Ecosystems and Landscape Evolution Group

ETH Zürich

Studying the processes shaping biodiversity from genes to ecosystems

Overview

Biodiversity is essential on many levels. It helps maintain the planet's ecological balance and affects well-being through its role in food production as well cultural, spiritual, and recreational activities. Despite these overwhelming benefits, we are currently experiencing the 6th mass extinction, mainly driven by anthropogenic pressure on ecosystems worldwide. These threats will likely increase in the coming decades, stressing the need to understand ecosystems' response to disturbances. Thus, providing an overview of the biodiversity state can help raise awareness about humans' impact on ecosystems.

In between the WSL and the ETHZ, the Ecosystems and Landscape Evolution (ELE) research group focusses on understanding the effect of history on extant biodiversity patterns as well as on monitoring and forecasting biodiversity and ecosystem responses to global changes.

The researchers in the ELE group come from multiple horizons, both geographically and scientifically, and are connected by the common goal of wanting to understand the mechanisms that shape biodiversity in both terrestrial and aquatic ecosystems. This interdisciplinarity in the group enables us to bridge ecology, evolution, Earth history and global changes using various approaches. Indeed, we collect data through biological monitoring, environmental DNA methods, remote sensing, and field sampling, and subsequently use these data to answer questions with statistical and process-based models of biological diversity. To further increase the connection between people from different background, our group is also associated with Agroscope, EAWAG, the European Joint Research Centre and Vogelwarte.





Research topics

Our research group is involved in numerous projects which are detailed on our website. In summary, we cover two broad topics:

- Understanding the origin of biodiversity. To tackle this question, we work in different geographic areas, from the Henduan mountains in China to coral reefs in the Caribbean Sea. We use multiple approaches such as the use of data on climate history, phylogeny, functional data, processed based simulation models, genetic data, and species observations.
- Monitoring and predicting biodiversity. This second pilar of our research is based on data collected through biological monitoring, environmental DNA methods, remote sensing, and field sampling. Some of our projects are based in Zurich, where we aim at assessing the effects of the local and landscape features of urban green areas on different taxonomic groups. Other projects rely on environmental DNA (eDNA) to implement long-term monitoring in different types of ecosystems worldwide (polar, temperate, tropical). We also aim at improving current monitoring methodologies by using cutting edge technology such as CRISPR-Cas assays and rely on museum collections to improve our knowledge of species distribution.

Collaborating

To broaden the interdisciplinary approach of our group, we would be happy to collaborate with an artist to tackle our research with a fresh perspective. We believe that this collaboration is a great opportunity to explore how art and science can work together to catalyze a shift in perspective for both parties. Through this common exploration, scientists may gain a new perspective on the impact and implications of their research, leading to new questions and areas of investigation. On the other hand, the artist may gain a deeper understanding of scientific concepts and processes, leading to new artistic forms of expression and methods of communication. By combining their expertise and approaches, artists and scientists can generate new ideas and solutions that might not be possible through traditional methods. This can lead to innovative approaches to problemsolving and new forms of creative expression that are both scientifically grounded and aesthetically engaging.

To foster such exchanges between art and science, you would be a part of the group and could assist to our lab meetings, interact with PhD students, post-doc, technical staff, and professors. There will be possibility to work in the lab on different projects, or to visit natural history museum collections and assist to the sampling of museum specimens. There might be a possibility to take part to field work depending on the period of the residency. We look very much forward to this collaboration!



research abstract for ZHdK Master Series 2023 – **Ecosystems and Landscape Evolution**



Selected publications and useful links

- Presentation of the ELE group | <u>https://youtu.be/pXVIAEiL0YQ</u>
- Group web page | <u>https://ele.ethz.ch</u>
- Current projects | <u>https://ele.ethz.ch/research/current-projects.html</u>
- Dispersal and habitat dynamics shape the genetic structure of the Northern chamois in the Alps <u>https://onlinelibrary.wiley.com/doi/10.1111/jbi.14363</u>
- Eco-evolutionary model on spatial graphs reveals how habitat structure affects phenotypic differentiation <u>https://www.nature.com/articles/s42003-022-03595-3</u>
- Disentangling the components of coastal fish biodiversity in southern Brittany by applying an environmental DNA approach https://onlinelibrary.wiley.com/doi/10.1002/edn3.305
- Temperature-Dependent Evolutionary Speed Shapes the Evolution of Biodiversity Patterns Across Tetrapod Radiations <u>https://academic.oup.com/sysbio/advance-</u> <u>article/doi/10.1093/sysbio/syac048/6637530</u>



