Mediterranean Exemplar

Sustainability of land systems assessed from ecosystem services & socio-economic indicators

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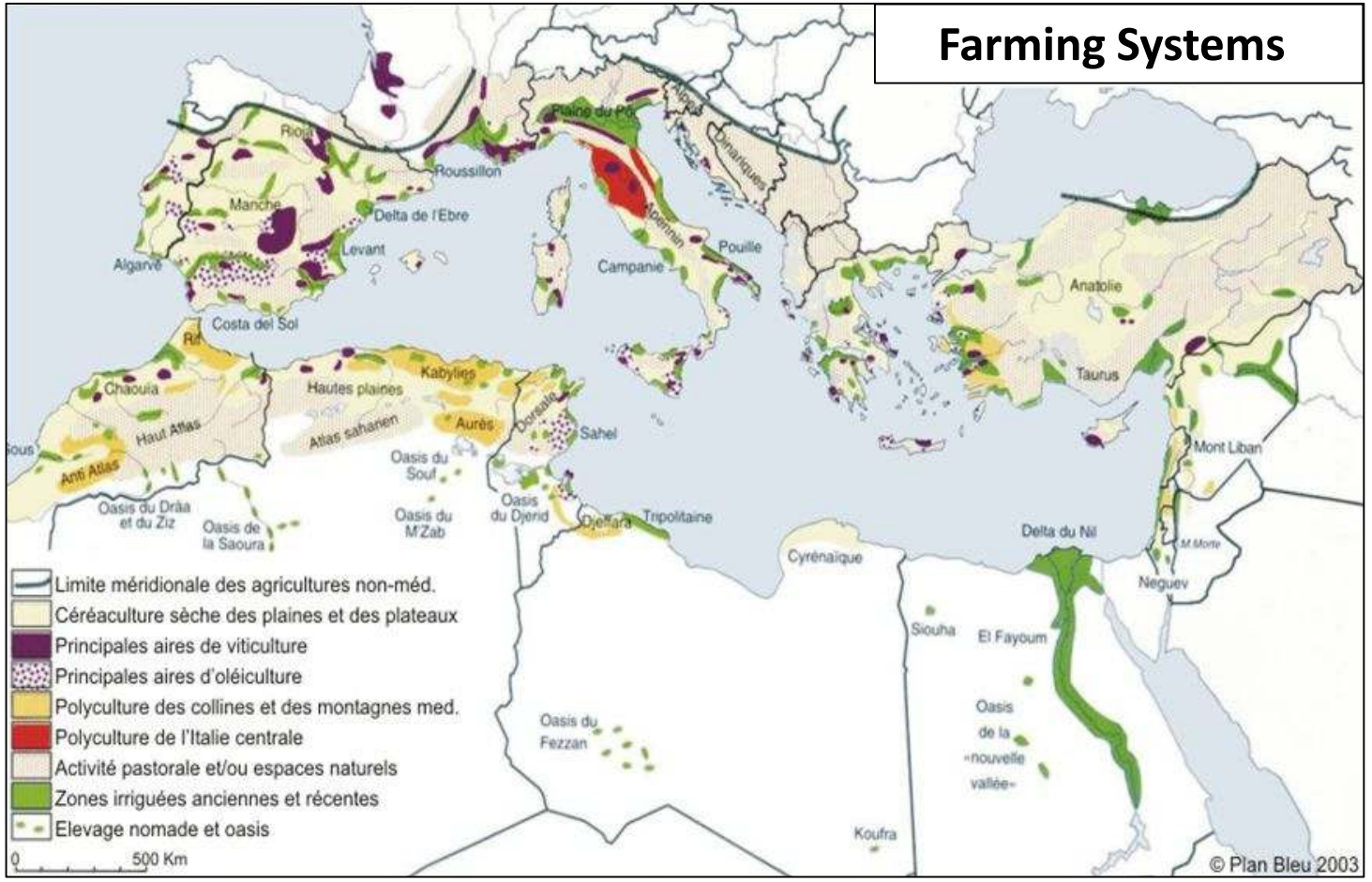
- Tour du Valat, Institut de recherche pour la conservation des zones humides méditerranéennes, Le Sambuc, Arles, France

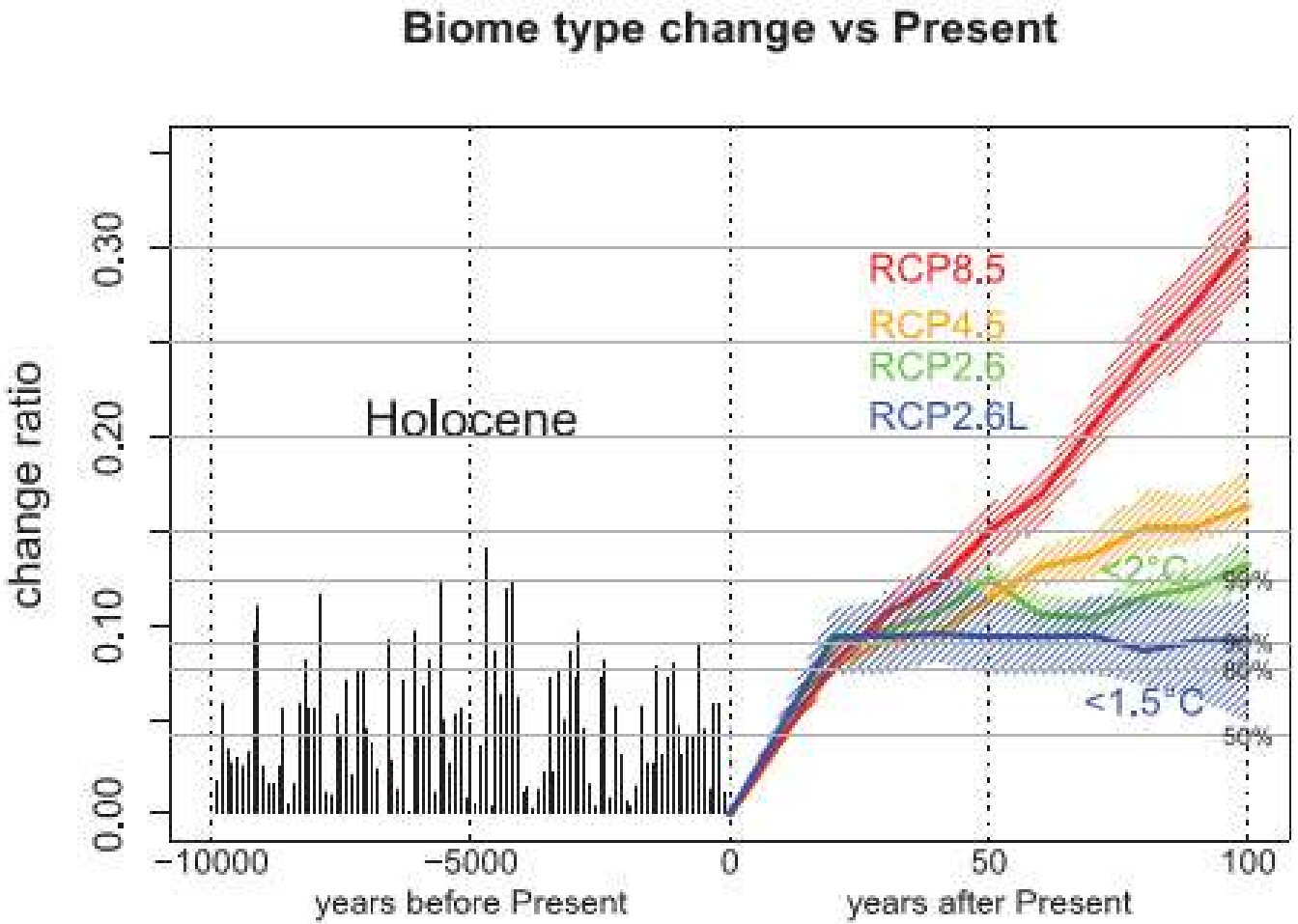
OPERAs meeting, May 16-18, 2017

Sofia - Bulgaria

Diversity of Mediterranean agriculture

Mediterranean agro-ecosystems between tradition, industrialisation, and innovation





Guiot & Cramer 2016

Fig. 2. Proportion of grid cells with a biome change relative to the preindustrial period for the Mediterranean area (10°W to 45°E, 28°N to 48°N). The horizontal axis represents the time scale, in years before the present (20th century) for the past (negative numbers) and in years after the present (CE 2000–2010) for the future (positive numbers). Holocene biomes (in black) are based on reconstructions from pollen data (4). Colored lines are given by the BIOME4 model as applied to the RCP projections (see text). Horizontal lines represent the 50th, 80th, 90th, and 99th percentiles of the Holocene values. The colored areas illustrate the interquartile interval provided by the intermodel variability.

Mediterranean traditional agro-ecosystems

Animals, trees, fields, semi-natural ecosystems, often mixed:

⇒ support a specific biodiversity,

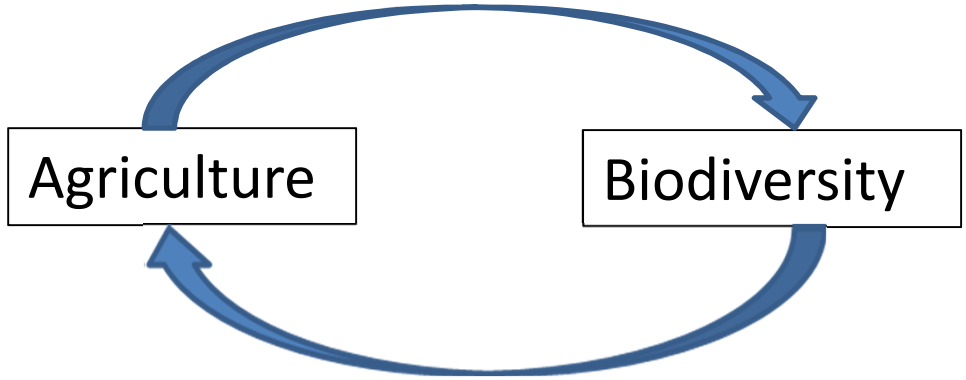
⇒ support functional biodiversity

Blondel et al. (2010): An exceptional richness of annual plant species in the Mediterranean flora due to long-standing but constantly changing human activities and heavily grazed areas.

Adonis aestivalis

Bifora testiculata

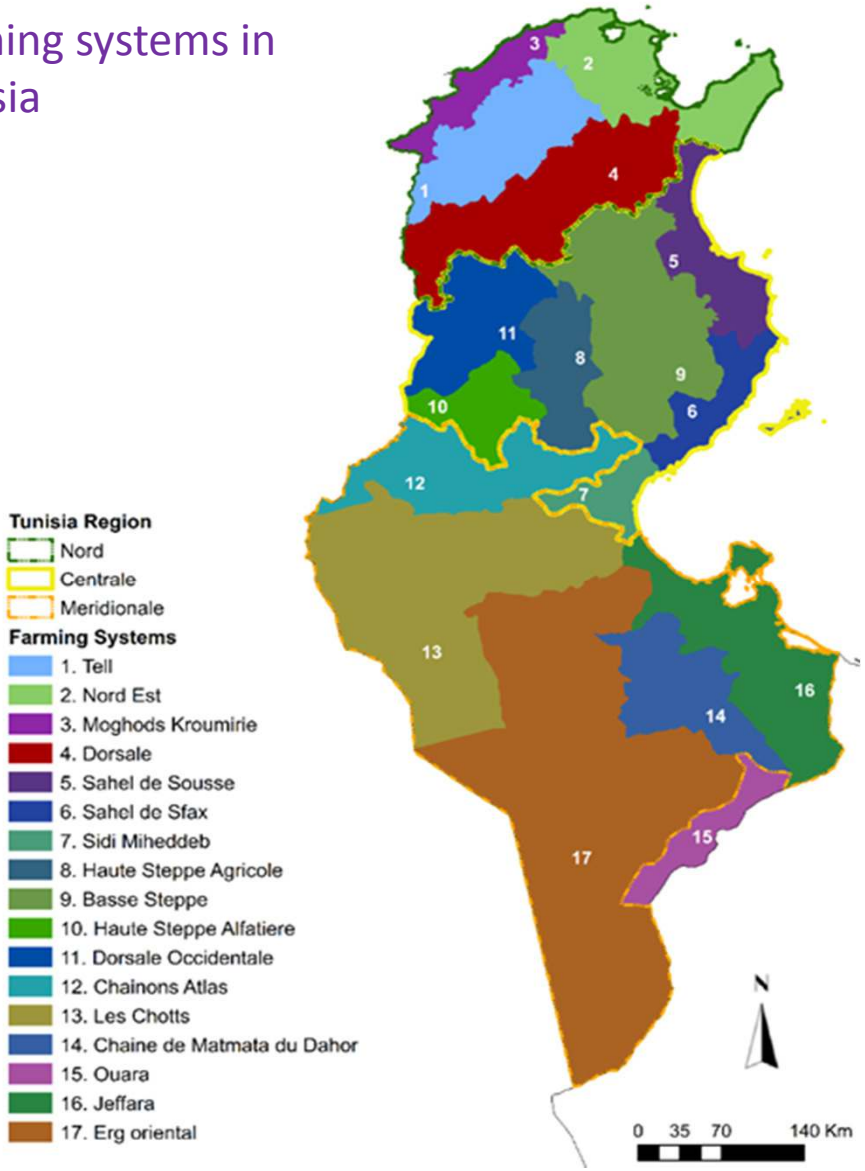
Consolida pubescens



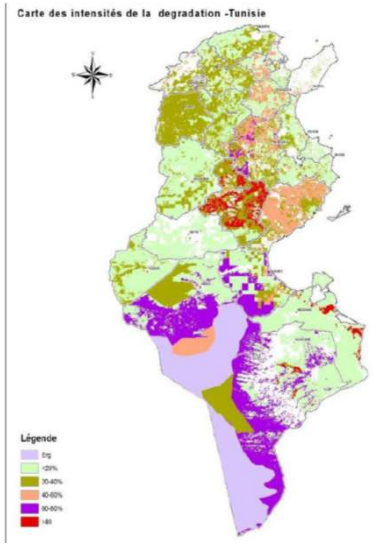
Inula viscosa

Farming systems in Tunisia

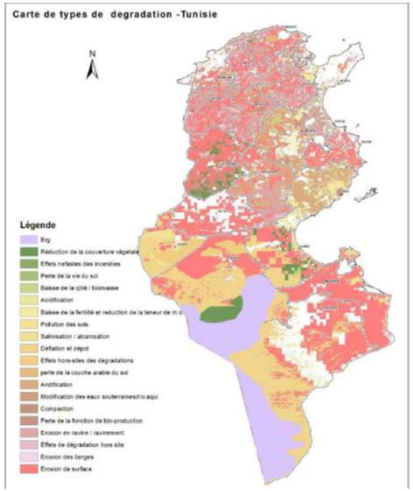
Farming systems in Tunisia



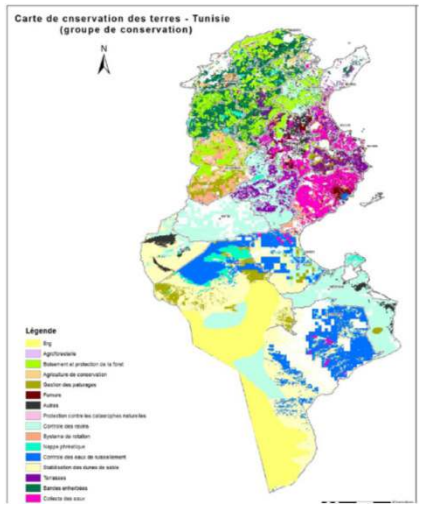
Degradation intensity



Degradation type



Conservation strategy

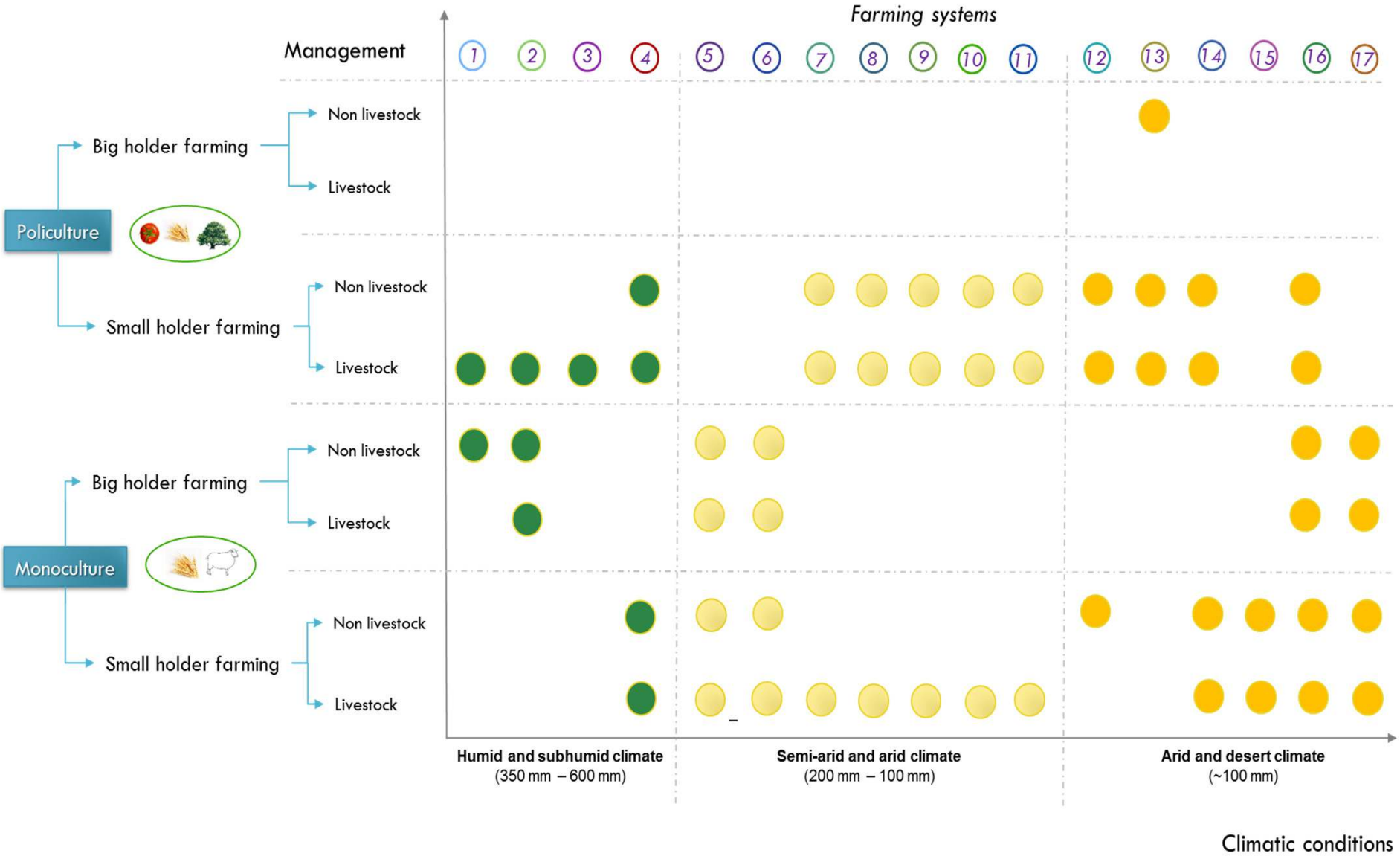


FAO project LADA (2006-2010) Land Degradation Assessment in Drylands

Tunisian farming system dynamics

	Traditional system	Actual system, possible degradation	Examples of sustainable practices
Upland (Tell)	agro-pastoralism rainfed cereals livestock	Expansion of rainfed cereals Extension of irrigation Pressure on semi-natural vegetation and rangelands	No-till farming for rainfed agriculture
Lowland (Basse Steppe)	agro-pastoralism, rangelands. Rotations with fallow for annual cereals (wheat, barley)	Perennial cropping + irrigation. Tillage, depletion of groundwater, overgrazing, soil degradation	Fodder trees, pulses within the rotation

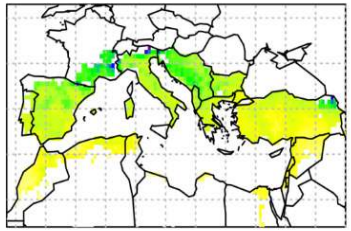
Tunisian farming systems – regional typology



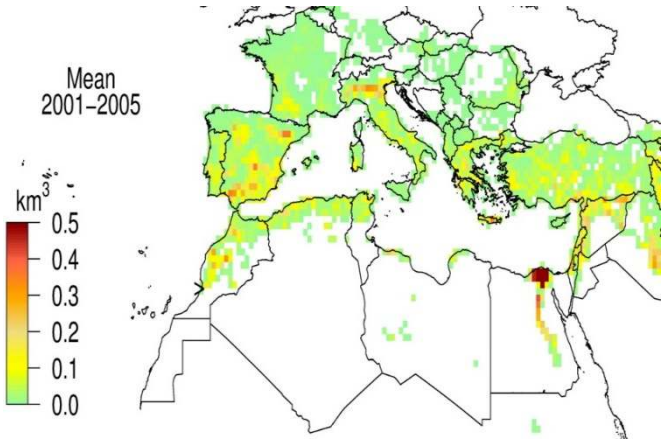
Farming systems typology

LPJmL applicable to agro-ecosystems and ES estimation

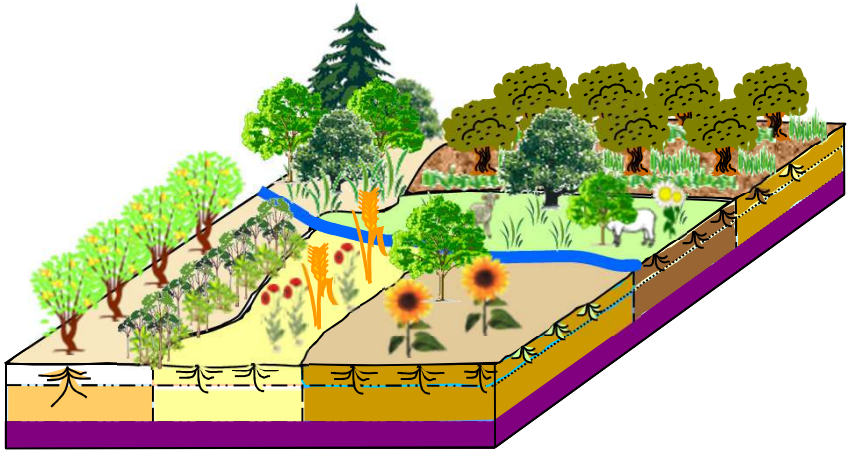
food, fodder, fiber, fuel production
water regulation
C sequestration
irrigation water consumption



Wheat yield



Irrigation water consumption

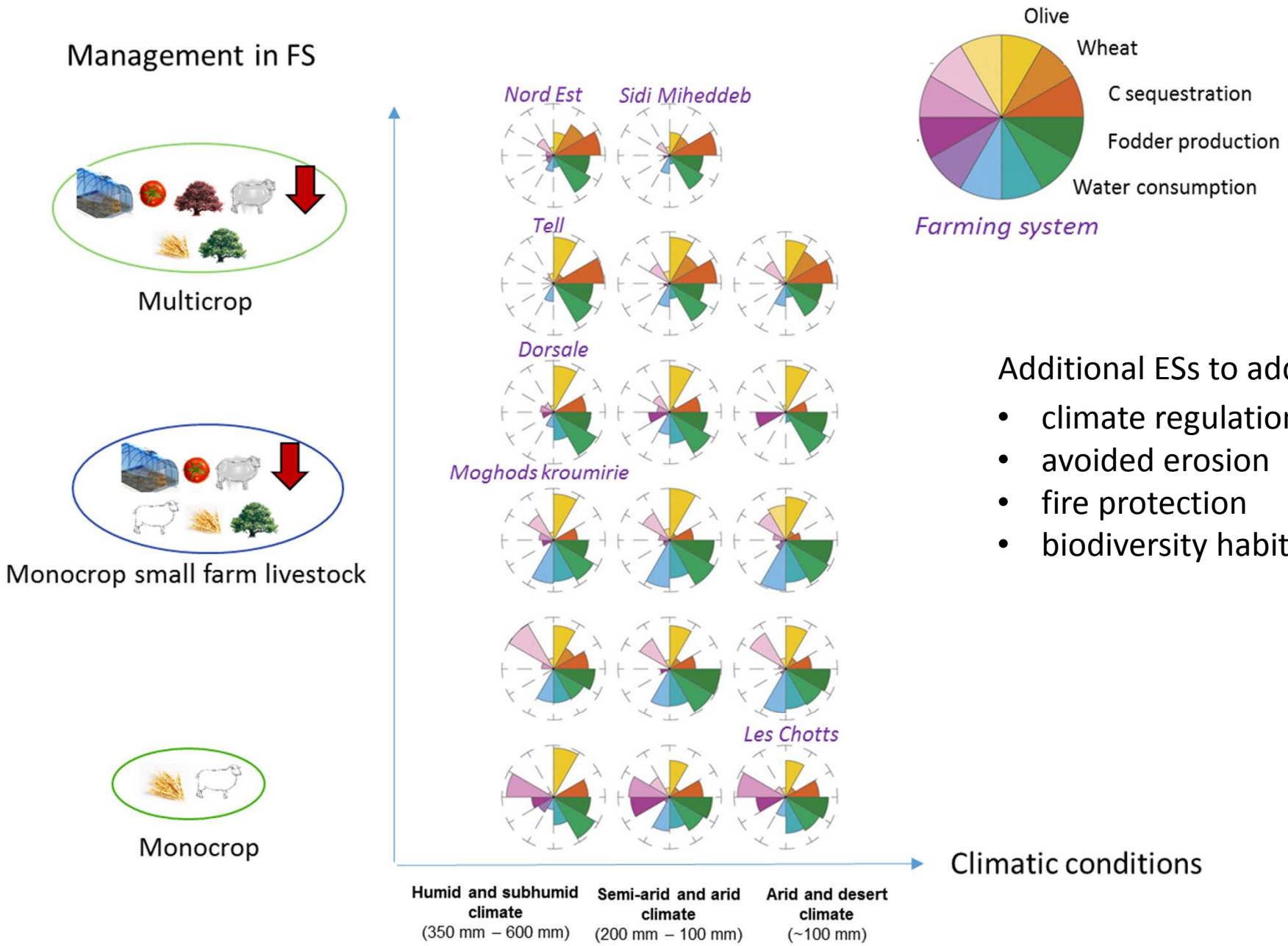


The agro-ecosystem model LPJmL,
22 crop types for the Mediterranean,
with perennial crops

climate regulation
avoided erosion
fire protection
(indicator-based)

landscape diversity
specific biodiversity
functional agro-biodiversity
(indicator-based)

Ecosystem service trade-offs in Tunisian farming systems



Additional ESs to add:

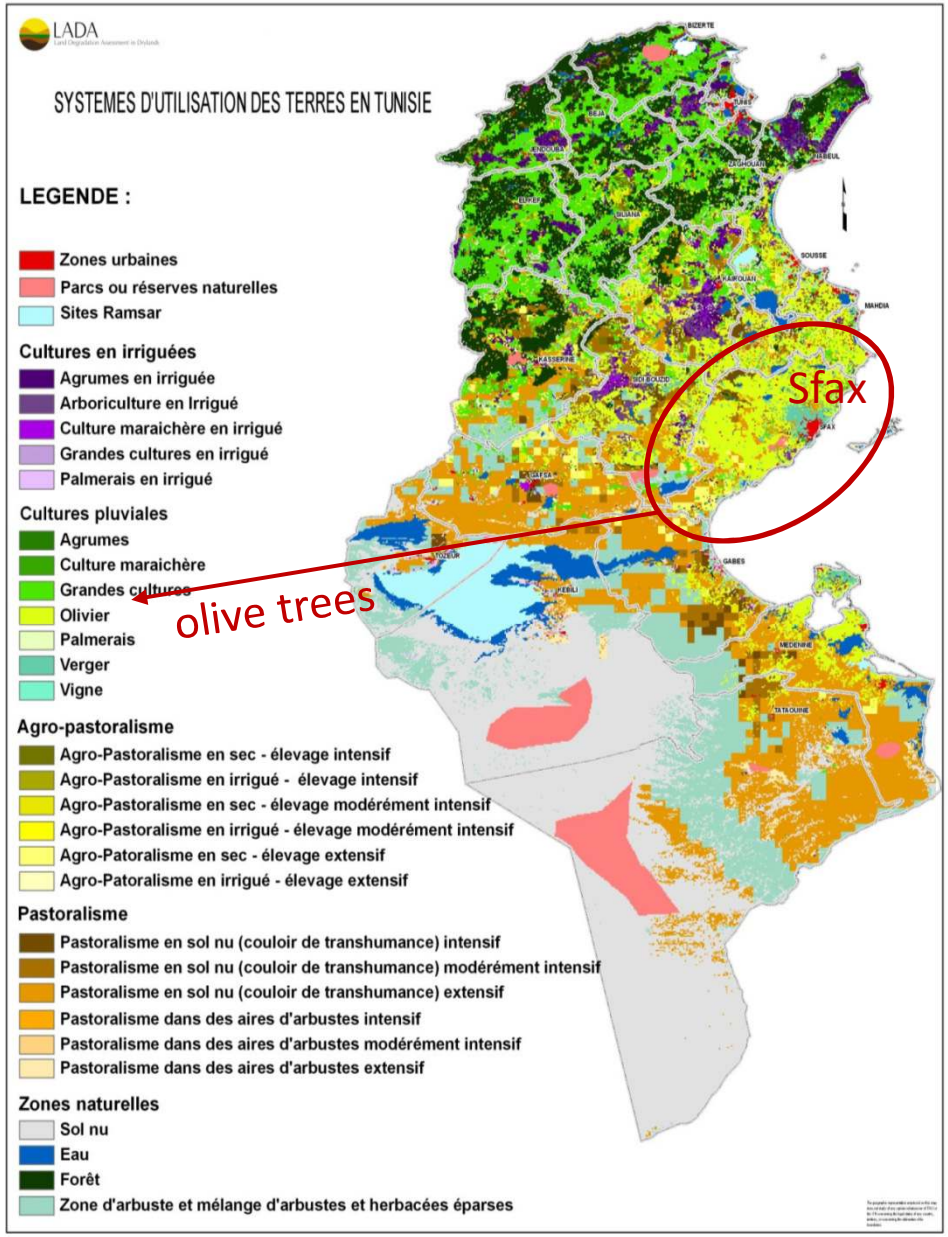
- climate regulation
- avoided erosion
- fire protection
- biodiversity habitat

Additional ES indicators envisaged

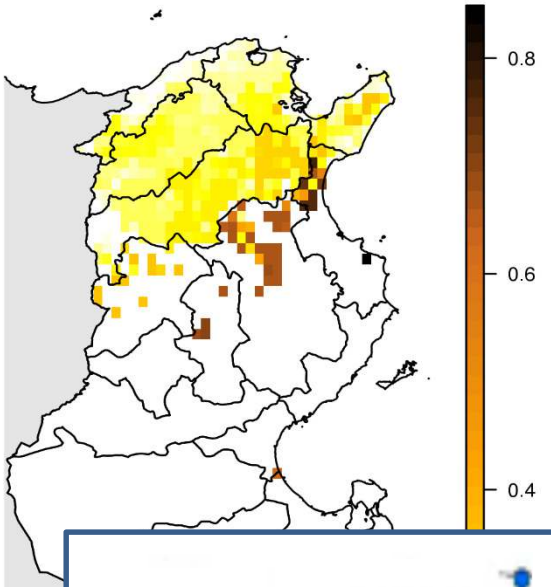
- Energy
- Employment
- Eco-tourism
- Biodiversity conservation
- etc

Oasis historique de Gafsa (Tunisie)

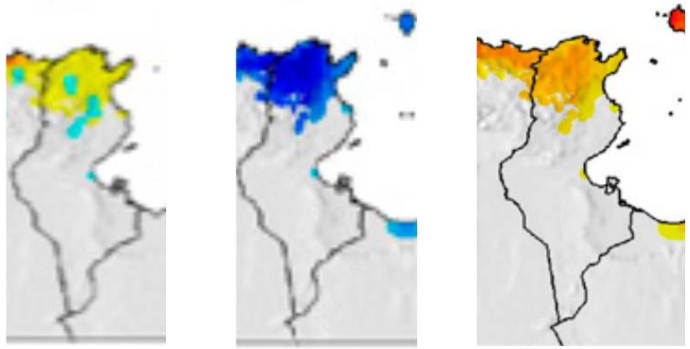
Problems with widely used land-use data sets in Tunisia



LADA project (FAO 2006-2010)



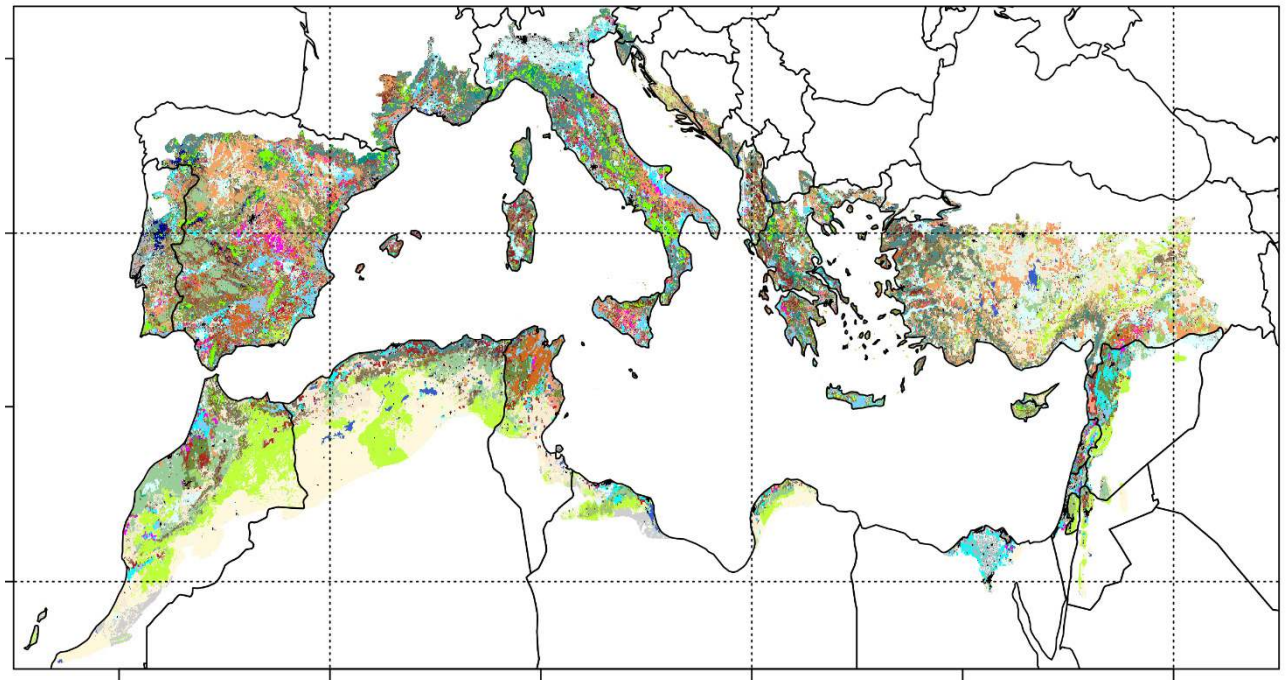
olive tree fraction cover (Monfreda et al. 2008)

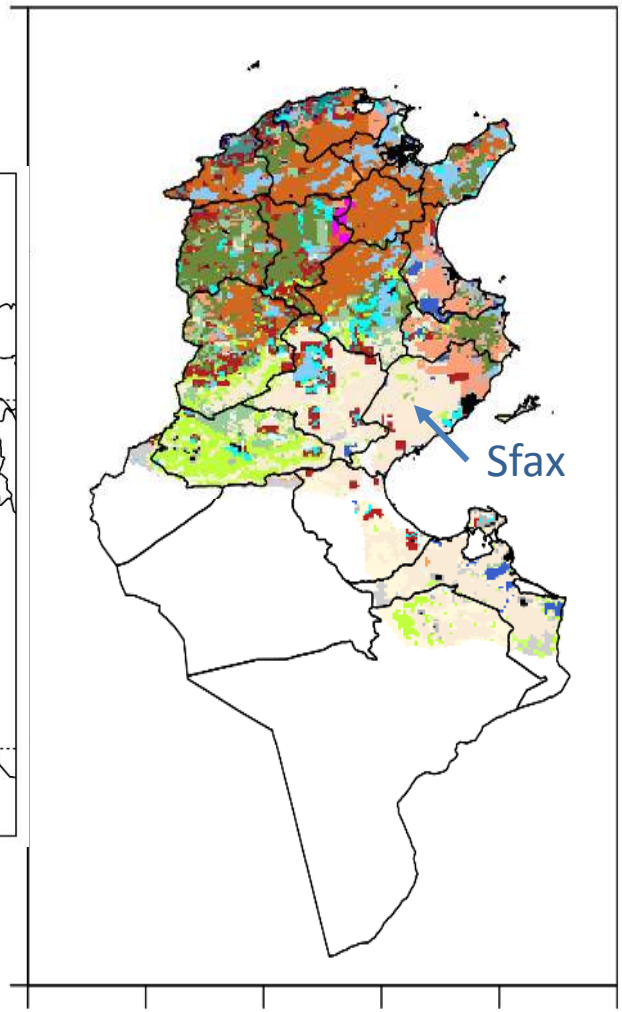


Ponti et al. (PNAS 2014)
Fine-scale ecological and economic assessment of climate change on olive in the Mediterranean Basin reveals winners and losers

From land cover map to land system map

Better representation of management and complex farming systems in the model





Malek et al. (submitted)

Aggregation of numerous data sets

desert, bare
planted forest
high inten. forest
(semi)natural forest
medium inten. forest
wetlands

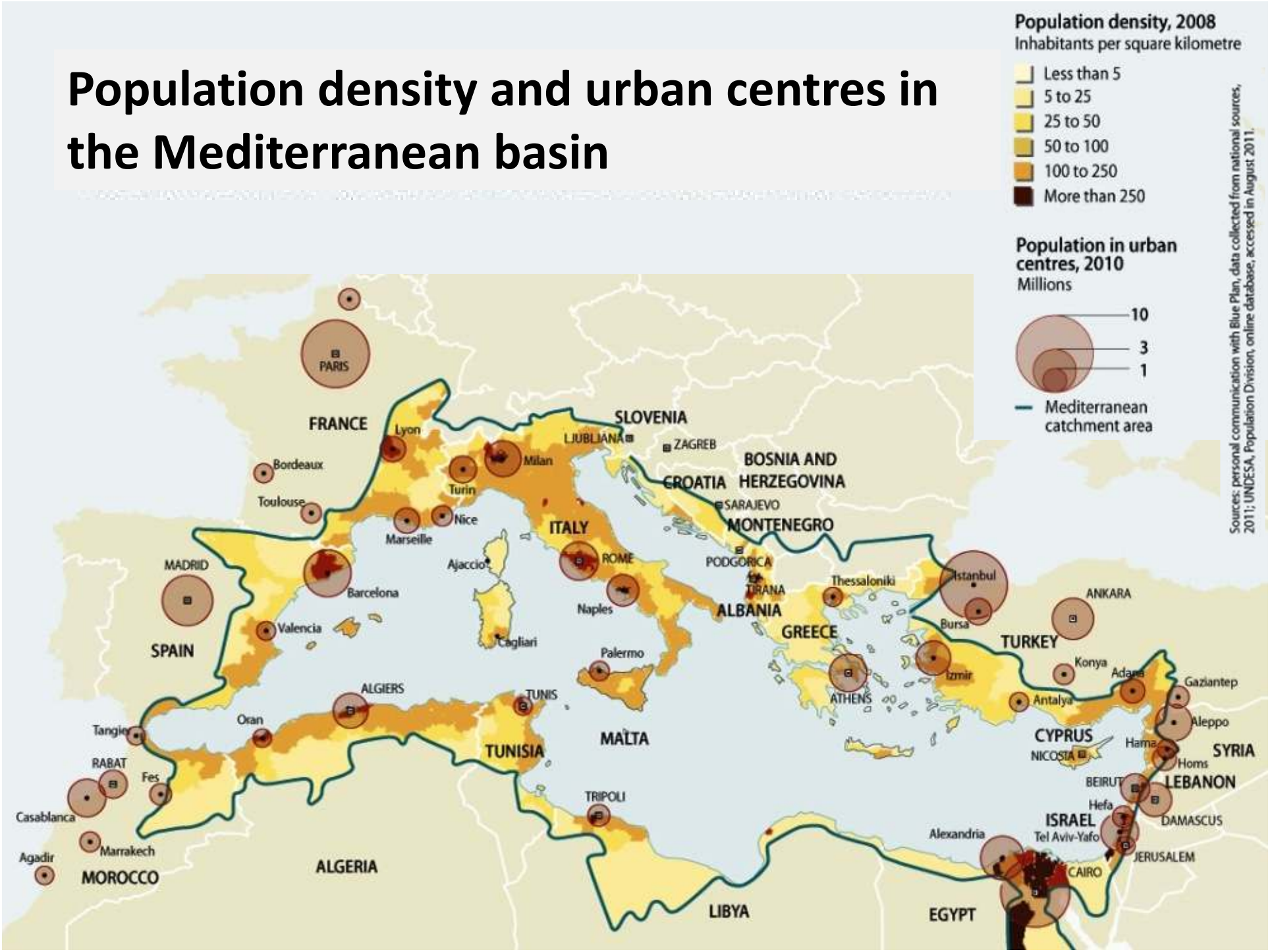
open wooded rangel.
open woodland
closed wooded rangel.
intensive open rangel.
exten. open rangel.
inten. arid grazing
exten. arid grazing

exten. mosaic
exten. permanent
exten. annual
perm. crops/rangel.
cropland/rangel.
cropl./wooded rangel.

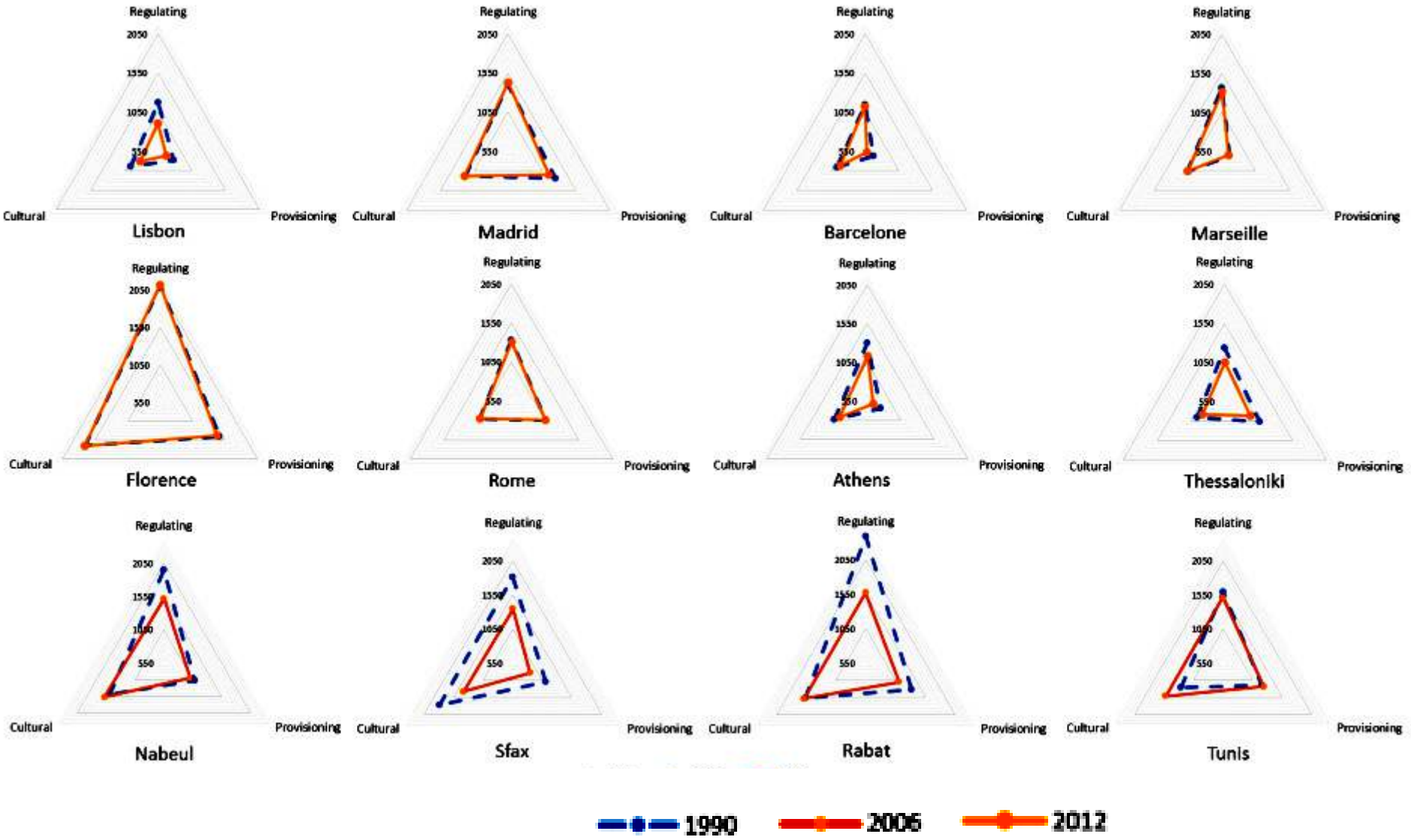
irrigated mosaic
irrigated permanent
irrigated annual
rainfed inten. mosaic
rainfed inten. perm.
rainfed inten. annual

urban
peri-urban

Population density and urban centres in the Mediterranean basin

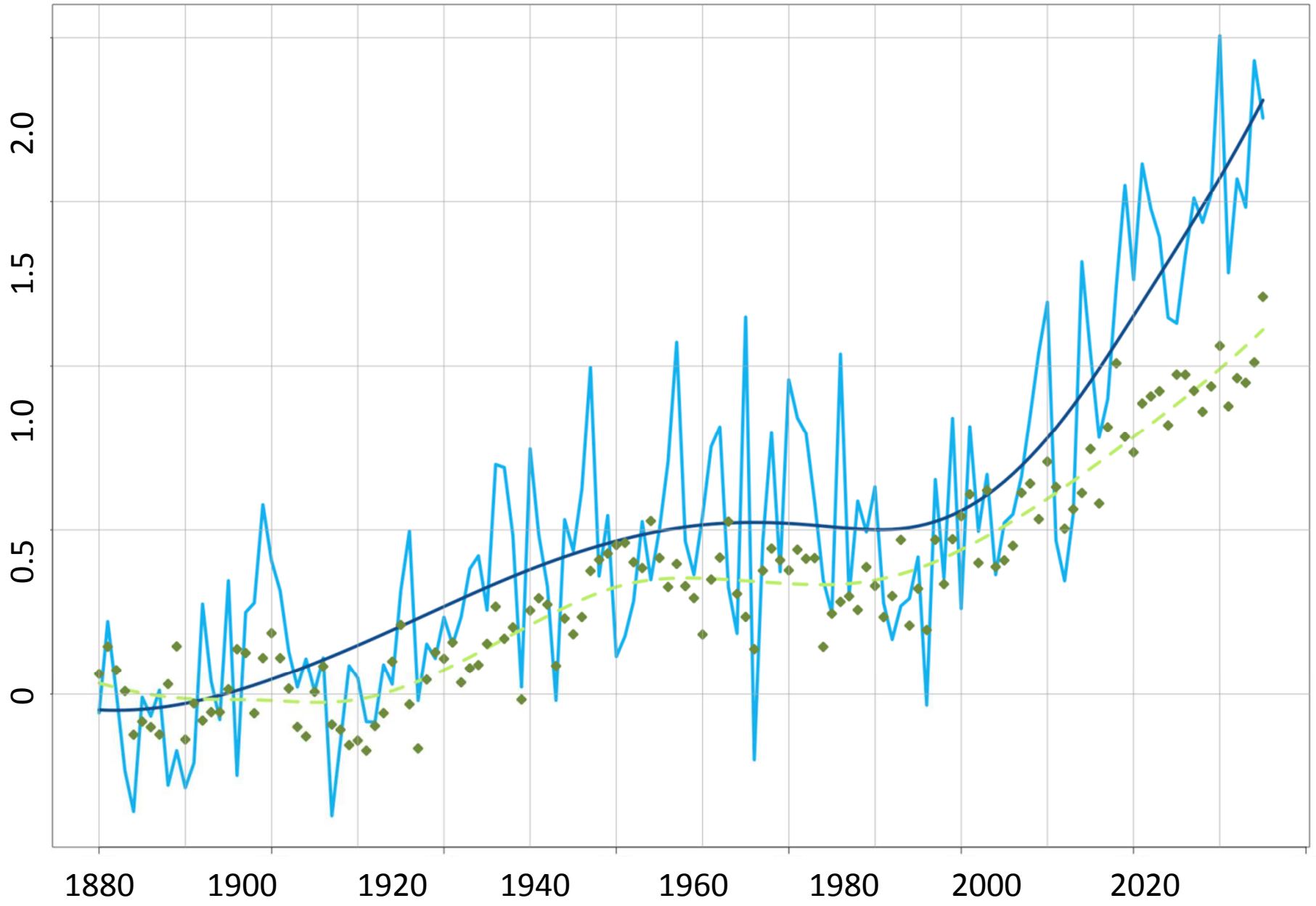


Changes in peri-urban ecosystem services around the Med.

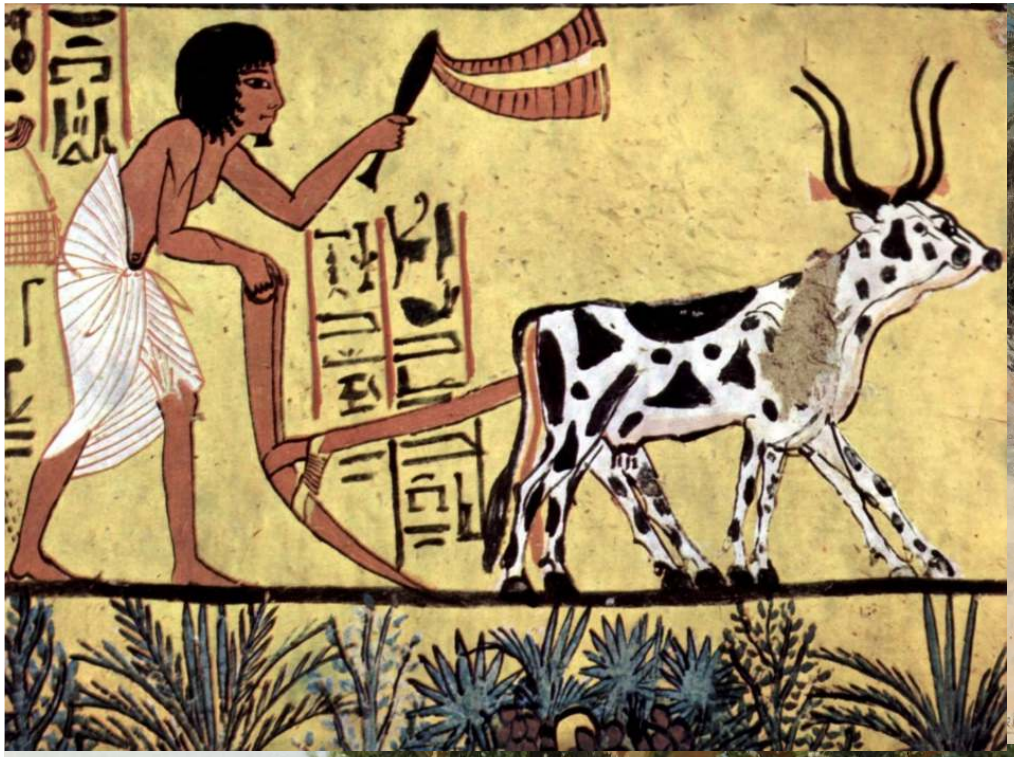


Garcia Nieto, submitted

Mediterranean and global warming since 1880



http://www.medecc.org/




Thank you for your attention!