



## Phenology in the Western Alps: first results of the PhenoALP project

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PHENOALP is a EU co-funded Interreg Project under the operational programme for cross-border cooperation "Italy–France (Alps-ALCOTRA)" 2007 - 2013, started in 2009, aiming to get a better understanding of phenological changes in the Alps and build a long term monitoring network.

The results obtained after the first year of the project are mainly related to the definition of observation protocols and to the implementation of the observation networks. In particular, we focused on the comparison of different approaches for monitoring alpine grasslands phenology. We developed a new protocol for vegetative and reproductive phases of the seven most common plant growth life forms of alpine pastures: cyperaceae, poaceae (palatable and non palatable), evergreen and deciduous shrubs, forbs and leguminous. For each group quantitative and qualitative variables (e.g. leaves length, bud number, fruits number and phenophases) are monitored during the growing season. Study sites are located along an elevation gradient from 1560 to 2580 m asl and measurements are carried out on marked individuals in permanent plots. The other techniques used to monitor grassland phenology are: analysis of webcam images, weekly nadir digital images, visual estimations of greening percentage, canopy structural measurements (i.e. height, fraction of absorbed photosynthetically active radiation, leaf area index, etc..) and high frequency radiometric measurements of vegetation indexes related to canopy structure. All methods are providing promising results and our goal is to define a protocol suitable for long term observation based on a reasonable trade-off between the quality and robustness of collected data and the heaviness of the observations.

For animal phenology we are focusing on many animal taxa among birds, mammals, amphibians and insects. First results are coming from birds and amphibians. In the case of birds, observations of reproductive phenology of some common alpine species are done along altitudinal transects of artificial nest-boxes. Moreover a protocol for the monitoring of the reproductive phases of *Rana temporaria* has been defined and observations are done in some ponds along an elevation gradient.

A third activity of the project aims to analyse the relations between the seasonal and interannual variability of plant phenology and productivity, assessed measuring CO<sub>2</sub> fluxes. To achieve this goal, two eddy covariance towers have been installed in a larch forest (2150 m asl) and in an alpine grassland (2160 m asl) in sites where phenology is monitored by field observations and webcams.

Associated with these activities, a great effort is made towards the involvement of educational institutions in the observations of the seasonal changes of alpine ecosystems. During 2010, five school complexes located in the Italian side of the Western Alps will be involved in the French monitoring network of phenology in the Alps: Phenoclim (<http://www.crea.hautesavoie.net/eng/phenoclim/index.php>). Italian project partners will train schools to start phenological observations.