Variation in canopy energy exchange characteristics across an ecosystem mosaic in dry Mediterranean region

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Methodology – Vegetation mosaic

Annual average precipitation: 403 mm (Dec-Mar)
Mean annual temperature: 20.8 °C

Wheat field

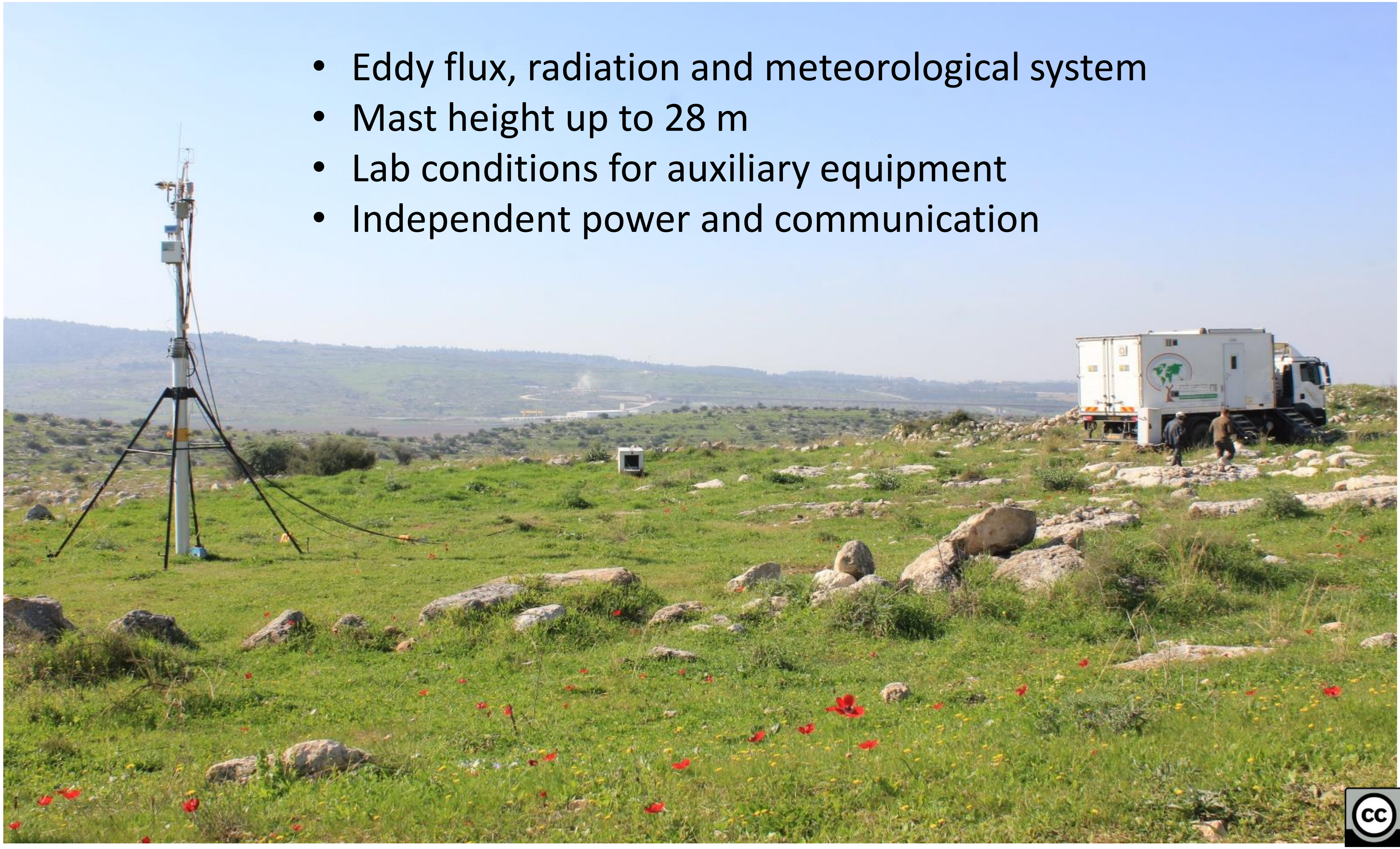
Maquis

Pines forest

Grassland

Our main objective is to chek how, under the same climatic conditions, will biogeophysical effects (albedo, sensible heat – H – and latent heat – LE) and biogeochemical effects (net ecosystem productivity, NEP) interact and balance.

Methodology - Mobile laboratory

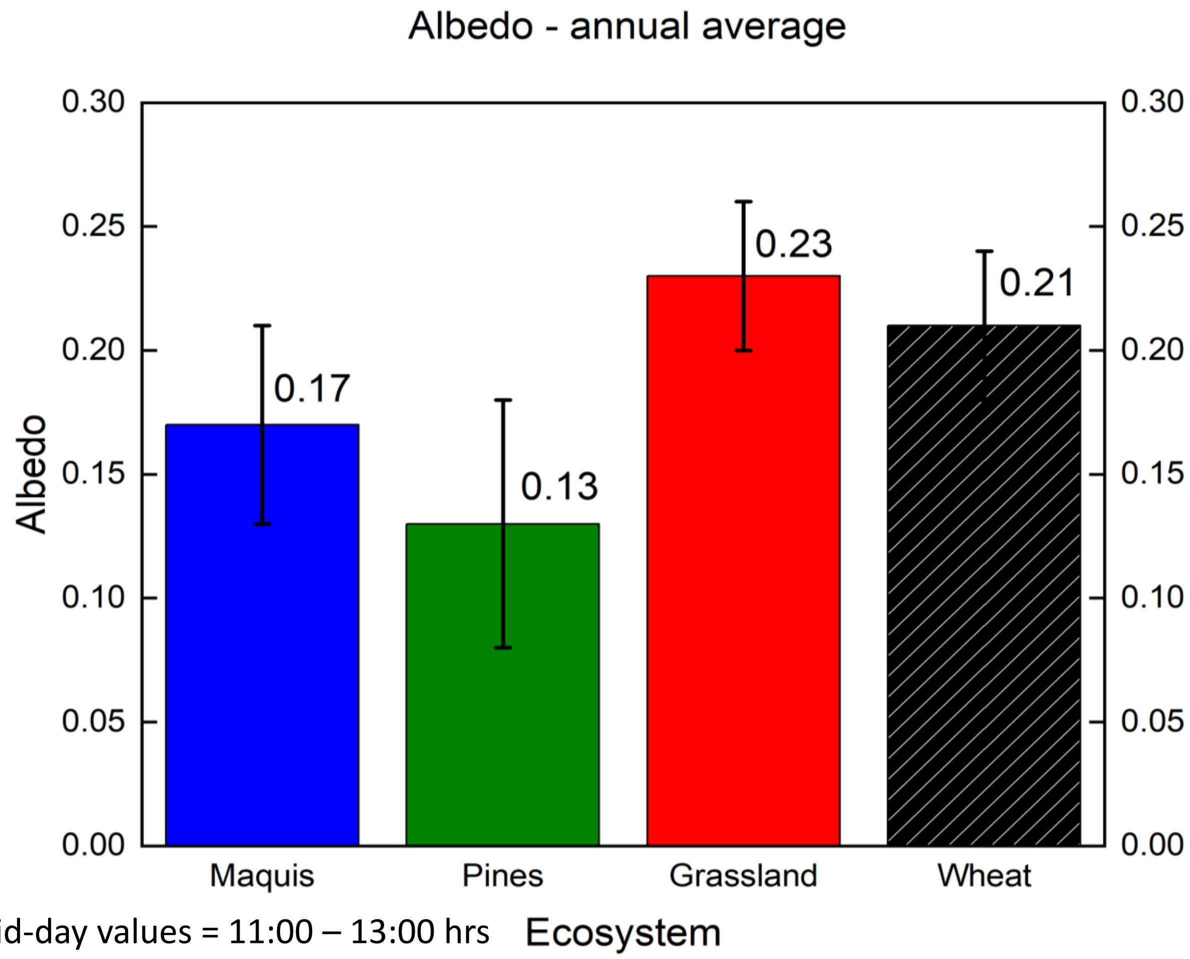


- Eddy flux, radiation and meteorological system
- Mast height up to 28 m
- Lab conditions for auxiliary equipment
- Independent power and communication

Results - Albedo

Annual average incoming solar radiation (Eg) = 216 W m^{-2}
Delta albedo (grassland – pines) = 0.1

Albedo radiative forcing = 216 * 0.1 = + 22 W m^{-2}
(could double when long-wave radiation effects will be considered in the next steps of this research)



Mid-day values = 11:00 – 13:00 hrs

Pines – lowest albedo (0.13)
May/2018

Grassland (dry in summer) – highest albedo (0.23)
Aug/2018

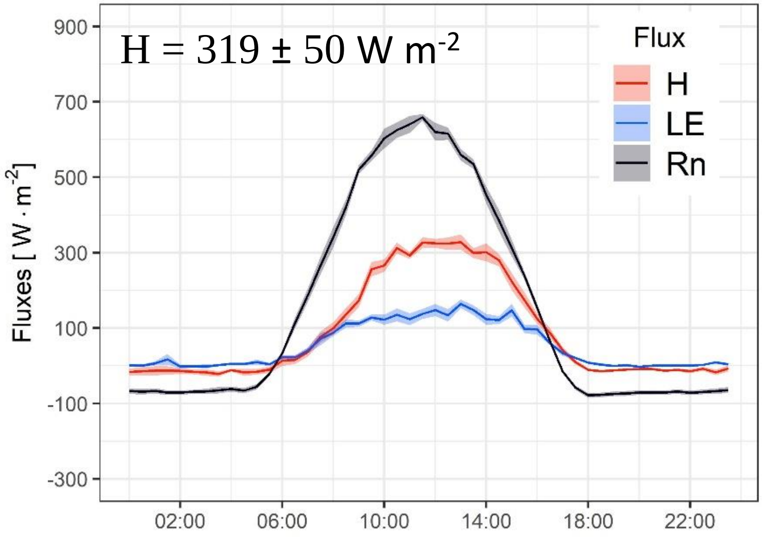
Net Ecosystem Productivity (NEP)

Season	Maquis NEP (gC/m^2/day)	Pines NEP (gC/m^2/day)	Grassland NEP (gC/m^2/day)	Wheat field NEP (gC/m^2/day)
Winter	0.75	0.62	1.62	0.09
Spring	0.60	0.42	1.15	2.02
Summer	- 0.15	- 0.46	Not measured	Not measured
Autumn	- 1.05	- 0.15	- 0.09	- 0.37

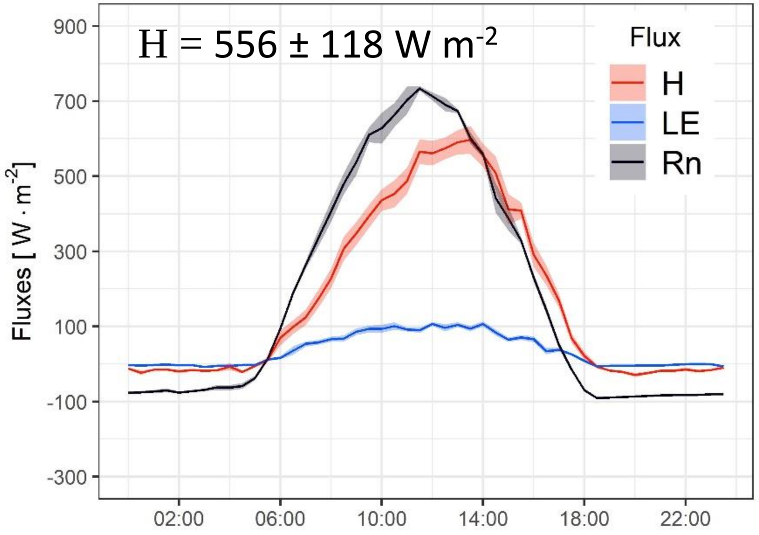
Results - Energy budget – Spring 2017

Mid-day values = 11:00 – 13:00 hrs

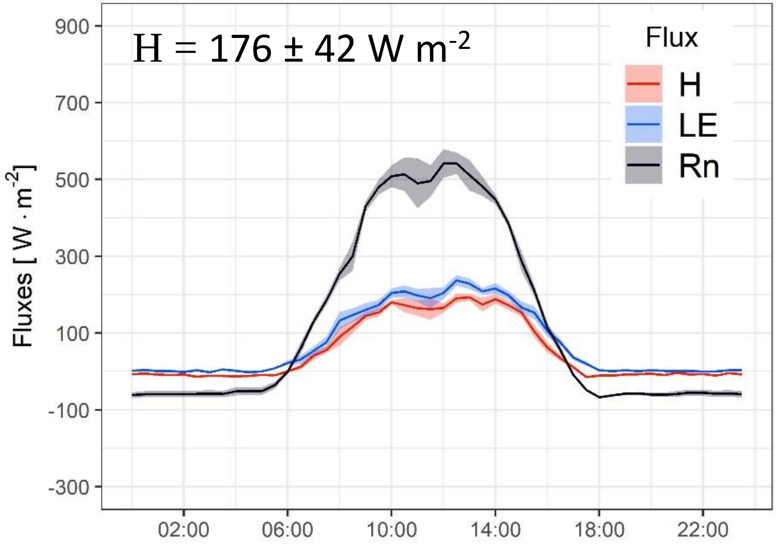
Spring Maquis



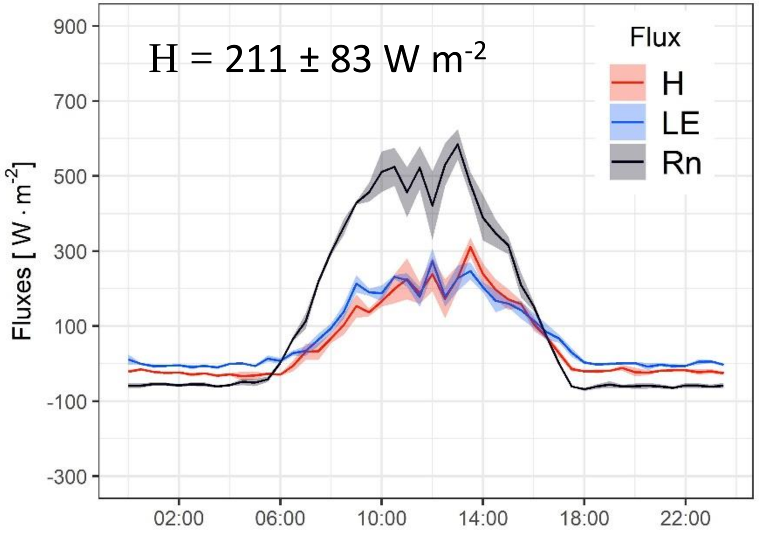
Spring Pines



Spring Grassland



Spring Wheat



- Largest H flux in the pines, among all ecosystems.
- Large H and small LE in dry pines forest was previously observed and termed “Convector Effect” (Rotenberg & Yakir, 2010).
- A time lag is observed between peak of Rn and H in the pines. Reasons will be further investigated, but may be related to ecosystem structure and storage.

Conclusions

- Large H flux ("Convector Effect") seems to be characteristic of the pines forests configuration, such as canopy structure, roughness, density and albedo, for example. This could have implications for local air circulation, and at large scale for climate (Yosef et al., 2018; Brugger et al., 2018).

- Pines presented lower carbon uptake than maquis in contrast to leaf scale studies and reflecting the complex ecosystem structures.

- The results show that land-use changes, such as across the study mosaic, can have significant impact on surface atmosphere fluxes of energy and carbon (biogeophysical and biogeochemical effects), and will be useful in management, and in predicting variations in ecosystem-climate interactions.