Chapter 3
Ecosystem Services Demand Management Under Climate Change Scenarios:
Use of WEAP Software in Case of Water Demand in Ziz Basin, Morocco

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ABSTRACT

Water ecosystem service is the most important element that supports Tafilalet agro-ecosystems. In this region, drought frequency is increasing, which complicate the management groundwater reserves. The ephemeral flows of the rivers force people to use groundwater to meet the population demand. Consequently, water resource management is of significant importance the sustainability of this area. Water evaluation and planning (WEAP) is useful management software used to evaluate and trace the trend of water demand. This model was applied in case of Ziz basin in order to simulate and analyze the situation of water under different scenarios. The results show an increasing of demand for water irrigation and with introducing modern irrigation scenario. However, a decreasing trend in reservoir storage volume and groundwater storage was projected in Tafilalet.

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INTRODUCTION

Arid and semi-arid ecosystems provide several goods and services. Water ecosystem service is the most important element that supports the human well-being. Climate change is a real challenge in the dry areas that affect some extreme events such as drought, which increases and complicates the management groundwater reserves. The change in precipitation influences the flows of the rivers, which forces local population to use groundwater to meet the increasing demand. Several studies have shown that it is important to include the effects of climate change in local water planning (Schimmelpfennig, 1996). Risbey (1998),seeking to link present-day planning decisions to uncertain future climate projections. More recently, researchers have used integrated water resource planning models to evaluate the impact of climate perturbations on the performance of current water management systems (Brekke et al., 2004; Vicuna et al., 2007; Zhu et al., 2005; Karmaoui et al., 2018; 2016; 2015).

The trend toward a global warming of the Earth's atmosphere is an important environmental force with significant implication for the state of groundwater ecosystems. The Earth's surface temperature during the last two decades has increased by about 0.5° C and an ongoing rise with similar amplitude is expected up to 2025 (IPCC, 2001; IPCC, 2007). The global warmth in 2001 was unusually high and is considered to be a consequence of anthropogenic greenhouse gases (Hansen et al., 2002).

Since 1970s, Morocco has experienced a general rainfall decline and temperature increase (Driouech, Déqué & Mokssit, 2009) that causes a decreasing trend in water resources. The Ziz-Gheris catchment in the south of Morocco is a concrete example of climate change impact on water resources and groundwater specially.

In this chapter, Water Evaluation and Planning (WEAP) software was used to evaluate and trace the trend of water demand. This model was applied in case of Ziz basin in order to simulate and analyze the situation of water (reservoir and groundwater) under different scenarios.

Study Area

Tafilalet is located in southeastern Atlas Morocco between the South-Atlas latitudes 29°30' and 32°30'. It occupies approximately 8.44% of the surface of Morocco (approximately 60 000 km^2 of which 60 000 ha is irrigated).

Ziz Valley (Figure 1) is located in Errachidia Province, with a density of 2 per square kilometer at provincial scale. The majority of people work in agriculture sector, the main economical source of income. The province host Tafilalet Oasis (1370 km^2), which is an important biosphere reserve. Hydrologically, the region is crossed by Rheris and Ziz Wadis that are fed by Hassan Edakhil Dam.

Tafilalet encompasses three watersheds: Ziz, Gheris, and Guir on the southern slope of the Oriental High Atlas. The high diversity of substrates found within the region, in combination with its large vertical extension and extreme moisture and thermal gradients create diverse ecological systems. This high environmental variability is at the origin of an exceptional biological diversity which makes the High Atlas a center of diversity and endemism at regional scale. The floristic richness does not result only from the superposition of the different regional floras; however, it is characterized by a remarkable individuality.