Mapping flood regulation capacity of coastal wetland ecosystems in the Mediterranean: Guadalhorce river mouth (Spain)

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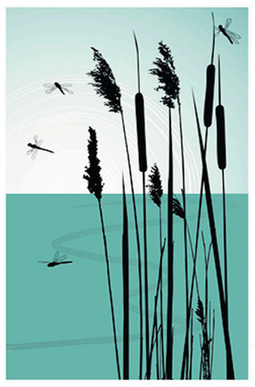
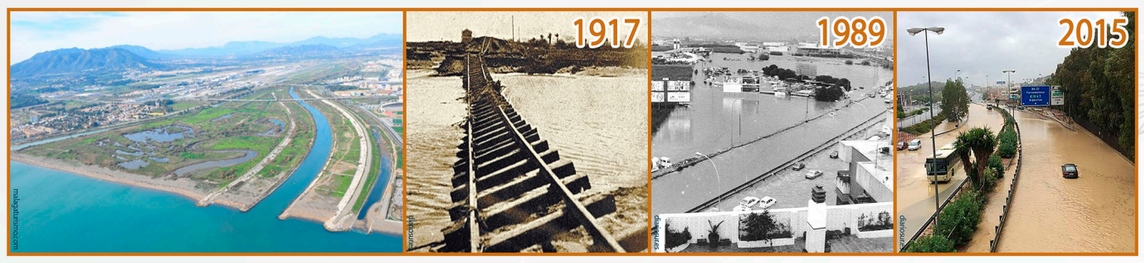


SWOS
Satellite-based Wetland Observation Service

Floods are extremely hazardous to human societies, where impacts are frequently registered in settlements around water bodies and flood plains. Additional problems arise with artificialisation of the structure of these bodies.

The capacity to regulate floods is a vital function of an ecosystem to control the negative effects of water-related disasters.

Guadalhorce river mouth - Malaga, Southern Spain
Recurrent flood episodes in the last century



Flood regulation service

According to the capacity of ecosystems to regulate floods through their functional retention capacity, flood regulation ecosystem service supply (or service production) and demand (or the benefit of the service) are calculated (Fisher et al., 2009) for the Guadalhorce river mouth in Southern Spain.

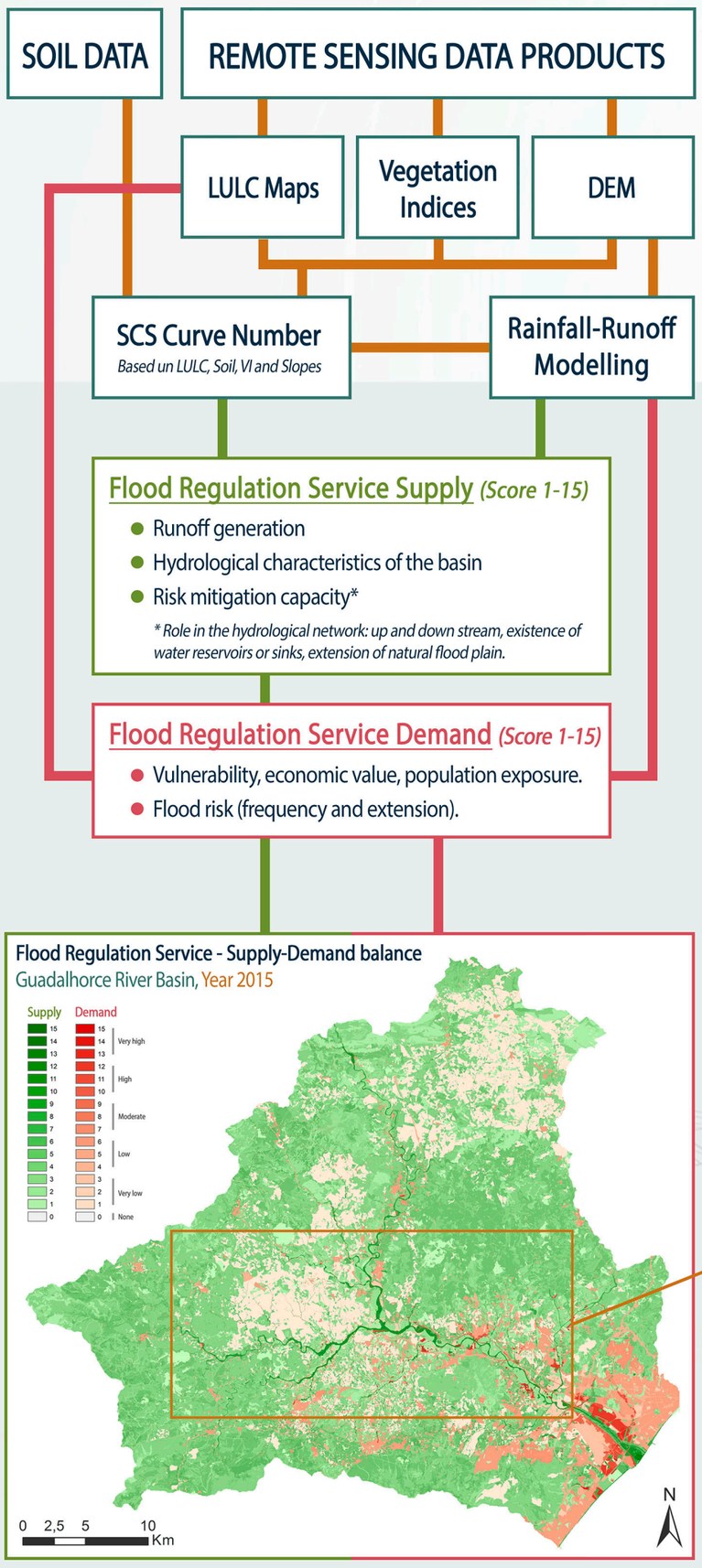
Service Supply
Forests, wetlands and densely vegetated areas provide natural flood mitigation and water regulation services:
- Reducing flood-danger
- Preventing damage to infrastructure
- Increasing water retention capacity

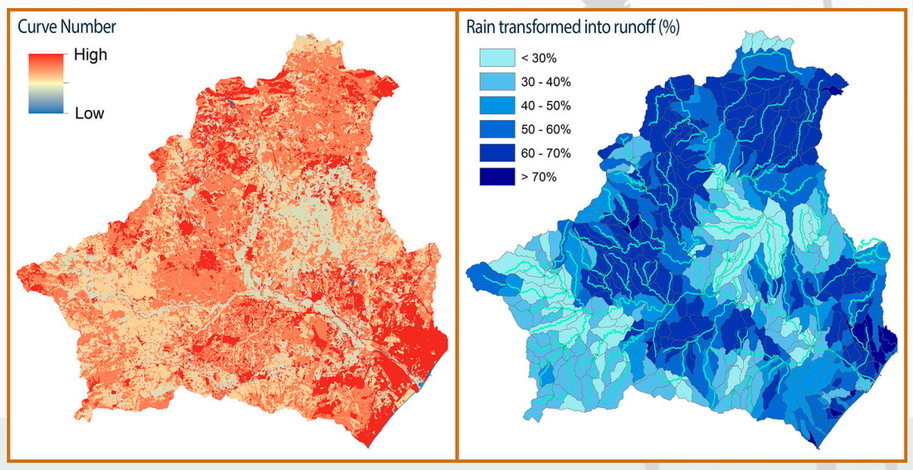
Service Demand
Human lives, settlements, and infrastructure are the service demanders:
- Urban, industrial, commercial areas, etc.
- Agricultural areas
- Protected areas, archaeological sites, etc.

The flood regulation indicator considers three key variables:

- Ecosystem or LULC capacity to provide the service
- Service demand of the ecosystem or LULC
- Environmental conditions affecting the generation and distribution of floods

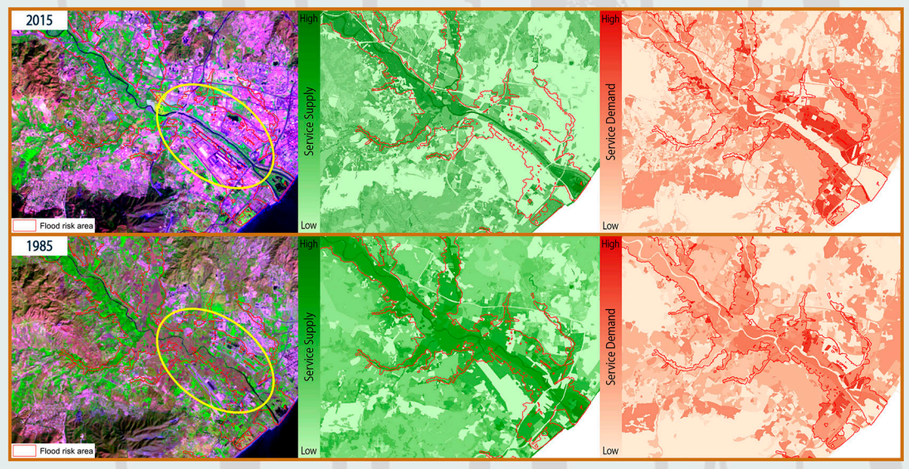
Mapping of flood regulation

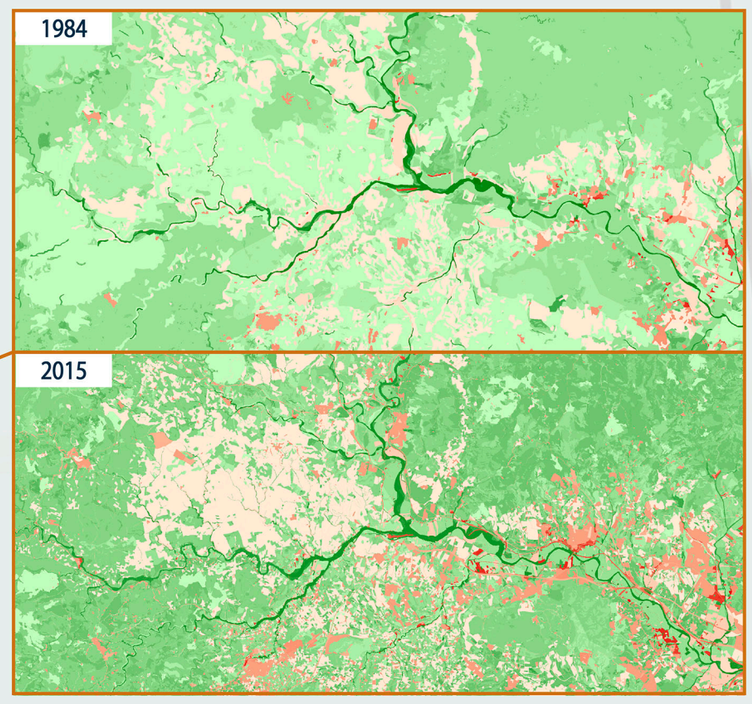




- The *Curve Number* map identifies the potential direct runoff generated from rainfall based on the LULC, soil properties, the density and continuity of the vegetation, and on the inclination of the area (USDA Natural Resources Conservation Service, 1986). Low CN corresponds to low runoff potential while higher values correspond to areas having high runoff potential.
- Rainfall-runoff modelling assesses the runoff potential of an area based on the hydrological characteristic of the basin and the river network (drainage volume, peak flow, etc.). It allows identifying the areas of the basin that mostly contribute to floods and provides a proxy of the % of the potential rain falling into a terrain that is transformed into runoff.

- In the basin of the Guadalhorce River, 44% of the region has suffered degradation in its capacity to supply flood regulation between 1984-2015. The most affected regions are around the flood plain, where 25% of the capacity has been lost. On the other hand, restoration measures in the upstream areas of the watershed have increased the supply capacity by 43%.
- However, the most important factor that have increased the impacts of floods is linked to the increase in land take within and around the floodplain. These areas have lost their capacity to supply the flood regulation as a result of soil sealing, and are subjected to a high demand for the regulation service. In flood risk areas, artificial surface have increased by 20%. 80% of semi-natural areas have suffered ecological degradation which affected negatively their capacity to reduce flood impacts.





Conclusions

- Flood regulating services cannot be imported from other regions. The service production areas (supply) have to be physically linked to the areas benefiting from this service (demand). Therefore, proper planning of the territory is vital to prevent the location of urban settlements in areas highly exposed to floods in order to minimise impacts on society.
- The Supply maps of Guadalhorce identify the areas that are naturally prone to reduce the severity of flood impacts, if their ecosystem function is preserved. In these regions, ecosystem restoration measures need to be prioritised, especially in degraded areas, to improve biological diversity and people's livelihood.
- The Demand maps spatially locate the areas that are in need of a high regulation of the flood episodes in Guadalhorce. These regions correspond mostly to urban areas that need protection and proper mitigation against floods. In these areas, the design of appropriate nature based solutions would support viable, sustainable, cost effective and greener solutions.
- Nature-based solutions are a recommended alternative to restore the ecological function of degraded areas in the region. Such measures will support an effective delivery of an improved flood regulation service and also help preventing erosion and other associated risks such as mudflows and landslides.

SWOS project partners

6 user organisations/NGOs | 3 universities | 4 companies

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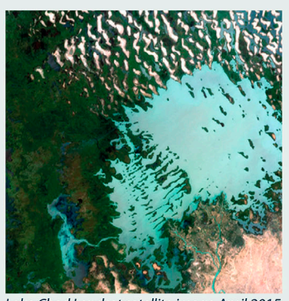
Lake Chad Landsat satellite image April 2015

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