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Water uses adaptation in Africa and Impact of water resources availability on several African communities

Adaptation aux usages d'eau en Afrique et impact de la disponibilité des ressources en eau sur plusieurs communautés Africaines

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Résumé : Dans cinq régions économiques d'Afrique des problèmes de pénurie de ressources en eau se posent et impactent les communautés les plus vulnérables.
Les études relatives à une communauté par région sont abordées dans l'article avec une description de l'utilisation de l'eau et de l'adaptation aux périodes de pénurie.
Ces exemples concernent les communautés Berbères nord-africaines, Touaregs d'Afrique de l'ouest, Wodaabe (ou Bororo) d'Afrique centrale, Masaï d'Afrique de l'est et Bushmen d'Afrique du sud.
L'auteur se livre à une analyse SWOT de l'adaptation de ces communautés aux changements climatiques et sur leur aptitude à adapter leur vie aux conditions environnementales extrêmes du futur.

Mots-clés : Usage de l'eau, Adaptation, Afrique, Berbères, Touaregs, Wodaabe (Bororo), Masaï, Bushmen

Abstract: In each of five economic regions of Africa, water resources shortages have occurred and impacted the most vulnerable communities. Case studies of one community by region are described in the article with a description of its water uses and related adaptation required during water shortage periods.
These examples are taken in Berber communities for Northern Africa., Tuareg for Western Africa, Wodaabe or Bororo for Central Africa, Masaï for Eastern Africa and Bushmen for Southern Africa.
The author undertakes a SWOT analysis of these communities adaptation to climate change and concludes on the conditions to improve their lives in the event of future temperature and extreme environmental conditions increases.

Keywords: Water uses, Adaptation, Africa, Berbers, Tuaregs, Wodaabe (Bororo), Masaï, Bushmen.

INTRODUCTION

Africa is the second driest continent in the world, after Australia (WWF, 1986) and one of the most vulnerable regions to climate change, variability and extreme climatic events. In Western Africa, the chronic drought resulting from climatic variability and change plays a catalyst role in desertification (NIASSE *et al*, 2004). African tribes are more or less impacted by the limited access to water resources. This paper aims at identifying the Strength, Weaknesses, Opportunities and Threats (SWOT) regarding water resources availability for Tuareg for Western Africa, Wodaabe or Bororo for Central Africa, Bushmen for Southern Africa, Masaï for Eastern Africa and Berber communities for Northern Africa.

PROBLEM

Some projections of the climatic conditions possibly faced in 2080/2099 compared to 1980/1999 are given in the Fig 1.
The trend of climatic conditions and variability is described in the pilot AMESD Continental Environmental Bulletin published in May 2011 (African Union Commission and European Union,


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2011) based on the analysis of remote sensing imagery and derived environmental indicators (FEWSNET Rainfall Estimation (RFE) decadal imagery for Rainfall; Spot-Vegetation NDVI (Normalized Differential Vegetation Index) Anomaly and Normalized Growth Index (NGI) for Vegetation Productivity and Potential Growth respectively and daily MODIS active fire product (FIRMS) for Active Fires.

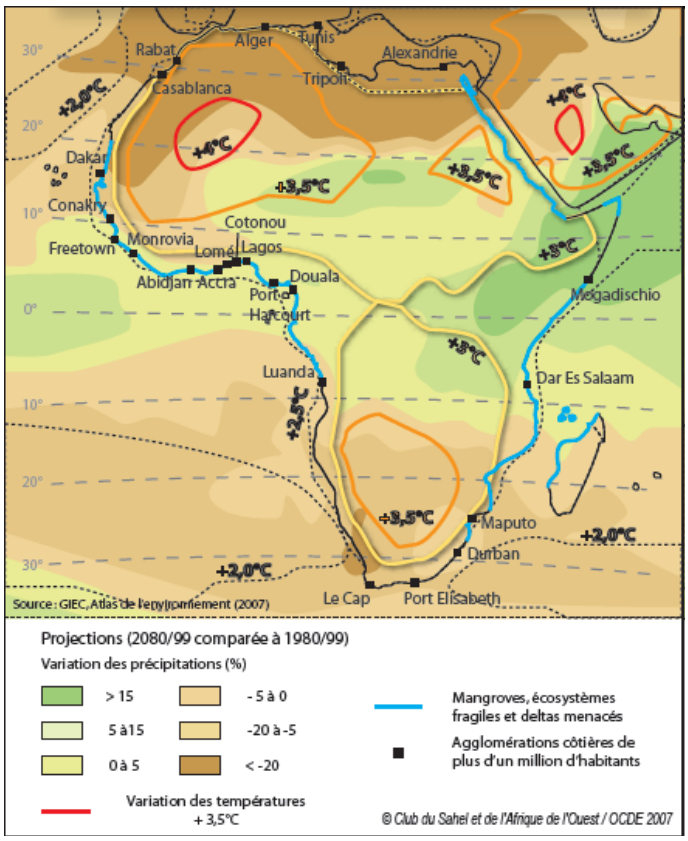


Fig. 1 : Projections of the climatic conditions in Africa in 2080/2099 compared to 1980/1999 (Club du Sahel/OCDE, 2007)

Fig. 2.summarises the current situation as:
- Persistent below-average[1] rainfall for two consecutive seasons in Eastern Africa leading to moderate to severe drought (north-eastern Kenya and south Ethiopia)
- Above-average vegetation conditions and flooding events in Western continental Southern Africa
- Drop in rainfall leading to short term dryness in South-Eastern Africa (south Botswana)
- Average rainfall conditions in Western and Central Morocco and below-average rainfall conditions leading to vegetation stress in central Morocco
- Above-average rainfall conditions in the Sudanian part of Western Africa
- Evapotranspiration and crops' water requirements increase with temperatures which make irrigation a way of reducing agriculture vulnerability to climatic events (CIRAD, 2009).

[1]Rainfall products used by AMESD programme
The products are derived from the FEWSNET Rainfall Estimation (RFE) decadal imagery. The RFE imagery combines Meteosat infrared data, rain gauge reports from the global telecommunications system, and microwave satellite observations to provide daily rainfall estimate in mm at an approximate horizontal resolution of 10 km. Link: http://earlywarning.usgs.gov/fews/africa
• aPcumt = Pcumt – avgPcumdt (mm and %)
The Pcum anomaly represents the deviation of monthly cumulated rainfall estimation (Pcum) from the climatic monthly average (avgPcumdt) computed based on a so-called Long Term period (1995 to present). This product allows highlighting the location and the intensity of the rainfall anomaly. It isprovidedboth in percentage and in mm.

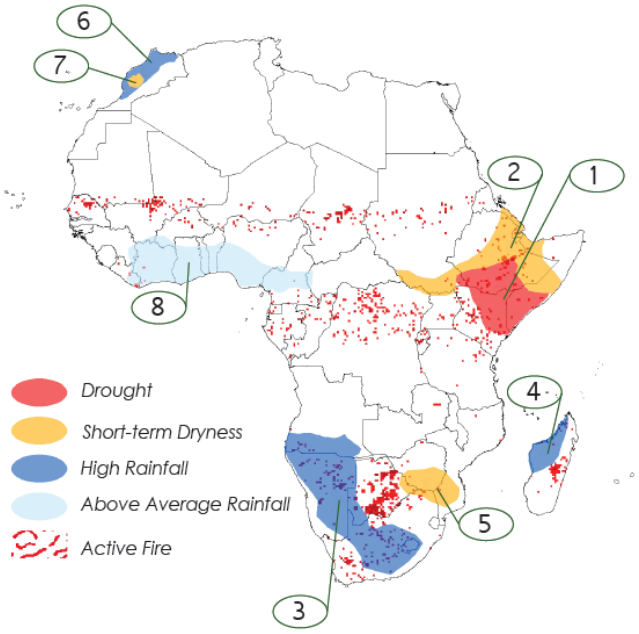


Fig. 2 : Spatial distribution of the main climatic events (AMESD Continental Bulletin, May 2011)

METHODS

In order to assess the water use adaptation of various indigenous tribes of Africa, a SWOT analysis of the impact of water resources availability on their communities has been undertaken taking into account the new trends they are experiencing in their daily lives (Fig.3.).

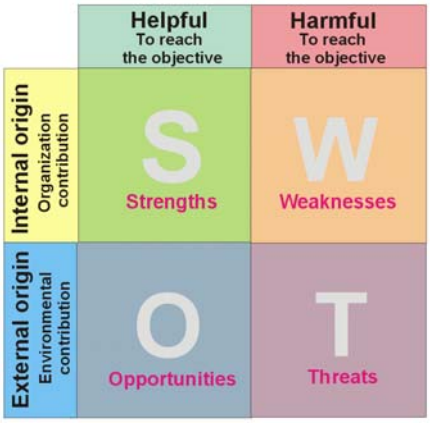


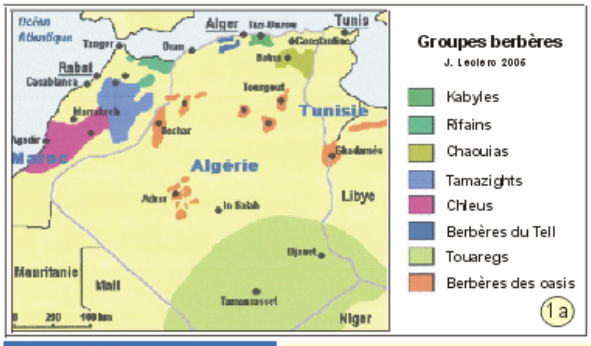
Fig. 3 : SWOT analysis diagram

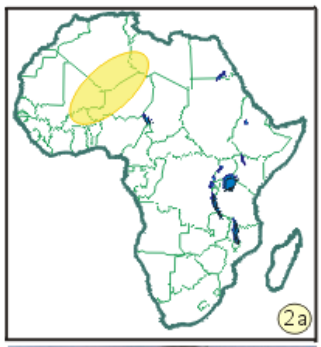
The results are presented by tribes below.

Berber communities for Northern Africa (25 millions persons)

Irrigation is a way of reducing vulnerability of agriculture to climatic events. It was developed in Maghreb where rainfall decrease has been very high since 20 years (CIRAD, 2009)

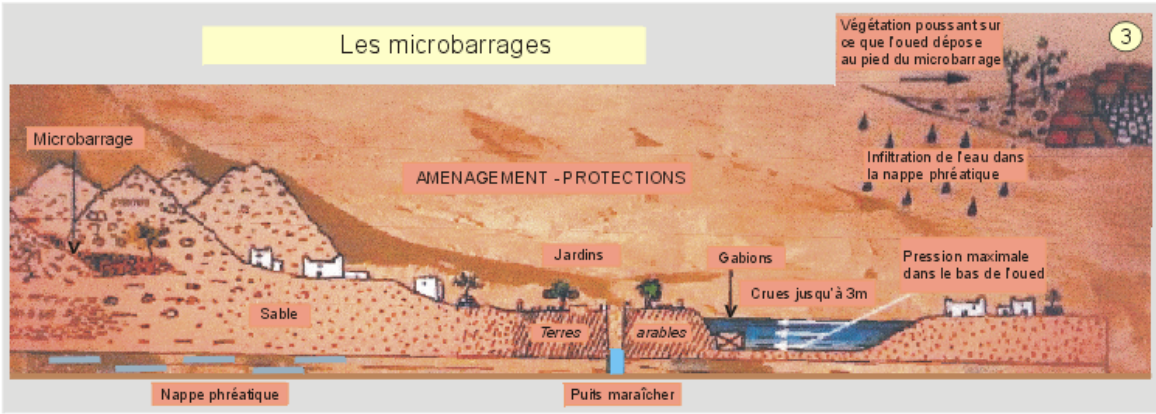
Plate





1a - 1b : Berbers populations
(Sources: Choc de cultures)

2a - 2b : Tuareg territory (in yellow) and Tuareg gardening system



3 : Adaptation in subdesert areas. Microdam developed to stop water from slopes while gabions retain water in fertile land during temporary water courses (wadis) and infiltrations in the ground (CARI Calendar, 2004)

4 - 5 : Wodaabe drinking water fom wadiand well (source: Projet Lissal)

6 - 7 : Masaï: water reserve and river in the Masaï Mara

including drip irrigation to reduce water consumption (Plate – Fig. 3). ROUSSET (2007) studied the potential of virtual water trade in Northern Africa to compensate local water shortages by a geographical shift of
the agricultural production and a sectorial shift of domestic water uses. She recommends in this context to substitute orchards towards exportation to irrigated cereal productions. She also support the adoption of a decentralized approach of virtual water trade within IWRM based on the progressive integration of the opportunity cost of water in water uses decision-making instead of centrally-decided sectorial limitations of access to the resource.

Berber populations estimated at 25 million persons (Plate – Fig. 1a/1b) adapted their water uses to the aridity of their environment (WORLD BANK, 2007).

Strengths Irrigation development	**Weaknesses** Aridity Scattered population
Opportunities Virtual water trade Commercial agreements	**Threats** Desertification

Table 1. SWOT analysis for water resources use by Berbers.

Tuaregs for Western Africa (1.5 million persons)

Tuaregs are a population of 1.5 million Berber persons spread in the desert territories (Tinariwen) of five countries (Plate – Fig. 2a/2b) of Sahara (Algeria, Libya) and Sahel border (Niger, Mali, Burkina Faso). Western Africa has been facing a chronic drought since 30 years (NIASSE *et al*, 2004). Annual rainfall decreased from 20 to 40% between 1931-1960 and 1968-1990 and agricultural losses are foreseen to reach 2 to 7% of GNP before 2100 in some parts of Sahara (WMO and UNDP, 2008). In Western Africa, severe drought events in the 1970-1980s have enhanced the development of small irrigation.

Strengths Nomadism as adaptative way of life Very good knowledge of their environment Adaptation to extreme events	**Weaknesses** Hostile environment (desert) Extreme temperatures
Opportunities Water conservation techniques Water value appreciation Trade / transhumance Small irrigation	**Threats** Sensitivity to extreme temperatures Settlement of population mainly in Tamaransset in Algeria and Agadez in Niger Economical and political marginalization Conflicts

Table 2. SWOT analysis for water resources use by Tuaregs.

Wodaabe (or "Bororo") for Central Africa (45,000 persons)

WoDaaBe are the "people of the taboo", those who respect taboos, a sub-group of the Fulas (Plate – Fig. 4/5). They were 45,000 persons in 1983 (BOUTRAIS, 1990). They are nomadic in Sahelian Niger and lived there 7,000 years ago. They were deeply impacted by the 70s and 80s' droughts with irregular and scattered rainfall and reduced vegetation. This led to erosion of plots which often become more or less covered by sand.

Strengths Herdsmen	**Weaknesses** Non-permanent streams
Opportunities Dry season transhumance migration Agriculture	**Threats** Conflicts between nomadic and settled populations Desertification Decrease of pasture land due to agriculture

Table 3. SWOT analysis for water resources use by Wodaabe.

Masaï for Eastern Africa (300 000-880 000 persons)

Masaï are originating from the Nile Valley. Herdsmen and warriors, they mainly live in Kenya and Tanzania in the mountainous areas created by the Great Rift Valley (Elgon, Kenya, Kilimandjaro and Meru monts).Water is scarce and rainfall very little. Their settlement in Masaï Mara National Park was badly welcome and they remain in permanent conflict with authorities (PERON, 2000; WETLANDS INTERNATIONAL, 2011). Samburu, Arusha, Baraguyn, Kwavi and Ilmmasaï are some of the tribes (Plate – Fig. 6/7).

Strengths Semi-nomadism Herdsmen Believe in Enkai God manifesting himself through rain	**Weaknesses** Drying of wetlands (Amboseli lake) Water uses conflicts (Kimana wetlands)
Opportunities Protection of their lifestyle in national parks	**Threats** Loss of traditional lands Settlement forced by government (to respect borders, in national parks) Drought

Table 4. SWOT analysis for water resources use by Masaï.

Bushmen (or "San") for Southern Africa

Bushmen are the oldest populations of Africa (since 20,000 years). They mainly live in the Kalahari Desert.
About 100,000 persons are remaining and have settled whereas 3,000 are still nomadic (KEENEY, 2010: ZIERVOGEL *et al.,* 2008).

Strengths Hunters-harvesters Knowledge of desert resources 3,000 are nomadic (in the Kalahari reserve)	**Weaknesses** Extreme environment (desert) No basic services
Opportunities Protection of their lifestyle in national parks	**Threats** Reduction of hunting territory Expulsion from Kalahari reserve Diamond mining in Botswana

Table 5. SWOT analysis for water resources use by Bushmen.

CONCLUSION

Climate change and variability impact on water resources also affect tribal populations in which communities the poorest people are found in the world. African tribes studied in this article are Berber, Tuareg, Bororo (Wodaabe), Masaï and Bushmen. They have their territory limited by the development of major groups and, for the poorest, live in rural extreme conditions where climate plays a key role.

Settlement of these tribes, either voluntary or forced, could be seen as a threat compared to a nomadic or semi-nomadic life style that was suitable for adaptation to climatic extreme events. It could for example be the starting point for improving water access through water points and developing agriculture using water saving and water efficiency techniques.

Tribal sensitivity to water resources shortage and climate change should therefore be scrutinized by African governments in their strategies to address climate change and variability and to propose adaptable measures of relevance also for them at regional level. Strengths of some tribes could be documented and transferred to other tribes facing similar conditions and threats.

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