Instituto de Investigación y Formación Agraria y Pesquera
CONSEJERÍA DE AGRICULTURA, PESCA Y DESARROLLO RURAL

NASA DIRECT READOUT CONFERENCE (NDRC-9)
THE 9TH INTERNATIONAL EOS/S-NPP DIRECT READOUT CONFERENCE
Valladolid, Spain • June 21 – 24, 2016

ITC Faculty of Geo-Information Science and Earth Observation

Water-stress monitoring of oak savanna woodlands using satellite thermal data

M.P. Gonzalez-Dugo[a], *X. Chen*[b], *A. Andreu*[a], *E. Carpintero*[a], *P. Gómez-Giráldez*[a], *Z. Su*[b]

[a] IFAPA, Consejería de Agricultura, Pesca y Desarrollo Rural. Apdo. 3048 ES-14071 Cordoba, Spain

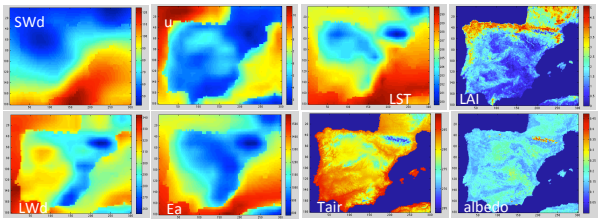
[b] Faculty of Geo-Information Science and Earth Observation, University of Twente, Enschede, the Netherlands

Holm oak savanna, known as *dehesa* in Spain and *montado* in Portugal, is the largest agroforestry ecosystem in Europe, covering about 3 million hectares in the Iberian Peninsula and Greece. It is considered an example of sustainable land use, supporting a large number of species and diversity of habitats and for its importance in rural development and economy. The same ecosystem is worldwide distributed in areas with Mediterranean climate and shares structural and functional properties with other type of savannas in Africa, Australia and South America.

This water-controlled ecosystem presents many interrelated links between climate, soil and vegetation, and is highly sensitive to changes in climate conditions and land use/management practices. These changes not only modify its structure, affecting the ecosystem long-term functioning, but also the land-atmosphere linkages and regional carbon cycle. In the last decades, this system has been exposed to multiple threats, which have caused tree decline, shrubs encroachment, changes in soil properties and hydrological processes, and an increase of soil erosion. Future climate projections for the region indicated that the situation is likely to be worsened, with more frequent and severe extreme events.

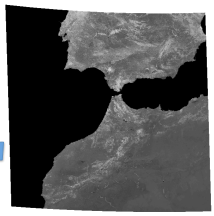
This work aims to map evapotranspiration and moisture stress of holm oak woodlands in Southern Spain using EOS data, and evaluate the response of the vegetation to the main droughts occurred during the study period (2001-2015).

1. INPUT DATASET



2001-2015: monthly 5km input dataset:

- METEO: reanalysis ECMWF
- LST: MOD11C3
- LAI: SPOT VEGETATION



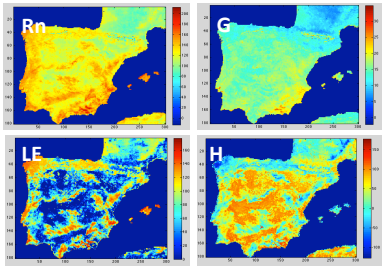
2000-2015
MODIS NDVI:
MOD13Q1

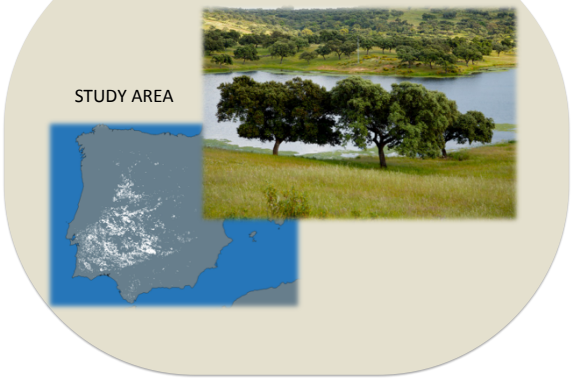
Every 15 days;
250 meter

2. ENERGY BALANCE MODELING

SEBS model
(Su 2002, Chen et al., 2014)

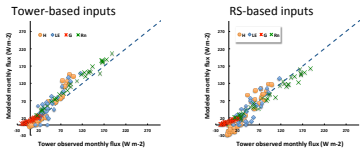
April 2009



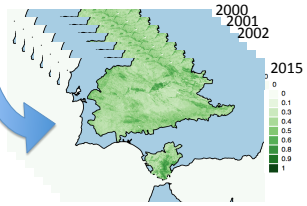


3. SURFACE ENERGY FLUXES VALIDATION

Two eddy covariance flux towers located over dehesa area

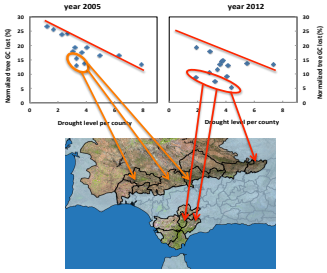


2. ANNUAL TREE GREEN CANOPY COVER

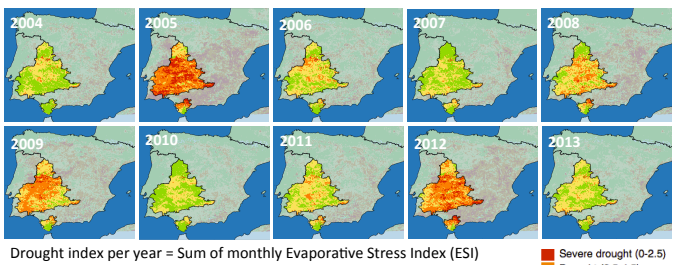


Average NDVI of July/August (to avoid background influence) were used to calculate yearly values of green tree canopy cover

VEGETATION CHANGES IN DROUGHT YEARS



4. DROUGHT MONITORING



Drought index per year = Sum of monthly Evaporative Stress Index (ESI)

ESI = ET / ETpotential (PM)

Most severe droughts occurred in 2005 and 2012, with similar spatial patterns.

- Severe drought (0-2.5)
- Drought (2.5-4.5)
- Dry (4.5-6.5)
- Normal (<6)

CONCLUSIONS

- The sum of monthly ESI is useful to monitor annual drought, but the presence of a repetitive spatial pattern in some areas may indicate a need to better account for the 'normal' state of specific sites.

- It can be identified a linear relationship between the local drought index and the evolution of the tree green canopy cover. However, this relationship is slightly different for the last two drought periods, and more mountainous areas.

REFERENCES:

Su, Z. (2002) The Surface Energy Balance System (SEBS) for estimation of turbulent heat fluxes, Hydrol. Earth Syst. Sci., 6, 85–100, doi:10.5194/hess-6-85-2002, 2002.
Chen X., Z. Su, Y. Ma, S. Liu, Q. Yu, Z. Xu (2014). Development of a 10 year (2001–2010) 0.1 dataset of land-surface energy balance for mainland China. Atmos. Chem. Phys. Discuss., 14, 14471–14518.

ACKNOLEDGEMENTS:

The authors would like to recognize the funding provided by INIA and FEDER 2014-2020 (Programa Operativo de Crecimiento Inteligente) through project RTA2014-00063-C04-02. Additional support was provided by the Cooperative Research Program of the Organization for Economic Cooperation and Development (OCDE).