Curriculum: 6. Health and Ecosystems scholarship code F3

Climate change mitigation through shrub removal in alpine environments

Research Keywords: Alpine vegetation, Ecosystem changes, Climate change mitigation

Reference ERCs (*): PE10_4, LS8_4, PE10_3

Reference SDGs (**): GOAL 13: Climate Action, GOAL 15: Life on Land

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Host University: University of Insubria
Scienza e Alta Tecnologia

Research topic

Mountains are among the most sensitive and vulnerable environment to climate change and the European Alps are one of the three regions characterized by the strongest warming in the period 1950-2000, with relevant impacts on ecosystems, including species upward migration, thermophilization, accelerated vegetation dynamics, shrub and tree encroachment. Shrub encroachment, recognized as a global response to climate change impacts, exerts positive feedbacks to climate change because, beyond its impacts on biodiversity and landscapes, it affects the Carbon cycle, the surface energy balance, soil temperature and moisture, snow cover, surface albedo, active layer thickness, and the hydrological cycle. In the European Alps shrub encroachment was performed by late successional species (e.G., Rhododendron, Vaccinium, Juniperus, Kalmia, Empetrum), with the regression of alpine grasslands and snowbeds occurring from the subalpine to the nival belt. Among the consequences of these processes, there are impacts on the CO2 emissions, as the sink effect of these systems is decreasing due to shrub encroachment, thus requiring urgent mitigation actions. Inedd, climate change mitigation aims to reduce the harmful effects of climate change through the reduction of GHG emissions which can be achieved by increasing the sink capacity of the natural systems to gain and store Carbon through good management practices.

The research topic will focus on a) the analysis of the process of shrub encroachment in mountain vegetation, from the subalpine to the nival belt, to address the mechanisms allowing shrub expansion in response to climate change acceleration, with special reference to new successional pathways ongoing in the Italian central Alps. The research will assess the suitability of specific mitigation actions, aiming to contrast shrub encroachment and promote the recovery of the alpine and nival non woody vegetation, that will be realized in the frame of the project Back from the Future, carried out in the territory of the Stelvio Nationa Park under the scientific coordination and supervision of Insubria University, within the initiative Parks for Climate promoted by the Ministery of the Environment. This project will perform specific mitigation actions to contrast shrub and tree encroachment and their upward migration through their physical removal allowing the recovery of the native alpine non woody vegetation and the conservation of the alpine vegetation communities, and associated ecosystem processes and biodiversity. Within this project will be assessed also the consequences on the compositional, structural and functional (CO2 fluxes) ecosystem processes.

Research team and environment

This PhD is developed within the framework of the Climate Change Research Center of Insubria University, where it will be possible to work in a multidisciplinary team, in particular within the Botany and Climate Change Lab (Resp. Prof. Nicoletta Cannone) working with other experts of vegetation and terrestrial ecology of alpine and polar areas, in particular Dr. F. Malfasi (expertise in Botany and vegetation of mountain and polar areas) and Dr. S. Piccinelli (expertise in dendrochronology). This group performs multidisciplinary research activities, interacting with the Cryosphere Lab (Resp. Prof. Mauro Guglielmin) with a Post Doc (Dr. S. Ponti, expertise in remote sensing) and two other PhD (Dr. Alessandro Longhi, expertise in soils) and Dr. Silvia Picone (expert in debris flows). This group interacts with the Ecology and Ecotoxicology Lab (Resp. Prof. Roberta Bettinetti) where other experts are working on acquatic ecology. The Climate Change Research Center of Insubria will have since 2022 the possibility to use the International Branch of Insubria at Barrow (USA, Alaska). The research team is working in cooperation of several national and international Instititutions like the British Antarctic Survey, the Alfred Wegener Institute, the CNR-ISP, the Genev University, the Temuco University.

Suggested skills
Basic knowledge on botany, vegetation ecology
Basic knowledge on ecology
Basic knowledge on general topics of environmental sciences