Climate, Forests, Ecosystem Services

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Mediterranean forests: the most important ecological infrastructure of the region

- High **biological diversity**, 25,000 species of vascular plants
- Impacts on the most strategic resources: **water and soil**
- High relative importance of **non-wood products and non-market services**
Forest abandonment vs. overexploitation
Impact of Climate change vs. Land use change
Relevant ecosystem services provided by Mediterranean forests & trees!

- Mitigation: forests sequester ca. 50 Mln ton C per year
- Water production: up to 75% of water from forest basins
- Soil protection from erosion and landslides
- Urban forests remove $O_3$ and PM$_{10,5}$ for better air quality
- Landscape, recreation, cultural services: 246 Mln tourists per year (most important industry in Mediterranean region)
In 2003–2012, forest cover loss caused a biophysical warming on land by about 18% (mainly in arid and semi-arid areas).

(Alkama & Cescatti, 2016)
Shift from a period dominated by the positive effects of fertilization to a period characterized by negative impacts of climate change. 

(Penuelas et al., 2017; Zhao & Running, 2010)
Likelihood of climate change impacts

- Ensemble of 20 LPJ simulations (A1B up to 2050)
- Adopting IPCC likelihood terminology

In the Mediterranean region most important effects of Climate Change expected on water scarcity and forest fires

Santini M., Collalti A., Valentini R. (Regional Environmental Change, 2014)
Geo-engineering: plantation and minimal irrigation of trees and forests may cause a positive impact on regional climate (-4°C/-8°C on mean air temperatures) (Ornstein et al., Climatic Change 2009)
Great Green Wall Initiative in Sahel and Sahara by AUC, FAO, EU, UN-CCD, WB & many others
Phytotechnologies use trees and shrubs to restore degraded environments and resources (i.e. soil and water); financed by Italian Cooperation and Italian Ministry of Environment.

In different sites, we developed an integrated approach to reduce water pollution (treating the waste water by constructed wetland) and to promote land rehabilitation (planting trees according to a multipurpose scheme and local needs).
Oasis of Brezina (Algeria)

Forest plantation with water flowing from phyto-remediation plant
*(Cupressus sempervirens, Elaeagnus angustifolia, Medicago arborea)*
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