PO258

Flooding episode and relations with soil texture in a Mediterranean wetland

Jose Navarro Pedreño*, Gema Marco Dos Santos, Ignacio Meléndez Pastor, Ignacio Gómez Lucas (*jonavar@umh.es)

Department of Agrochemistry and Environment, University Miguel Hernández of Elche, Elche, Spain

Introduction

The effects of flash floods depend on different factors such the rain intensity, duration, and different land characteristics: topography, land uses, vegetation cover, soil texture and permeability or initial soil moisture conditions.

Soil texture is one of the properties that greatly influences in the water infiltration rate. Using traditional methods to estimate soil water content in the field is expensive and time consuming, mainly for large areas.

Therefore, in recent decades new methods have been studied by using remote sensing. Hunt and Rock [1] used the Moisture Stress Index (MSI) to analyze canopy stress [2] and to detect changes in the leaves water content using Near- and Middle-Infrared reflectance.

The index values range from 0 to more than 3: lower values indicate a higher moisture content and, higher values of the index indicate water stress in the vegetation. The average values for green vegetation are from 0.2 to 2.

Objectives

The objectives are, by using remote sensing, 1) to study the seasonal evolution of soil moisture content under a Mediterranean rainfall regime and 2) to evaluate the relationship between topography, soil texture and soil flooding after a flood episode

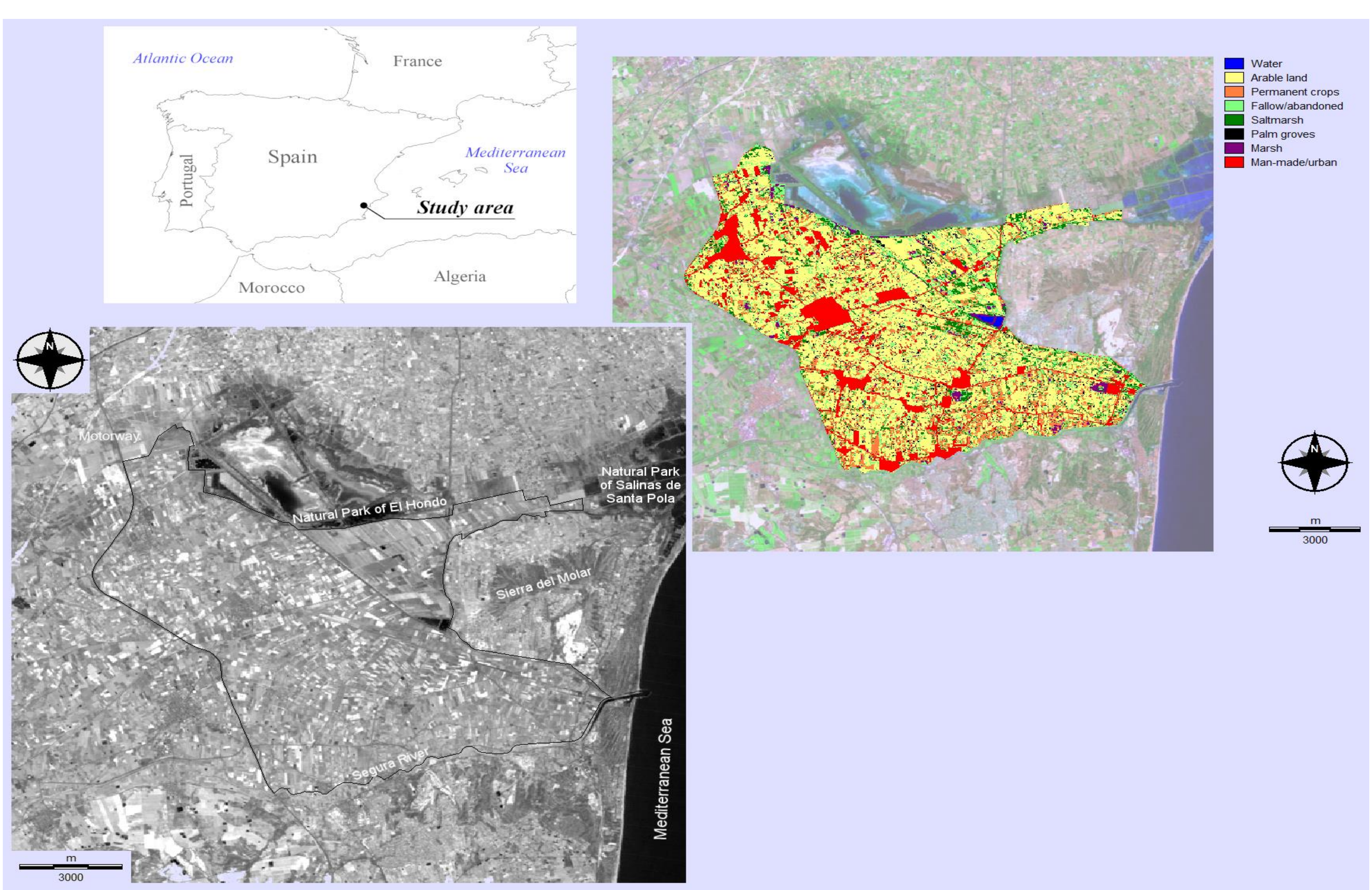

Figure 1. Location of the study area. Main land cover classes are also shown.

Material and Methods

The area selected is located in the south of "El Hondo" Natural Park wetland in Elche, Spain (Figure 1). This is of special importance for agriculture.

The area was delimited taking into account a low relief and was defined using physical barriers as the Segura river, Sierra del Molar mountain, the wetland, and the highway.

MSI was calculated using Landsat 8 Operational Land Imager (OLI) satellite in 4 different periods of 2019: in September after a rainstorm which caused floods in the area, October (a month later), April (spring) and August (summer). The study area was delimited using ortho-photography and then, a mask was created. Bands 6 and 5 from Landsat 8 images, previously cropped with the mask, were used to calculate the MSI following the [1] formula: R1.6/R0.82.

124 samples of topsoil were collected in different agricultural fields, and geographically located with GPS and ortho-photography. Then, the samples were analyzed for particle size estimation (percentage of sand, silt and clay), based on the Bouyoucos method.

The RGeostats package for R Studio was used to perform kriging and interpolate the point data obtained from sampling to the rest of the study area.

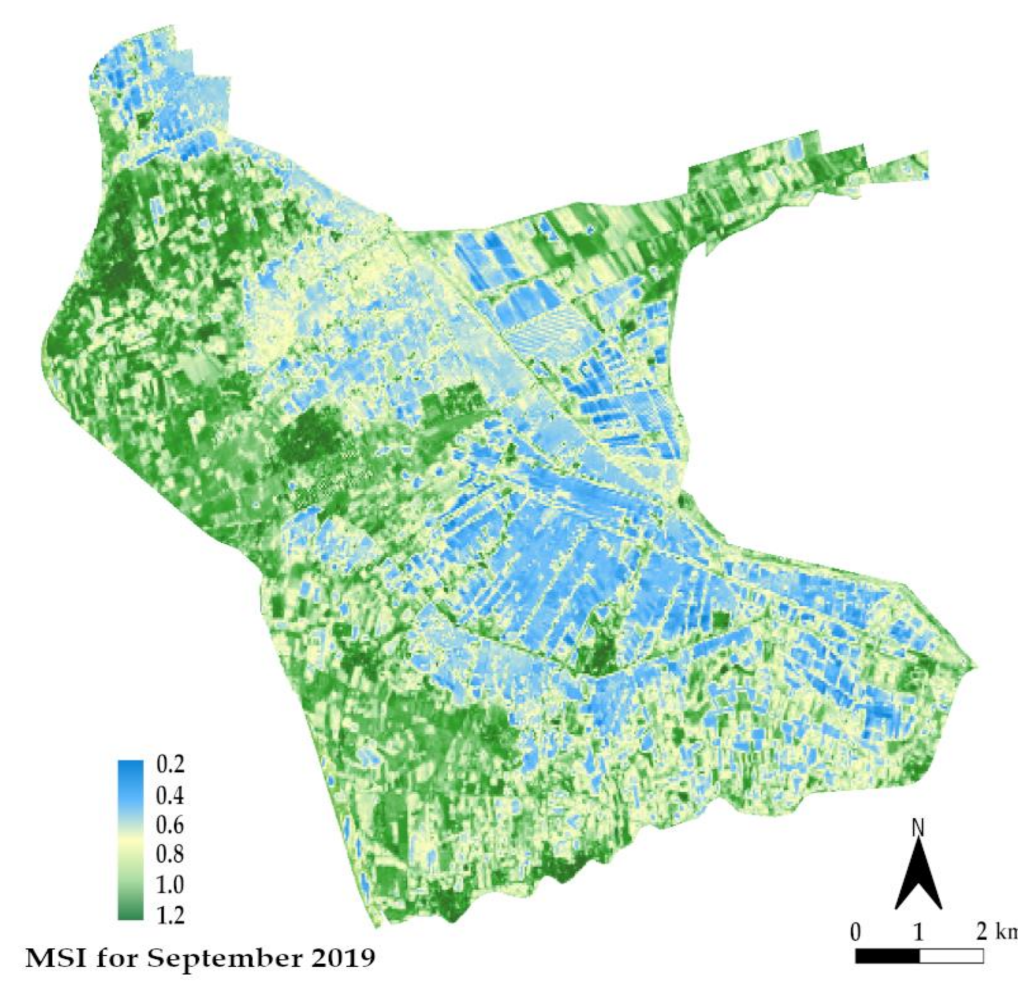

Figure 2. Moisture Stress Index (MSI) obtained in September 2019.

Results and Discussion

For the dates selected (spring, summer, September after a heavy rain and October), the most frequent MSI values vary from 0.2 to 1.4.

In April, the most frequent values are in the range of 0.4 to 1. The blue areas match with irrigated fields.

In August, values vary from 0.8 to 1. In this case, the wettest points correspond with irrigation ponds/reservoirs. Despite the high evapotranspiration, the MSI values continue below 2.

In September, the most frequent values range from 0.4 to 1,blurring the shape of the crops. These data fit with the floods suffered in the area after the rains.

According to the texture values obtained, the highest percentage of sand is in the northeast part of the study area. The clay content is generally lower for the entire area.

The topography, generally flat, is related with the higher silt accumulation in soils and these are associated to the flooding areas.

In general, what we found is that the flooding areas are closely related to those where the presence of silt. However, the irrigation management system has a lot of influence in the MSI and combined with the soil texture, determine the areas where the soil moisture is high.

In this sense, attention should be given in order to use the adequate plants that can resist high soil moisture and control the irrigation system to avoid floods.

Conclusions

The moisture content of the soil can be determind by using de MSI. This moisture can be determined by the weather, e.g. heavy rain in Mediterranean environments, and the irrigation system. Both combined with the soil texture should be considered to avoid flloding areas that can affect the agricultural management and yield.

References

1.Raymond Hunt Jr., E.; Rock, B. N. Detection of changes in leaf water content using Near- and Middle-Infrared reflectances. Remote Sens. Environ. 1989, 30, 43–54.
2.Welikhe, P.; Quansah, J. E.; Fall, S.; McElhenney, W. Estimation of Soil Moisture Percentage Using LANDSAT-based Moisture Stress Index. J. Remote Sens. GIS 2017, 06.