Learning Outcome:	The students are expected: -To recognize the past present land use types in mountain areas in a historical perspective. -To recognize the main resources and conditions influencing plant growth. -To understand and assess the multiple ecosystem services. To be able to quantify the different variables influencing mountain agricultural systems in the viewpoint of an efficient, sustainable agriculture. -To be able of organize simple experiments in order to quantify plant and animal impacts on the environment. -To be able to conceive scenarios with modifications in land use and climate in order to be able to take actions for the optimization of the ecosystem services in a changing world.
Contents:	-The mountain landscapes as affected by historical land use. Near-natural woods, thickets and pastures at high elevation ranges. Formations created and maintained by human activities. -The limiting factors influencing mountain and alpine plants establishment and growth. Specificity of cultivations in mountain ranges. -The animal and human-induced impacts on ecosystem functioning.. Agricultural production, biodiversity and multiple ecosystem services in mountain areas. Composting and bioremediation. -The application of the concept of ecosystem in the study of biotic/abiotic interactions. The solar radiation and the atmosphere. The Liebig's law and the limiting factors. Favourable and unfavourable, direct and indirect biotic interactions. -The energy budget and its quantification. The available energy, the albedo, the Stefan-Boltzmann law. -The hydrological budget and its quantification, with special reference to evapotranspiration. The Penman-Monteith equation. -The carbon budget and its quantification. The net ecosystem production and the net ecosystem carbon balance. -The Nitrogen cycle -The measurement and modelling of ecosystem properties and functions: direct measurements, proximal sensing and remote sensing. -The measurements of matter and energy exchange at leaf and canopy level. Reflectance indices. Fluorescence based estimates of vegetation activity. Biogeochemical modelling. Model-data fusion.
Methods:	Frontal lectures with PowerPoint presentation slides. Practical lessons during field excursions, laboratory and computational activities are also foreseen.

Assessment:	Oral
Literature:	Recent scientific literature, online material of the presentations given during the lectures and didactic material for the exercises will be provided. In addition, required formative readings are: Vegetation Ecology of Central Europe, 4th Edition, Heinz H. Ellenberg, Cambridge University Press, 2009. Alpine Plant Life, Functional Plant Ecology of High Mountain Ecosystems; Christian Körner, Elsevier, 2003. Principles of Environmental Physics, Plants, Animals, and the Atmosphere, Fourth Edition. John L. Monteith and Mike H. Unsworth. Academic Press, 2013.
Remarks:	