

MASTER IN ECOLOGY

Topics for Master Theses at the Institute of Environmental Sciences (NLU), Section of Conservation Biology (begin from spring 2020 onwards). More details at <https://conservation.unibas.ch/teach/>



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Project details and supervisor contacts at <https://conservation.unibas.ch/teach/>

Invasive species and their impacts



Non-indigenous species can have big impacts on local ecosystems and some native species.

1. Impact of the invasive moth *Cydalima perspectalis* (Buchsbaumzünsler) on box trees

The box-tree pyralid *Cydalima perspectalis*, native to Eastern Asia, is a newly introduced species causing severe damage to box-trees (*Buxus* sp.) in private and public gardens as well as in wild box-tree forests in Central Europe. Various aspects of the moth's biology and the impact on wild box trees are still unknown. The Master thesis aims to examine the life-history of the moth and the impact on wild box trees (dendrochronological approach).

Type of research: Behavioural ecology, applied ecology, applied entomology
Begin: Experimental work May 2020 or later
Supervision: Prof. Dr. Bruno Baur

2. Invasive plants

Invasions of non-native plant species are a major threat to the biodiversity in many habitats. Invasive plants can affect biodiversity in many different ways, notably by altering nutrient cycling and disturbance regimes, disrupting naturally occurring mutualisms or promoting erosion. A large percentage of invasive species in Europe have been deliberately imported for horticultural purposes. Although the majority of imported horticultural plants have proven to be non-invasive, many successful horticultural garden escapes are causing severe economic and environmental harm. Many of these garden refugees interact especially with their related native species by competition and hybridization. This Master study aims to examine different ecological and genetic aspects of such invasive plants in forests and on river embankments.

Type of research: Applied ecology, population biology, conservation genetics, molecular techniques. Field and/or lab work
Begin: March 2020 or later
Supervision: Dr. Hans-Peter Rusterholz, Prof. Dr. Bruno Baur

3. Distribution of invasive plant species in the canton Ticino

The invasions of the non-native palm (*Trachycarpus fortunei*) and the shrub (*Prunus laurocerasus*) have been progressing rapidly in the canton Ticino for the last century. Two Master projects are available. The first project will focus on small and large-scale distribution of *Trachycarpus fortunei*. The second project aims to assess the impact of *Prunus*

laurocerasus on soil characteristics and on the biodiversity of above-ground vegetation in forests.

Type of research: Field surveys in the Ticino, and lab work. Projects are especially suitable for Italian speaking students

Begin: March 2020 or later

Supervision: Dr. Hans-Peter Rusterholz, Prof. Dr. Bruno Baur

4. Effects of invasive non-native species on the native invertebrate diversity in the river Rhine

Besides of habitat degradation, the impacts of non-native invasive species are a major cause of extinction of native species. Invading species may interact with the native biota in a variety of ways, for example, by competition, predation, parasitism, disease and hybridization. In the past two decades, the majority of the native species of the macrozoobenthos in the river Rhine has been replaced by invasive amphipods and molluscs. The aim of this Master study is to examine experimentally interactions between invasive species (e.g. the clam *Corbicula fluminea*) and native invertebrate species. Another Master study aims to test the hypothesis that invasive amphipods (e. g. *Corophium curvispinum*) prey upon eggs of native gastropods (e. g. *Theodoxus fluviatilis*), resulting in their local extinction.

Type of research: Ecology, field work in the river Rhine, lab work

Begin: March 2020 or later

Supervision: Prof. Dr. Bruno Baur

5. Feeding behaviour in two introduced populations of the Green Whip Snake (*Hierphis viridiflavus*) from different origins

Two different morphs occur in the Green Whip Snake (*Hierphis viridiflavus*). Both morphs have been introduced in Switzerland (near Bex and Yverdon – Waadt) and first observations suggested a different feeding behaviour. Whereas the *viridiflavus* type seems to be a generalist, the second type (*carbonarius*) could predate mainly on reptiles. Ecological implications on the local herpetofauna are drastically different, the first type cohabiting with threatened populations of *V. aspis*, whereas the second type seems to have led to a disappearance of this species.

The aim of this work is to investigate the feeding behaviour of both morphs in different locations and to compare it to prey availability.

Type of research: Behavioural ecology, mainly fieldwork

Begin: March 2020 or later

Supervision: Dr. Sylvain Ursenbacher

Urban ecology



Cities are expanding. However, even within urban areas there are habitats for many species.

6. Urban forest and ecosystem functions and services

Urban forests provide a wide variety of ecosystem functions ranging from water retention capacity, air cleaning and habitat for many species. In this project we aim to examine the relationship between biodiversity and the provision of ecosystem services.

Type of research: Field sampling and lab work
Begin: March 2020 or later
Supervision: Dr. Hans-Peter Rusterholz

7. Sizeability: Sizing-up the small world underfoot

Studies focusing on various groups of arthropods have reported that species that live in urban habitats tend to be smaller species. This could have many implications for ecosystem services by for example influencing the size of prey taken by ants or of seeds dispersed by ants in urban habitats. But size distributions could be changed by urbanization at other levels than the community too. For example there may be a shift towards smaller individuals in polymorphic species. In this project size distributions will be examined in ant species in sites along an urbanization or disturbance gradient.

Type of research: Lab work to measure ants, possible fieldwork surveys or food preference experiments
Begin: Start possible at any time
Supervision: Dr. Brigitte Braschler

Biology of rare species and their habitats



For successful conservation management it is essential to know the biology and habitat requirements of rare species.

8. Biology of *Trichia caelata*, a land snail endemic to the Northwestern Jura mountains

Knowledge of the biology of rare and threatened species is essential to develop appropriate conservation strategies. This Master thesis aims to investigate several aspects of the life-history (including natural diet) of an extremely rare land snail species which is endemic to the Northwestern Jura mountains. Furthermore, the student can examine whether the density of dead shells predicts the density of living snails.

Type of research: Ecology, field work in Jura forests, also laboratory work
Begin: Spring 2020 or later
Supervision: Prof. Dr. Bruno Baur

9. Particularity of rocky cliffs in the Swiss Jura Mountains

Cliffs in the Swiss Jura Mountains can be considered as islands, which nowadays have an important function as refugia for numerous plant and invertebrate species. At the top of the cliffs, the plateau, the small forest free areas harbor a high diversity of plant species, some of which occur also in the alpine region of Switzerland. Many of these species have small populations and are isolated from each other. As a consequence, dispersal of seeds and pollen might be reduced between populations. Small populations have to face the negative genetic consequences of increased inbreeding and/or reduced genetic diversity caused by genetic drift. The following topics can be addressed by Master theses:

- (1) Identifying factors determining plant species diversity at the plateau of rock cliffs in the Swiss Jura mountains.
- (2) Comparison of the genetic structure of populations from the Jura mountains with alpine populations.
- (3) Determining amount of pollen flow between isolated cliff plant populations.

Type of research: Applied ecology, population biology, vegetation survey, conservation genetics, molecular techniques. Field and/or lab work
Begin: March 2020 or later
Supervision: Prof. Bruno Baur, Dr. Hans-Peter Rusterholz

10. Subterranean invertebrate communities in scree slopes of the Jura Mountains

Scree slopes harbour a poorly known but very interesting invertebrate fauna living up to 1 meter below the surface. The aim of the study is to examine the species composition of invertebrate groups and factors (soil compaction due to human use, sun exposure, vegetation type, etc.) that may determine species composition. Sampling will be made in several sites of the Jura mountains by means of subterranean traps. Previous experience in entomology is not required (although desirable). The student will be trained to identify the target species. The

project will focus on the following groups of invertebrates: millipedes, beetles, woodlice and/or ants.

Type of research: Fieldwork in the Jura Mountains, lab work and computer work.
Begin: Spring 2020 or later.
Supervision: Dr. José D. Gilgado

Land use change



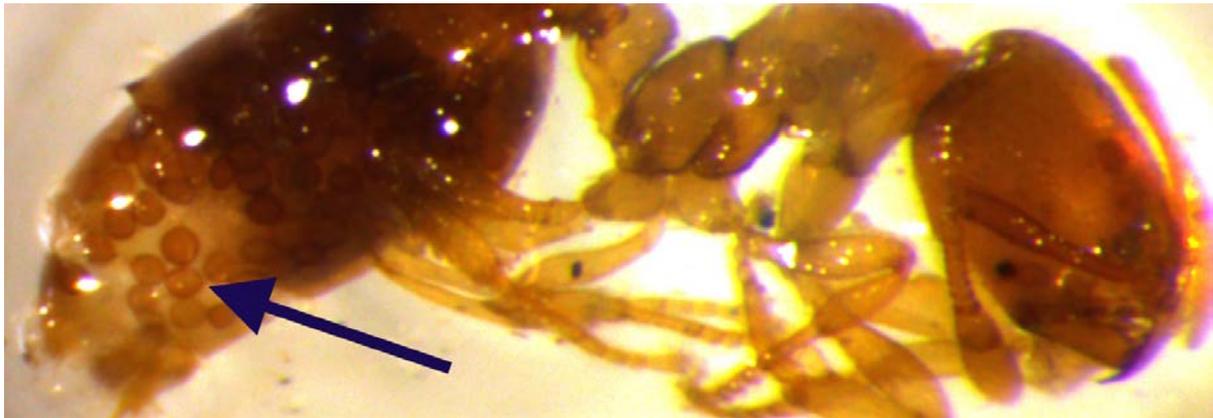
Many habitats are now used differently from earlier periods. Both intensification and less intensive use are common changes. These changes in management practices lead to changes in environmental factors as well as changes in species composition.

11. Human impact on aquatic invertebrate diversity in Hungary

There is considerable interest in determining which human activities influence the natural invertebrate communities in water bodies. In the present project, field surveys and experiments will be conducted to examine which human factors influence both the community structure of aquatic invertebrates and the functional diversity in streams, rivers and ponds in Hungary.

Type of research: Field work in Hungary (two Master-students from Basel University should cooperate in this project)
Begin: Spring 2020 or later
Supervision: Dr. Denes Schmera, Prof. Dr. Bruno Baur

Impacts of disease on species and populations



Disease has various impacts on populations and individuals including changes to behaviour.

12. Parasite-induced changes in the reproductive behaviour of a simultaneously hermaphroditic land snail

Parasite infection can reduce diverse fitness parameters of the host. In simultaneously hermaphroditic animals, parasites may affect either the male or female reproductive function. This Master study aims to examine various aspects of reproductive behaviour including sperm competition in a land snail infested by parasitic mites. It is possible to learn molecular techniques (microsatellites).

Type of research: Behavioural ecology, observation of snail behaviour in the lab, field work possible
Begin: Experimental work April 2020 or later
Supervision: Prof. Dr. Bruno Baur

13. A little known enemy: Ant diseases

Ants fulfill important roles in ecosystems, acting as ecosystem engineers and interacting with many plant and animal species. They are also used as bioindicators. Even so one aspect of ant biology is little researched: ant diseases. In Riehen an enigmatic endoparasitic fungus is infecting some ant colonies. Several different ant species have been shown to be affected, including species never before reported to be hosts for this parasite. The aim of the project is to study the effect of the disease on the infected ants and on ant colonies, as well as identifying how the infection is transmitted between individuals and between species. Master projects can focus on any of these aims.

Type of research: Field surveys or physiological or behavioural experiments in the lab depending on the focus of the project
Begin: March 2020 or later
Supervision: Dr. Brigitte Braschler

Behaviour in Zoo animals



Behavioural studies can help improve enclosures in zoos.

14. Zoo biology: Behavioural studies on animals in Basel Zoo

Various topics on the behaviour of animals are possible in Basel Zoo. Recent Master studies investigated the effect of heavy noise on the activity of Snow leopards, the influence of the terrarium structure on the locomotory activity and behaviour of young Veiled chameleons, and the behaviour of African elephants on the outdoor exhibit.

Type of research: Behavioural study in Basel Zoo
Begin: 2020
Supervision: Prof. Dr. Bruno Baur

Spider webs



Spider webs are incredibly efficient structures.

15. Effects of prey capture on web building in orb web spiders

Spiders build webs to trap prey. To maximize the efficiency of their webs, spiders should fine-tune the stickiness of the different areas of their web based on previous prey capture experience. The stickiness of a spider web largely depends on the number and the size of the glue droplets on the sticky silk threads of the web. This Master thesis aims to analyze how the number and the size of the glue droplets varies within orb webs of *Araneus diadematus*, and how number and size of glue droplets are influenced by previous prey capture experience.

Type of research: Behavioural study, mainly in the lab
Begin: May to August 2020
Supervision: PD Dr. Samuel Zschokke

Climate change impacts



Recent and future climate change is affecting ecosystems, species, populations, and individuals with both expected and unprecedented consequences, many of which are still poorly understood.

16. Succession of subterranean fauna communities in melting permafrost and block glaciers in the Alps

There is a specialized fauna in the higher elevation subterranean environments different to that of lower elevations. Ice melting, due to climate change, and subsequent plant colonization are changing the soil properties (temperature, availability of nutrients) but it is not known how this is affecting the subterranean fauna communities. The succession of these communities and the vertical migrations due to seasonal temperature changes will be studied for the first time in the Alps.

Type of research: Fieldwork in the Alps (experience in hiking desirable), lab work.

Begin: Spring 2020 or later depending on snow cover

Supervision: Dr. José D. Gilgado

17. Succession of subterranean fauna communities in debris flows in the Alps (Valais)

Subterranean communities of arthropods (living up to one meter in depth) are poorly known. Climate change increases the frequency of landslide risk, and each catastrophic event of land movement (debris flow) influences the soil communities. The aim of the study is to examine how the disturbed soil structure will recover and the soil and subsoil animals will establish again populations in landslides. Together with other members of the team, the student will sample subterranean invertebrates in several landslides of different successional stages (time since the last debris flow). The student will sort and identify one or several groups of invertebrates, and will study the relationships between their species richness and abundance and the age of the landslide where they were captured. While the details (taxa studied by the student) can be discussed, the project will focus on the following groups of invertebrates: millipedes, beetles, woodlice and ants.

Type of research: Field work in the Alps (canton Valais), lab work and computer work.

Begin: Spring 2020 or later,

Supervision: Dr. José D. Gilgado

GMOs



GMO cultivation can have effects beyond the target species. Photo Myrabella/ Wikimedia Commons

18. GMOs and wild relatives: risk assessment of potential gene transfer

Herbivores and pathogens can have big effects on the population dynamics of plants. Genetically modified organisms (GMOs) that produce defending substances are increasingly cultivated. Hybridization in plants is common and gene transfer to wild relatives may occur. The aim of this Master study is to assess the potential risk of such transfers in terms of the population dynamics of wild relatives. Population dynamics of non-target organisms (e.g. butterflies) may be an alternative focus to plants. Ideally, a team of 2-3 students would work together with the goal to integrate the plant and insect part, and combine both parts with a geographical information system (GIS).

Type of research: Plant or animal population biology, simulation modelling with literature or own field/experimental data
Begin: Spring 2020 or later
Supervision: PD Dr. Peter Stoll