Predicting wildlife genetic extinction without DNA data

Background:

Genetic diversity is key for ecosystem resilience in the face of climate change. Populations with high genetic diversity are better equipped to respond to environmental stressors, which helps maintain ecosystem function. The gold standard for monitoring species genetic diversity is DNA sequencing, which is costly and labor-intensive.

To mitigate this limitation, a set of indicators has been developed to monitor genetic diversity in absence of DNA data. These indicators measure species demographic characteristics that are related to genetic diversity. For example, a small population size may signal a risk of genetic erosion, which could lead to extinction. However, these indicators can be difficult to estimate if little is known about the demographic characteristic of a species (for example: how small populations need to be for genetic erosion to happen?).

Assessing power and limitations of these indicators remains difficult, particularly because empirical data to validate them is limited. Computer simulations offer a solution to this gap. By simulating species evolution and extinction, we can evaluate how well demographic indicators predict genetic erosion and extinction.

Project Overview:

Using demographic simulation software, you will create virtual populations living on artificial landscapes impacted by climate change. Following these realistic simulations generation after generation, you will track the extinction trajectories while measuring genetic diversity indicators. Finally, you will assess how accurately the genetic indicators predict extinction risk, and develop guidelines for applying them to real-world species.

Skills Developed:

- Run demographic simulations on a HPC environment.
- Conducting spatial analysis and statistical inference in R.
- Handling environmental change data (e.g., Copernicus, BioClim).
- Applying exploratory analyses (e.g., PCA).
- Using advanced statistical techniques like mixed models and machine learning.
- Scientific writing and reporting.

Interested?

We're excited to hear from you! If you're passionate about conservation, climate change, and data analysis, apply by contacting us at oliver.selmoni@geo.uzh.ch. The project will be conducted within the Spatial Genetics group in the Remote Sensing Laboratories.

Starting date:
Late 2024/early 2025.