



Century long assessment of herbaceous plants' physiological responses to climate change in Switzerland

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The isotopic analysis of archived plant material offers the exceptional opportunity to reconstruct the physiological activity of plants over long time periods and thus, to assess plant responses to environmental changes during the last centuries. In addition, the stable isotope analysis of herbarium samples offers the opportunity to reconstruct the physiological processes of a large range of different plant species and from different environments. Interestingly, only few studies have to date assessed these archives.

We will present a novel analysis of leaf nitrogen, oxygen and carbon isotope ratios of more than a thousand herbarium specimens collected since 1800 until present from the unique herbaria hold at the University of Basel. The objective of our study was to assess century-long physiological responses of herbaceous plant species from different plant functional groups and along an altitudinal gradient in Switzerland. The goal of our study was to determine with our investigations the long-term responses of plants to climate change. Such investigations are important as they allow to assess long-term processes of acclimation and adaptation in plants to global environmental change.

In our study we found that herbaceous plants have increased their intrinsic water use efficiency in response to increasing atmospheric CO₂ concentration but this increment was higher in plants from higher altitudes, due to the higher efficiency of CO₂ assimilation of alpine plants compared to plants from lowlands. There were also differences among functional groups, with grasses and forbs showing the highest increments.

In addition, herbaceous plants showed a decreasing trend with time in their N isotopic composition, which may indicate progressive N limitation due to higher biological activity with increasing atmospheric CO₂ concentration.