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Modelling land use and species effects on carbon and water cycle feedbacks

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Forest cover in the European Alps is expected to increase in the future due to an increase in temperatures and land abandonment. This will lead to an increase in above ground carbon storage capacity but will also influence the water budget of the ecosystems by changing the evapotranspiration patterns and consequently the soil moisture content.

If soil moisture decrease below a threshold level, observational evidence (Leuzinger et al. 2005) suggests that some tree species do safe water by reducing transpiration while other tree species do not. These different water saving strategies are expected to have an impact on the ecosystem evapotranspiration pattern and the total water budget. Furthermore, we expect that the ecosystems net carbon exchange is influenced in two ways; tree species with different water use will differ in productivity (carbon uptake) and these differences in above ground productivity together with differences in soil moisture will influence the soil decomposition (carbon release).

Here we apply an ecosystem model to test the hypothesis that the plantation of water saving tree species can change the responses of ecosystems in terms of daily and annual water and carbon fluxes. We implement the concept of tree species with different water saving strategies into an ecosystem model (LPJ-GUESS), using two different implementation approaches; rooting depth restrictions and difference in water uptake capability. We show that land use, e.g. management as grassland or forest, is more important, than considering different tree species for the ecosystem water balance, both at the short and longer time scale. We also interpret these results, considering the car-

bon storage capacities of the different management scenarios, showing the trade-off between the carbon sink potential of afforested areas and the change in evapotranspiration patterns.