

Science for Environment Policy

More plants and less snow at high elevation in the French Alps

Satellite images taken over a 30-year period have shown that a French national park in the Alps has become greener with more vegetation, as snow cover disappears under a changing climate. These landscape changes have important implications for alpine biodiversity and ecosystem services, warn the scientists behind the study.

Scientists often measure changes in vegetation cover across a landscape using the normalised difference vegetation index (NDVI). This indicator uses data gathered by remote sensing technologies, mainly satellites, to assess plant cover based on how the land reflects near-infrared and red (visible) light. NDVI scores are useful when monitoring plants' responses to environmental change and to complement observational studies on the ground.

However, there is a lack of NDVI studies in the European Alps. This new study helps fill this gap by measuring the NDVI of the Ecrins National Park in the French Alps over the period 1985–2015. This particular park was selected for study as there is plenty of data on land cover and land use.

Data for the NDVI in this study came from two NASA satellite programmes: [MODIS](#) and [Landsat](#). To help the researchers understand what might be driving changes in NDVI, they also analysed air temperature data from the [SAFRAN-SURFEX/Crocus-MEPRA model](#), and livestock grazing data from a series of grazing surveys.

The results show that NDVI scores increased in the majority (67%) of alpine habitats (above the treeline — the line above which trees cannot grow) in the park. Higher scores indicate more vegetation or increased productivity of existing vegetation. Greening occurred more rapidly during 1984–2002 than 2000–2015. This earlier period coincided with a pronounced increase in the number of warmer, snow cover-free days when plants are able to grow, as indicated by the air temperature data.

Livestock grazing appeared to have only a very small influence on NDVI scores. However, the researchers note that grazing here is low-intensity.

The researchers believe that there are three possible drivers behind the overall greening of the Ecrins National Park:

1. Glacier retreat, which has allowed plants to colonise newly exposed land.
2. A decrease in the duration of snow cover throughout the year and increasing spring and summer air temperatures, enabling more time and energy for plants to grow.
3. A fertilising effect of high levels of nitrogen in the air which deposits onto the land.

Although many of the ecosystem services provided by increasing vegetation are positive (e.g. erosion control and pasture resource), increased plant cover is not necessarily good news for [biodiversity](#), the researchers warn. Although more plants are growing, they may not be good-quality plants for herbivorous animals to eat. They point to the case of the Apennine chamois, a goat-antelope, which suffered a loss in palatable plants when a tall grass invaded its habitat in the Italian Alps¹. Changes in plant communities could also affect soil microorganisms and insects, the researchers say.

The vegetation changes could also affect ecosystem services. Although higher plant cover could help stabilise slopes and the soil's ability to retain water, this reduced erosion could disrupt local hydrology. Tourism may also suffer, as visitors to the region often expect to see pristine snowy and rocky landscapes.



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1. Corazza, M., Tardella, F.M., Ferrari, C. and Catorci, A. (2016). Tall grass invasion after grassland abandonment influences the availability of palatable plants for wild herbivores: insight into the conservation of the Apennine chamois *Rupicapra pyrenaicaornata*. *Environmental Management*. 57(6):1247-61. doi: 10.1007/s00267-016-0679-1.