Chapter 7
Geospatial Technics, Modelling, Meteorological, and Ground Data for Crop Management in Semi-Arid Zones of Morocco

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ABSTRACT

Recent geospatial technologies offer an infinite number of opportunities in the domain of land management and governance. This is due principally to the fact that new satellites allow the collection and monitoring of important information about soil, crops, weather, and climate. In this context, this chapter presents a review of studies conducted in three semi-arid plains in Morocco during the last two decades on the combined use of geospatial technologies, modelling tools, meteorological, and ground data to manage irrigated lands in semi-arid zones. The three studied regions are located in three different sites well distributed over the country. This chapter presents a simple and clear summary of what has been performed using geospatial technologies by Moroccan researchers to improve agricultural management in irrigated areas in Morocco. Such work could help policymakers in developing efficient land governance policies by taking into account the latest scientific results.

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INTRODUCTION

Land governance consists in better managing earth's surface and its various resources such as crops, water, air, and biodiversity. This governance is increasingly important especially in the actual context marked by a population increase, extension of urban areas and climate changes. These factors affect mainly agricultural sector in underdeveloped countries where, unfortunately, agriculture represents the main activity of the population. Morocco is a good example of these countries since agriculture accounts for 15% to 20% of gross domestic product (GDP) of the country, depending on the amount and the distribution of rainfall during each year (Balaghi, Jlibene, Tychon, & Eerens, 2013). The effect of rainfall fluctuations on agricultural production explains 75% of the year-to-year variability in national GDP. Agriculture sector is the largest employer in the country and employs about 40% to 50% of the nation's workforce. In term of area, about 9,895,000 hectares or 22.1% of the total land area is arable (excluding Moroccan Sahara). About 43% of arable land is devoted to cereals and in a normal year, Morocco produces about two-thirds of the grains (mostly wheat, barley, and maize) needed for domestic consumption. Irrigated land accounts for about 15% of cropped area and produces over 50% of the value of production and irrigation accounts for 87% of water use.

However, water resources constraint the development of irrigated agriculture in Morocco. Water is exploited beyond its renewable limits, and the expansion of irrigated areas is not an adequate solution. Agriculture, which currently accounts for 87% of water use, suffers from increasing competition from urban and industrial demands. In irrigated agriculture, productivity is undermined by farmers' uncertainty about water supply, water scarcity being a key factor in lower-than-potential agricultural revenues. Introduction of more efficient irrigation techniques can help sustain production while conserving water resources, especially in the climate change context.

Realizing the gravity of the situation, Morocco has invested significant efforts since 1961 in the mobilization of water resources. The country currently has more than 100 dams with a total storage capacity of approximately 16 billion m^3. To reinforce this infrastructure, 30 other dams will be built by 2030. Regarding the development of agriculture, many irrigation areas have been created in several regions of Morocco. Result, about 1.5 million hectares are now irrigated from dams. However, the context of climate changes imposes to develop new good land governance approaches to better manage these irrigated areas and to preserve the limited water resources of the country.

Recent developed geospatial technologies offer new opportunities in the domain of crop management. This is due mainly to the fact that new satellites allow the collection and monitoring of important information about soil, crops, weather and climate. Thanks to new cloud computing services, it is now possible to analyse large amount of data at high spatial and temporal resolutions. Remote sensing data have been widely used around the world to monitor crops and lands at large spatial scale ((de Wit, Boogaard, & van Diepen, 2004) ; (Dinku, Chidzambwa, Ceccato, Connor, & Ropelewski, 2008); (Du et al., 2013)).

In Morocco, important efforts were deployed by Moroccan researchers during the last two decades to improve water management in irrigated areas by combining remote sensing data, crop modelling, meteorological data and field measurements. This chapter reviews three example of such studies conducted in three regions of Morocco. Firstly, a brief synthesis of adopted methodologies and used data are presented. The main results obtained are then summarised in this chapter.

The authors expected that this modest contribution will present a simple and clear summary of what has been done by Moroccan researchers to improve agricultural management in three regions based on