**A vegetation survey on woody species encroachment of**

**abandoned pastures in the Alps**

D. Ferraris 1, M. Galvagno 2, L. Oddi 3, G. Filippa 2, E. Cremonese 4, P. Pogliotti 2,

F. Grosso 2, U. Morra di Cella 2,4, S. Koliopoulos 2, C. Guarnieri 2, G. Wohlfahrt 5,

G. Leitinger 5, M. Migliavacca 6, A. Hammerle 5, D. Papale 1,7

*1 Università degli Studi della Tuscia, Viterbo, Italy, 2 Environmental Protection Agency of Aosta Valley (ARPA VdA), Climate, Change Dept., Aosta, Italy. 3 Department of Life Sciences and Systems Biology, University of Turin, Italy. 4 CIMA Research Foundation, Savona, Italy. 5 Department of Ecology, University of Innsbruck, Austria. 6 European Commission, Joint Research Centre (JRC), Ispra, Italy. 7 National Research Council (CNR) - IRET, Rome, Italy.*

###  daria.ferraris@unitus.it

The research focuses on the investigation on how climatic and socio-economic shifts drive woody species encroachment into mountain grasslands, altering carbon sequestration patterns and contributing to ecosystem changes.

In recent decades, the investigated area in the Aosta Valley region has seen the transition towards the abandonment of pastures by grazing livestock, below the forest line (~1500 meters asl), a widespread occurrence in the alpine region.

The dynamics of the regrowth of shrub and tree vegetation on this mountainous terrain is inevitably influenced by climate change and therefore it represents an observatory and sentinel of the impacts of global climate change in the transition towards the restoration of a pre-anthropic state.

The activities were carried out at the ICOS associated site Torgnon (IT-Tor), an abandoned subalpine pasture located at about 2100 m asl. An area of 15000 square meters was selected in the pasture, which is undergoing recolonization by larches (*Larix decidua*) and shrubs. Since 2015, periodic surveys (2015, 2018, 2021, and 2024) were conducted to monitor vegetation dynamics. Employing a *GNSS system* we mapped larch tree locations, measured trunk diameters, heights, and crown dimensions, and documented associated shrub growth. Also, *UAV aerial images* of the area were collected annually through drone images.

Moreover, continuous measurements of CO2, water fluxes, and meteorological variables are available at the site since 2008. To further evaluate ecosystem fluxes, an additional eddy covariance station was installed in October 2024 in the encroached area and preliminary flux measurements will be presented.

Overall, results highlight an ongoing shift from grassland to woody vegetation, that affect carbon and water dynamics.

This research underscores the critical role of *LCLU* changes in shaping present and future global vegetation dynamics and carbon sinks, that need to be considered to improve our understanding and modelling of ecosystem carbon cycle.

**Keywords: abandoned mountain grasslands, woody species encroachment, Larix decidua**