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Biophysical effects of forest management on surface temperature

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In the context of ongoing global warming, forests are thought to be an important mitigation option due to their biogeochemical properties. This study focuses on the impacts of a change in forest cover (i.e. replacing native tree species by an non-native tree species) on surface temperature through biophysical interactions between forest and atmosphere.

Measurements from the FLUXNET network above European temperate forests were used to establish pseudo-chronosequences and as such study a change in forest cover, with respect to leaf trait, tree species and forest structure. A method to decompose the land surface temperature signal was applied to quantify the change in temperature and the main drivers (albedo, latent heat, sensible heat, ground heat flux, emissivity, incoming radiation) of this change in the canopy energy budget.

Unclosed energy balance for site level measurements were an important source of uncertainty. A correction based on the Bowen ratio was applied to the eddy covariance data of latent heat and sensible heat fluxes in order to force the closure of the energy budget. We will present the drivers of the change in surface temperature for two case studies: (1) a change from native oaks to a pine plantation under a Mediterranean climate and (2) two pine forest with a different canopy structure under temperate climate. During a heatwave (2003/2006), no advantage of one forest cover over another was observed. All forests had the same behaviour in response to a sudden increase in radiation load. For all conversions, the change in latent heat flux was driven rather by ecological properties through canopy stomatal conductance than by atmospheric boundary layers physics such as vapor pressure deficit. The results of this study are to be considered at a local to regional scale. It shows the need to consider finer parameter such as forest structure and tree species characteristics when analysing the effect of a land cover change on surface temperature.