Chapter 7
Irrigation Monitoring Using Geospatial Techniques in Plastic Greenhouse Landscapes:
Case Study – Chtouka Plain, Morocco

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ABSTRACT

The practice of under plastic agriculture is a key economic driver in Chtouka plain in Morocco and plays an important role in agriculture systems. The spatio-temporal information of PGH is still not available countrywide neither at regional nor local scales. This information is required for agriculture and water managers as well as environmental agencies, especially since it represents the first pressure on groundwater resources, which knows a deficit of 60 to 80 million m3 per year. This chapter represents an optimized workflow for monitoring irrigation activities in a

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plastic greenhouses landscape, where machine learning techniques are used to build a model for automatic extraction of plastic greenhouses as well as irrigated areas in open fields using time-series Sentinel-2 imagery. The model was tested and validated firstly on one acquisition (29th July 2019) and then run on the cloudless time-series Sentinel-2 images for the period (August 2019-August 2020) at a monthly basis. The overall accuracy achieved exceeds 97%, and kappa coefficient was around 98%.

INTRODUCTION

The North Africa region faces three major challenges: aridity, recurrent drought and desertification. The economy and people's livelihoods are based primarily on the exploitation of natural resources including water and land. This region is affected by water scarcity issues where over-abstraction for agriculture use is causing irreversible damages on soils and groundwater resources. In addition, the high reliance of agriculture in the region on irrigation and the rainfall variability make the sustainable water resources management an urgent and mandatory action.

The practice of under plastic agriculture is a key economic driver in Chtouka plain in Morocco and play an important role in agriculture systems. In fact, plastic greenhouses (PGH) are widely used for vegetables and fruit trees cropping since the micro-climate beneath can be well controlled and hence optimal temperature, humidity, and other conditions required for crop growth are ensured which increases considerably the yields and the water productivity and food supply for the whole year.

However, the spatio-temporal information of PGH is still not available country wide neither at regional and local scales. This information is required for agriculture and water managers as well as environmental agencies. From one hand, there is a considerable pressure on groundwater resources by the PGH, especially in areas known by high added-values of crops like Chtouka plain. From another hand, plastic films are not easily degradable and have negative impacts on the environment. Therefore, it's important to find a solution to monitor easily the PGH extensions, and estimate their water consumption based on their temporal presence which can match a local agricultural calendar.

Traditional techniques for monitoring PGH through extensive field visits have proven their limits, they're time-consuming, and very expensive to be afforded at a regular basis by national administrations in charge of agriculture and water resources monitoring. In addition, the high dynamics of PGH and the short growing season for some vegetables makes the exhaustive mapping in field quasi-impossible, especially at large scale.