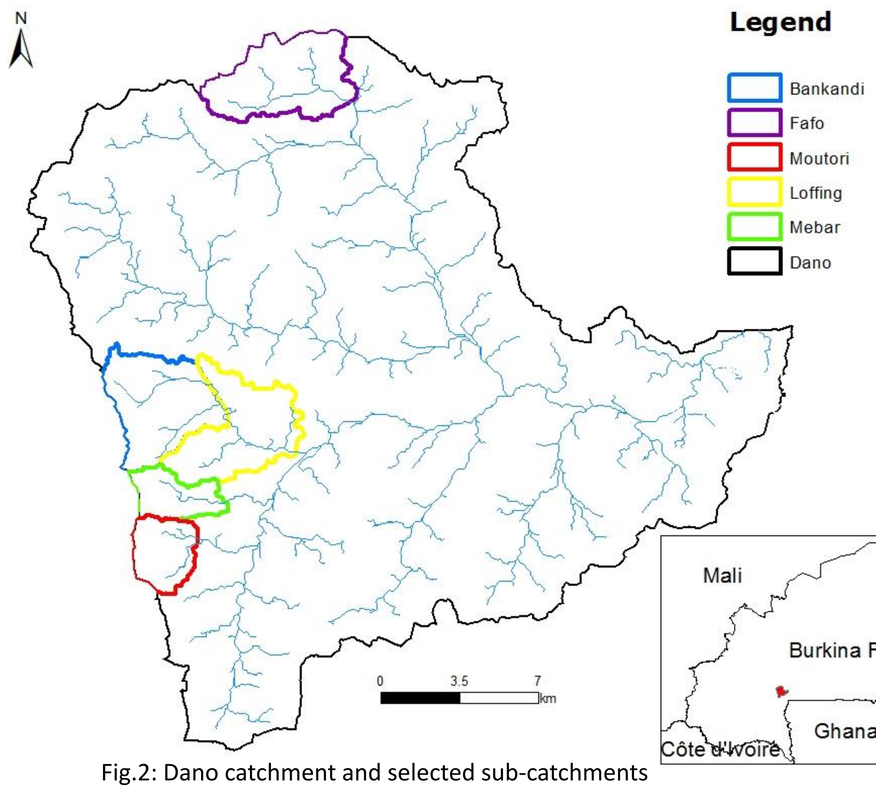


Fig.2: Dano catchment and selected sub-catchments

- Five inland valleys have been selected regarding the infrastructure in place for irrigation in the called Dano catchment (see fig.1). A simple water balance equation has been established, based on the monitoring of the water fluxes during a dry year in 2014 and a wet year in 2015:

  Precipitation + Irrigation = Evapotranspiration + Outflows
- Climate scenarios have been chosen based on anomalies of 11 Global Circulation Models predictions using the Representative Concentration Pathways RCP 4.5 and RCP 8.5 between the periods 2010-2020 and 2045-2055 and 2075-2085:

	2015-2050		2015-2080	
	T (°C)	P (%)	T (°C)	P (%)
RCP 4.5	+1	-10	+2	-20
RCP 8.5	+2	-20	+4.5	-30

- Indicators used to assess the irrigation performance:
  - Reliability: Crop Water Requirements / (Precipitation + Irrigation)
  - Adequacy: (Precipitation + Irrigation) / Crop Water Requirement per ha
  - Impacts: Outflows/ (Precipitation + Irrigation), Nutrients load (N, P, K)
  - Productivity: Production/Inflows, Yields

Preliminary Results

for a demand-driven and reservoir based irrigation scheme in Moutori

- Increase in crop water requirements and decrease in precipitation will increase the share of crop water requirements on the water inflow up to 20%. The irrigation will be less reliable with scarce months, specifically for dry years and during the rainy season.
- Increase in crop evapotranspiration and decrease in water availability through less precipitation and storage will increase the crop water requirements per ha and reduce the cultivable areas up to 22% of the scheme area.
- The outflow consisting of infiltration and drained surface water will decrease up to 27% with a risk of total depletion.

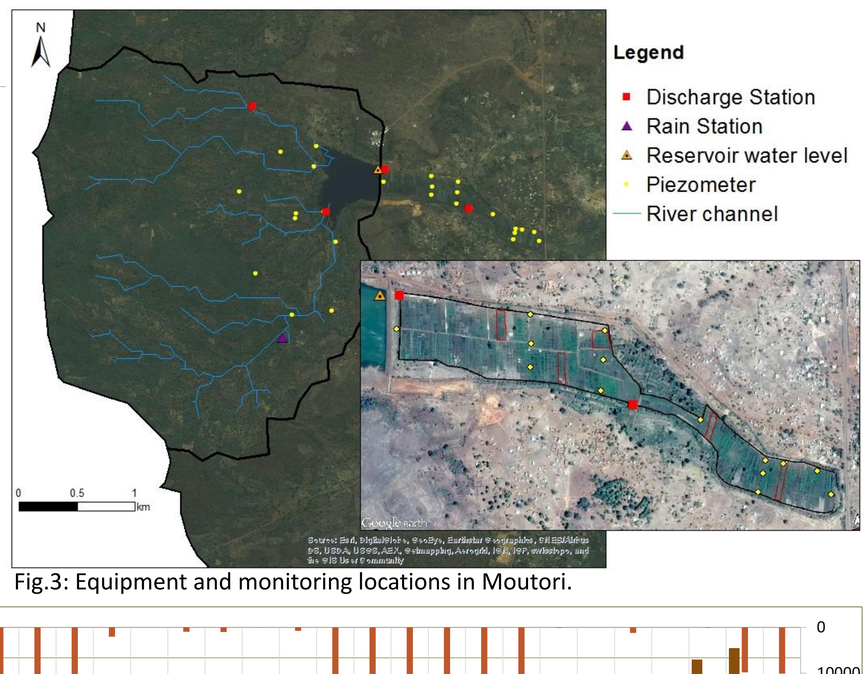
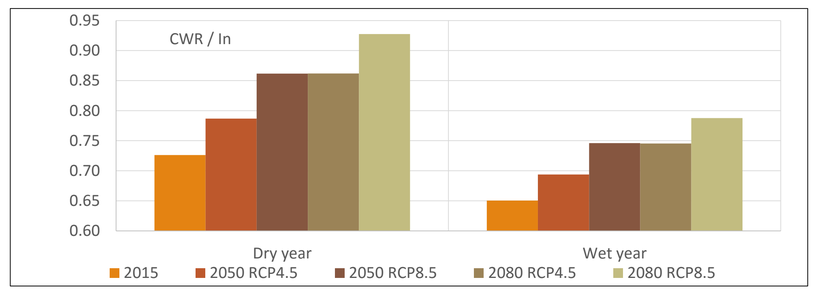
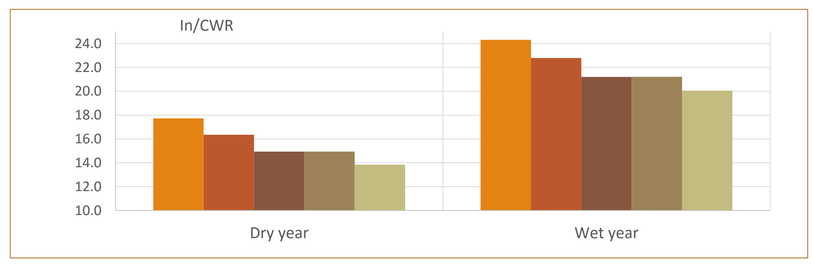


Fig.3: Equipment and monitoring locations in Moutori.

Fig.4: Components of the water balance in Moutori.





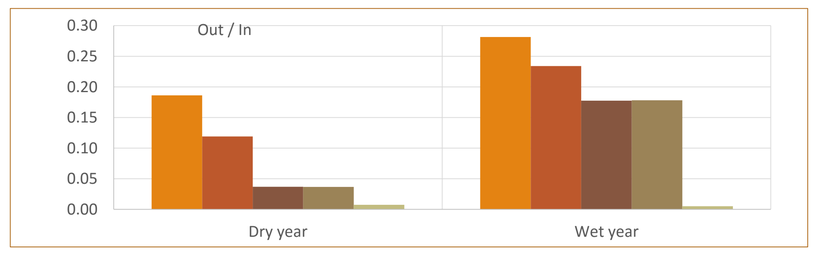


Fig.5: Irrigation performance assessment indicators for 2014-2015 and for the years 2049-2050 and 2079-2080 under RCP 4.5 and RCP 8.5.

Conclusion

Farmers are already experiencing water scarcity during dry years specifically during the dry campaign (Dec-May), and try to adapt by reducing already the cultivable area (50% in 2014).

Solutions imply from the demand side an improvement in the use of water to increase the efficiency and the productivity, and more flexibility in the management of land and the choice of crops to better adapt to the available water, and from the supply side the research of alternative solutions like the use of groundwater.

Acknowledgment

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