Improvement of water management under severe scarcity and climate change in the upper Drâa catchment

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Upper Drâa catchment is characterized by an arid climate with huge contrast spatial and seasonal water availability. Climate change models indicate decrease of precipitation and increase of drought frequency and severity. The economic dynamic in the territory is diverse: solar energy, tourism, mining and agriculture. Therefore, business sustainability of these sectors requires sufficient water management under scarcity and lack of supply. In order to sustain the socio-economic growth of the region and its resilience toward the water crisis, Integrated Water Resources Management (IWRM) practices need to be checked to date and adopt an inclusive approach involving all stakeholders including drinking water providers businesses and farmers communities. In this work, based on current critical situation data, we propose a dynamic framework of management by sub-basin and by communities while adapting some key principles neglected in classical management: precision monitoring, focus on controlling demand and supporting local know-how management skills.
The efficiency of water management could be assessed more effectively using simple and reliable indicators like: crop yield, soil stability and demand control. By collecting data from users and stakeholders continuously and getting feedback from them to refine the practice. Emerging methods of data collection like citizen science and crowdsourcing could contribute to this end in addition to earth observation and IT technologies. Moreover, this approach can provide sustainable water management which concerns three pillars (Economic, social and Environmental) of sustainability.

Introduction

The upper Draa catchment is located south-eastern Morocco between latitude 30 and 32 °N and longitude 5.5 and 8° W. The basin drains an area of about 15K km2 starting from High Atlas Mountain (4060m) Mgoun mount and the total flow is captured by the Elmasour Eddahbi reservoir (1064m) near Ouarzazate city (Figure 1) show the localisation of the basin. This reservoir is used to irrigate the downstream oasis system of Draa valley and supply water for socio-economic needs. The climate of the basin is semi-arid on its north part and arid in the middle and south parts. The average amount of annual precipitation is 160mm. The simulation of the impact of climate change on water shows a decrease of 4 to 15% and increase of main temperature between 1.4 to 3°C (Karmaoui et al., 2019). Persistent drought coupled with overuse and exploitation led to surface and ground water depletion as well as degradation of quality (Reichert, 2010). The socio-economic and environmental consequences of this situation threaten business sustainability as well as ecosystem services, economic activity and livelihood of local population. The aim of this work is to propose a framework of governance that emphasise the social inclusion of local population through active participation in water management.

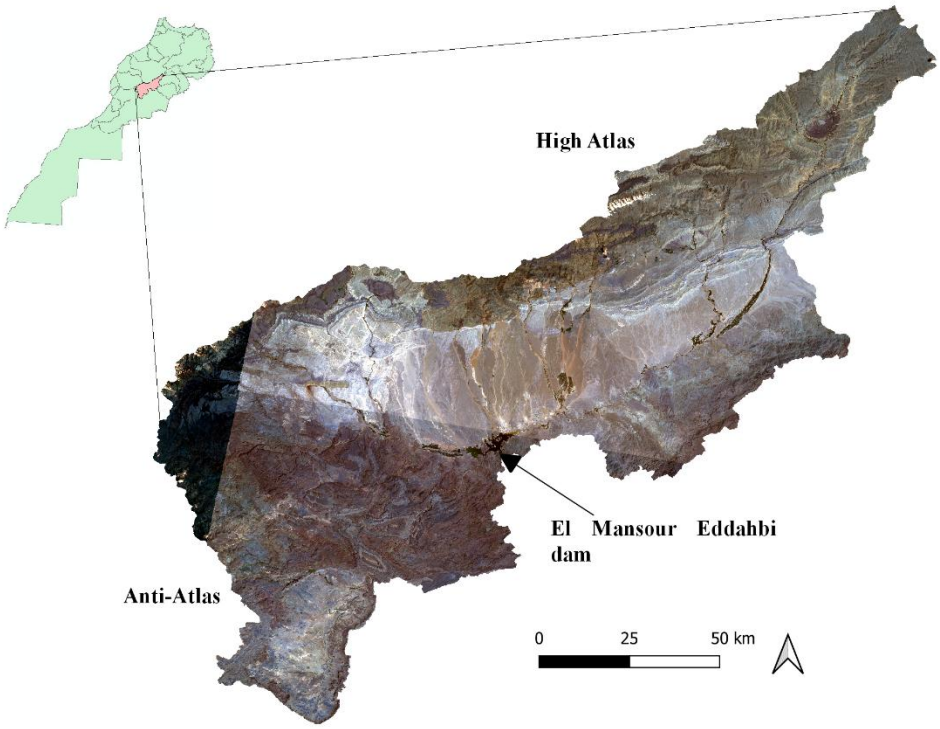

Figure 1: Localisation of upper Drâa catchment

Socio-economic setting

Population evolution shows a positive annual change of +0.75%. With this amount, the projection of 2022 is about 314K inhabitants. More than 60% of this population live in rural area and meanly practice agriculture and pastoral activities (HCP, 2016). In addition, tourism and mining activities are also a source of revenues. The solar energy project NOOR is the biggest governmental investment in the region. The potential of available water resources is evaluated to 556 Mm3 and mobilized resource to 306 Mm3 (ABHDON, 2018). The area is considered under water stress with average of 970Mm3/inhab/year.

Regional organisation of water sector

Hydraulic Basin Agency (ABH) is the executive entity of water policies. However, the effective implementation needs to be initiated through other stakeholders, including, the local authorities, ORMVA, ONEE, and the water user's associations. The figure (2) present regional stakeholders of the sector.

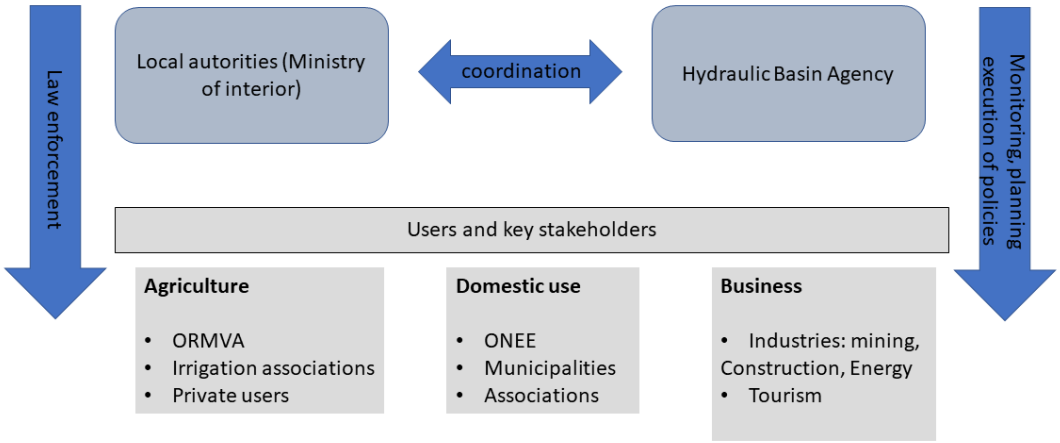

Figure 2: Stakeholders map

The panoply of actors intervening in water planning, decision making and execution makes the mission of assimilating all the strategies a heavy task. Therefore, various problem of water management surge:

- Poor implication of local communities' results in difficult implementation of different programmes which yield insufficient outcomes;
- Competition among users and ineffective coordination of public actions;
- Increasing of demand especially for agriculture appeal for increase supply which deplete resource;
- Change in land use increase desertification and the vulnerability to drought and floods.

Improve governance system

Local communities can participate actively in the process of monitoring and assessment of different aspect related to water and environment. For instance, reporting on infrastructure of water (wells, boreholes, and upstream of dams.) and change in water quality. They can also provide vital information regarding waste disposal on stream network that is a concerning problem in watershed management. In addition, in remote area, risk of soil erosion and landslide can be uncovered by local population. Monitoring precisely water resource is a time and money consuming for water manager (Hydraulic Basin Agencies) and researchers. Therefore, the establishment of links of coordination and cooperation with local communities, and their active implication in diagnosis, planning and implementation of water policies, could ease the pressure on state administration and contribute to efficiency of management (Branchini et al., 2015). Experiences of some NGOs demonstrates that local people with key training on how to operate and report can be game changing shift on water management (Dodson & Bargach, 2015). The figure 3 present a general perspective of interaction according to this approach.

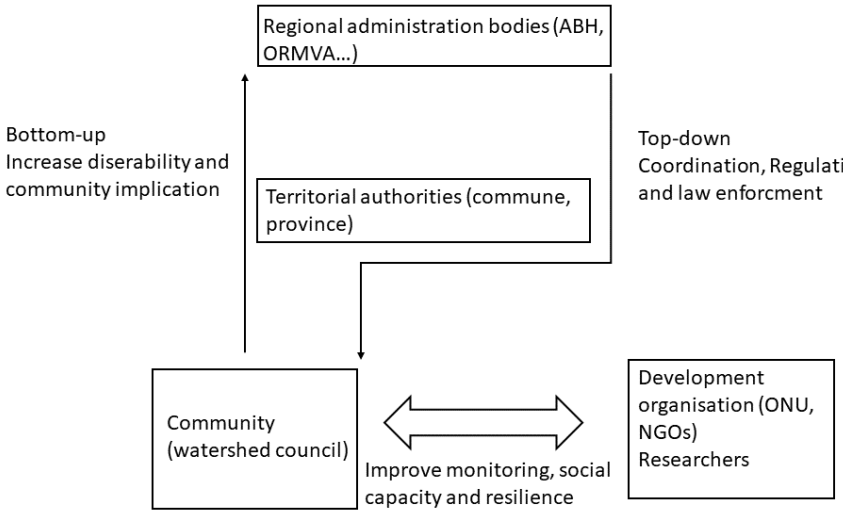

Figure 3: framework of governance

This approach uses both top-down and bottom-up management strategies. This framework is supported by scholars in common pool resource management. For instance, (Ostrom, 1990) argue that the government action could not be effective without support by individuals and communities. Thus, the principle that common resources are well managed by those communities that benefit the most from them and that their regulation should be addressed at the local level, through the farmers, communities, local authorities and NGOs. Moreover, innovation of indigenous and local community led to resilient ecosystem governance in the past which can serve as a source of inspiration to collective action and intelligence.

Conclusion

Water scarcity is a fact in Morocco and it only becomes worsen with global climate change. The situation is more critical in Southern Atlasic basins. The sector of water management face huge challenges to sustain economic development and ecosystem services. Therefore, more focus on inclusive governance system is needed to strengthen the gains and improve the weaken points. The proposed scheme is inspired from ancestral heritage and supported by empirical studies to emphasise community implication and social aspect of water governance and management.

Acknowledgement

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