Geophysical Research Abstracts,
Vol. 11, EGU2009-13568, 2009
EGU General Assembly 2009

Consequences and feedbacks on CO2 fluxes of climate change impacts on alpine vegetation

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The vegetation in a high alpine site of the European Alps experienced changes in area between 1953 and 2003 as a result of climate change (Cannone et al. 2007). Shrubs showed rapid expansion rates of 5.6% per decade at altitudes between 2400 m and 2500 m. Above 2500 m, vegetation coverage exhibited unexpected patterns of regression associated with increased precipitation and permafrost degradation.

The warming of air temperature induced a cascade effect, with changes in the all ecological series (from the shrubland to the nival snowbed vegetation), with the arrival of the alpine shrubland and upward displacement of the alpine grassland (especially between 2230 and 2500 m).

During the growing season 2008 (since the late-spring snowmelt to the start of the continuous snow cover in fall) we analyzed and measured the CO2 fluxes associated to the vegetation types exhibiting the highest changes since 1953 until today.

In particular, we monitored two different ecological types of shrubland vegetations (the chionophilous alpine shrubs dominated by Rhododendron ferrugineum and the wind-swept community of dwarf shrubs dominated by Loiseleuria procumbens), the climax alpine grassland (dominated by Carex curvula), the pioneer discontinuous alpine vegetation, the snowbed vegetation (dominated by Salix herbacea) and the barren ground.

CO2 fluxes (i.e. net ecosystem exchange, ecosystem photosynthesis and ecosystem respiration), biomass, soil C and N were measured for all these vegetation types. Implications of the changes occurred to the CO2 fluxes above 2200 m a.s.l. in response to the areal changes of spatial distribution of the investigated vegetation types and their potential feedbacks are discussed.

Nicoletta Cannone, Sergio Sgorbati, and Mauro Guglielmin 2007. Unexpected impacts of climate change on alpine vegetation. Front Ecol Environ 2007; 5(7): 360-364