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The GREEN GRASS experiment on mountain grassland in the Italian Alps

The effect of the summer drought of the 2003 in the GHG annual balance

S. Baronti (1), G. M. Lanini (1), F. Berretti (1), P. Stefani (2), E. Rosato (2), G. Manca (3), A. E. Agnelli (4), P. Ciccioli (5) R. Valentini (2), A. Raschi (1)

(1) CNR-IBIMET– Institute of Biometeorology, National Research Council, 50145 Florence, Italy

(2) UNITUS, Department of Forest Science and Resources, University of Tuscia, 01100 Viterbo, Italy

(3) CEALP, Centre for Alpine Ecology, Viote del Monte Bondone, 38040 Trento, Italy

(4) ISSDS, Reserch Institute for Soil Study and Conservation, 50121 Florence, Italy

(5) CNR –IMC, Institute of Chemical Methodologies, National Research Council, 00100 Montelibretti-(Rome) Italy

Contact person:

Silvia Baronti

C.N.R. IBIMET Institute of Biometeorology National Research Council

Via G. Caproni, 8 50145 Firenze Italy

Tel. 0039-055-3033711

Fax. 0039-055-308910

E-MAIL s.baronti@ibimet.cnr.it

Summer 2003 was an anomalous season in Europe because of extreme temperatures

that remained unusually high for a long period. Air temperatures from 35 to 40 ˚C were repeatedly recorded in July and August over a large portion of Europe, extending from northern Spain to Czech Republic and from Germany to Italy. This heat wave had adverse social, economic and environmental effects, such as increased incidence of forest fires, reduction of crop yield and the glacier shrinking. Many research teams are investigating the effect on ecosystem carbon cycling in order to understand possible feed-backs on the global warming.

In this study we present some results that highlight the consequences of the heat wave on the carbon balance, CH4 and N2O of Italian mountain grasslands.

The two years of measurements showed a clear difference in carbon exchange patterns; while in 2003 the investigated grassland was a C source throughout a large part of the vegetative season, in 2004 the trend was opposite. Thereafter, integrating the two whole years, the grassland resulted to be a source in 2003 and a sink in 2004. The difference is consequence of the reduction in C assimilation and of the increase in soil respiration under the high atmospheric temperatures and the limited rainfall that characterized summer 2003. On the contrary, NO2 emission was higher in 2004 than in 2003, probably because the climatic conditions and the dryness of soil severely limited microbial activity. For the same reason, methane uptake by soil was more limited in 2003.

The productivity of alpine grasslands above timberline is known to be heavily dependant upon climatic trend that, from the two available years of measurements, seems to affect heavily the balance of all GHG. In winter, CO2 efflux through snow is the main component of C balance. As the year 2003 is to be considered as an anomalous year, a longer dataset will be necessary to asses the relative importance of the summer's climatic parameters and of the length of the growth season. In the perspective of a persistent climate change, further researches will have to focus on other factors, such as soil erosion or species composition that may acquire a relevant role.