Masters' presentations in biology
May 2023

Schedule & abstracts

Tuesday May 23

At Zoologen (Seminar room), 10-17

Wednesday May 24

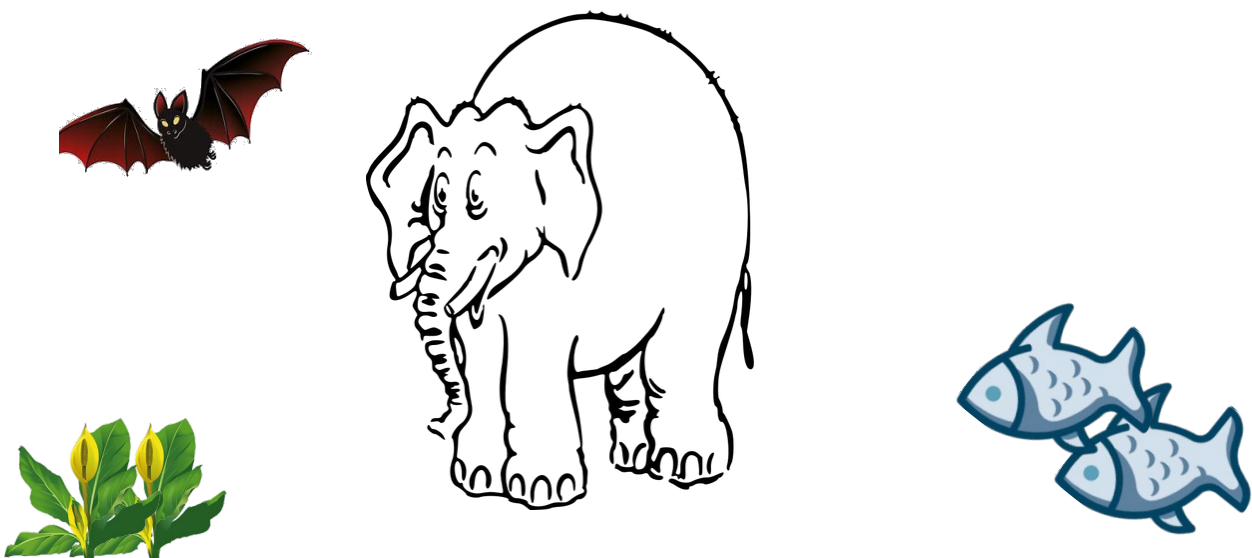At Zoologen (Lecture hall), 11-17

Thursday May 25

At Botan (to be announced), 9-16

All presentations can also be followed via Zoom, see also under "Events" on the department's web page

Welcome!

Schedule

Times below are approximate (except for first presentation each day)

Tuesday May 23

10.00　**Fred Halldén** (Conservation biology, 60 hp)

Exploring population genetics and spatial distribution of pikeperch *(Sander lucioperca*) in lake Hjälmaren, Sweden, using acoustic telemetry and microsatellite data

Opponent: Carl-Johan Dekker

11.00　**Amanda Trail** (Conservation biology, 60 hp)

Invasive and native gobiid species compete with the commercially important Atlantic cod: A potential reinforcement mechanism for an altered ecological regime on the Swedish West coast

Opponent: Andreas Källman

Lunch break

13.00　**Celia Oni** (Conservation biology, 60 hp)

How equity affects farmers likelihood to cooperate in conservation efforts

Opponent: Malin Johansson

14.00　**Josefin Holm** (Conservation biology, 30 hp)

Monitoring alien or invasive species – a comparison between traditional methods (eRAS) and DNA-based identification of species in harbors

Opponent: Melissa Miranda

Short break for coffe

15.00　**Andreas Källman** (Conservation biology, 45 hp)

Hibernation preferences of the Northern bat (*Eptesicus nilssonii*)

Opponent: Isidora Dundjerovic

16.00　**Linnéa Svensson** (Conservation biology, 60 hp)

Biogeography of two freshwater fish communities in South Pacific Costa Rica: Evaluating non-invasive census methods for effective conservation

Opponent: Vera Ruijs

Wednesday May 24

11.00　**Faiza Tahsin Rashid** (Physiology & cell biology, 60 hp)

Role of Androgen receptor signaling in the differentiation and activation of human plasmacytoid dendritic cells

Opponent: Christopher Liechti

Lunch break

12.30　**Christopher Liechti** (Physiology & cell biology, 60 hp)

Behavioural toxicity of conventional vs. biobased and marine recycled polymers in European perch and netted dog whelk

Opponent: Faiza Tahsin Rashid

13.30   **Isidora Dundjerovic** (Physiology & cell biology, 45 hp)

Heart rate as an indicator of stress in Gotland's Russ horses

Opponent: Rebecka Relfsson

Break for coffee & cake ca. 14.15-15.00

15.00   **Malin Olsson** (Conservation biology, 60 hp)

The Bzzt of Friends: Interspecific competition in Arctic plants for pollination services

Opponent: Stina Skånhoff

16.00   **Carl-Johan Dekker** (Conservation biology, 60 hp)

Invasive plant species in Southwest Sweden - Evaluating methods of removal by empirical study and literature review

Opponent: Linnéa Svensson

Thursday May 25

9.00   **Vera Ruijs** (Evolutionary & behavioural ecology, 60 hp)

Investigating the use of olfactory cues to re-direct African savannah elephant pathways: a potential conflict mitigation tool

Opponent: Amanda Trail

Short break for coffe

10.150   **Rebecka Relfsson** (Biodiversity & systematics, 60 hp)

African elephants' effect on temporal use of elephant highways by predator and prey

Opponent: Celia Oni

11.15   **Melissa Miranda** (Biodiversity & systematics, 30 hp)

Estimating historic ranges of extinct scavenging birds from North America during the late Pleistocene using co-occurrence data from the fossil record

Opponent: Daniel Bäck

Lunch break

13.00   **Stina Skånhoff** (Conservation biology, 60 hp)

Examining plant trait plasticity and implications for future community dynamics in response to warming in the high arctic

Opponent: Josefin Holm

14.00   **Daniel Bäck** (Biodiversity & systematics, 30 hp)

Taxonomic overview of common valerians (*Valeriana officinalis* aggr.) in Sweden: A preliminary study

Opponent: Sebastián Giraldo Gómez

Short break for coffe

15.00   **Sebastián Giraldo Gómez** (Biodiversity & systematics, 60 hp)

Phylogeny and evolution of flower symmetry of *Posoqueria* (Rubiaceae)

Opponent: Malin Olsson

Abstracts

Exploring population genetics and spatial distribution of pikeperch (*Sander lucioperca*) in lake Hjälmaren, Sweden, using acoustic telemetry and microsatellite data

Fred Halldén (Conservation Biology, 60 hp)

Supervisors: Johan Höjesjö, Biological and Environmental Sciences, GU & Gustav Hellström and Daniel Palm, Department of wildlife, fish and environmental studies, SLU

Knowledge about genetic structure and spatial distribution is valuable information when managing fish populations, both in terms of regulating harvest and implementing temporal or spatial protection measures. Population genetics and modern fish tracking telemetry technology are two powerful methods generating such information, however, comparisons between the two approaches regarding their agreement in identification of subpopulation structure are rare. This study aims to assess how well telemetry-derived data on fish population distribution across a lake, align with estimates of the genetic differentiation in the population. To do this, acoustic telemetry was used to identify spawners of pikeperch in lake Hjälmaren, Sweden, and assign these spawners to specific spawning areas in the lake. The genetic differentiation between the spawners assigned to spawning areas was estimated using microsatellite data. The study could not detect genetic differentiation between pikeperch based on assigned spawning areas, using wcFst estimates and PCA plots. The findings might suggest that homing behavior and spawning site fidelity is not a major driving force shaping genetic structure of pikeperch in lake Hjälmaren. Alternatively, the result may reflect an insufficient resolution in telemetry and/or genetic data which limits the ability to detect subpopulation structures at the spatial scale attempted in this study. A de-novo clustering approach using Kmeans, and sNMF-methods suggest subpopulation structure with up to 9 clusters in the lake Hjälmaren pikeperch population, and inspection of PCA-plots that includes information from the clustering methods indicates that 2-3 clusters may best describe the genetic structure of the population. However, the result was somewhat inconsistent both within and between clustering methods, indicating lack of distinct genetic differentiation in the population estimated from the genetic sample used. Results are discussed based on how telemetry and genetic data can be interpreted and utilized in a management context, with focus on data resolution and study design.

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Invasive and native gobiid species compete with the commercially important Atlantic cod: A potential reinforcement mechanism for an altered ecological regime on the Swedish West coast

Amanda Trail (Conservation Biology, 60 hp)

Supervisor: Leon Green, Biological and Environmental Sciences, GU
Examiner: Lotta Kvarnemo

Commercial fisheries have dramatically decreased the abundance of large, piscivorous fish such as the Atlantic cod (*Gadus morhua*). Declines in piscivore populations in the Baltic Sea and Sweden's West coast have reduced the predatory influence of piscivores and contributed towards a regime shift with increased densities of teleost prey: mesopredators such as gobies, sprat, and stickleback. Juvenile cod utilize coastal areas for growth and maturation, with

habitats like seagrass meadows providing key invertebrate resources for cod development. The black goby (*Gobius niger*) has a similar dietary overlap with juvenile cod and are found in sympatry in coastal areas, suggesting that food competition occurs between the two species. Alongside the anticipated impact of the round goby (*Neogobius melanostomus*), a new invasive threat along Sweden's West coast, cod recruitment may be threatened by increased gobiid exploitation and behavioral interference. In this study, food competition over live *Palaemon* spp. was assessed by measuring juvenile cod growth, condition, and morphology over 36-days when cod communities were alone or cohabiting with black or round gobies in mesocosms. Cod housed without gobies showed increased growth and end-point intestinal mass compared to cod housed with either goby species; condition trends, however, were similar across all groups. Cod housed with round goby showed increased hepatosomatic index relative to cod housed with black goby. No other differences between cod were observed based on cohabitation between a non-native or native goby species. These findings indicate that food competition exists between juvenile cod and gobiid species. Starting mass also predicted growth rate in cod regardless of cohabitation status, suggesting that growth may also be modulated by size-dependent dominance interactions. Efforts to manage cod should focus on restoring seagrass habitats as nursery-grounds for juvenile cod, as well as rebuilding cod populations to help facilitate top-down control over lower trophic levels.

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How equity affects farmers likelihood to cooperate in conservation efforts

Celia Oni (Conservation Biology, 60 hp)

Supervisor: Luc Bussière, Biological and Environmental Sciences, GU
Examiner: Karin Hårding

Conflicts between wildlife conservation and other human activities are complex, and we need to better understand factors affecting stakeholder decisions to resolve them. One factor that might play a role is equity, the notion of being rewarded based on the work done. Humans have biologically evolved to avoid unfair situations, and so may be act less favorably towards conservation if they feel unfairly treated relative to neighbors. Crop-raiding by elephants is an example of a conservation conflict that negatively impacts farmers' livelihoods. In response to crop raiding, farmers may resort to lethal methods to protect their crops. Elephants are a threatened species, and protected in many areas, but conservation policies may not compensate for losses incurred due to elephant crop-raiding. Because elephants are not equally distributed across farms, some farmers are more impacted by crop raiding than others. In these conditions, adversely affected farmers might feel unfairly treated and be less prone to cooperate in conservation efforts. To investigate this problem, I used data gathered through a web-based interactive game developed to study human decision-making. In the game, farmers are tasked to make sustainable landscape management decisions. I predicted that farmers with high scores (representing high farm yield in the game) would be less likely to try to kill elephants and might be more willing to participate in conservation efforts. I predicted further that farm yield might be especially important when there is high variation between scores (reflecting large differences in farm outcome, and perhaps lower levels of equity). Consistent with these predictions, farmers who had a higher performance compared to others were less likely to try to kill elephants and provided more land for elephants, but the magnitude of these effects depending on the exact conservation policies in place during a game. Variation in score did not affect the likelihood to try to kill elephants. However, when provision of habitat was subsidized and a bonus was added for contiguous habitat, low scorers

provided less land for elephants as score variation increased. Thus, performance was an important factor in predicting farmers cooperation with conservation efforts. My study shows the importance of equity in addressing underlying social conflicts to reach mutually beneficial outcomes in conservation conflicts.

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Monitoring alien or invasive species – a comparison between traditional methods (eRAS) and DNA-based identification of species in harbors

Josefin Holm (Conservation biology, 30 hp)

Supervisors: Mattias Obst and Per Sundberg. Marine Science, GU
Examiner: Karin Hårding

A major concern with increasing global boat travels is the spreading of alien and invasive species. Species are spread via ballast water, as fouling on ships and in fishing gear. If an alien or invasive species ends up in a foreign environment, it can negatively affect the native species on the site. This study wanted to investigate which method, DNA-based or traditional, that is more suitable when tracking and determine alien and invasive species in harbours. To detect alien or invasive species in an early stage is crucial to prevent spreading, and for this, sensitive methods that can detect species in all their life stages are needed. The research question was as follows "Which method is best when tracking and determine potentially alien – or invasive species in harbours? ". The DNA-based methods, water samples, plankton samples and arms settling panels, collected genetic material and then used metabarcoding to identify and species determine any findings. The traditional methods; panels, scrapings and artificial habitats, identified and determined their findings by only using visual morphological identification. The results showed that the DNA-based methods found ten alien and invasive species in their samples, were two, round goby and the red algae *Bonnemaisonia hamifera*, is classified as invasive. The traditional methods recovered zero alien or invasive species in their samples. The traditional methods are today included in the Swedish monitoring program and with the results of this study, it is proposed that these be replaced by DNA-based methods for future enhanced monitoring of alien and invasive species.

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Hibernation preferences of the Northern bat (*Eptesicus nilssonii*)

Andreas Källman (Conservation biology, 45 hp)

Supervisors: Karin Hårding, Biological and Environmental Sciences, GU & Magnus Gelang, Department of Vertebrae, Natural History Museum of Gothenburg
Examiner: Staffan Andersson

Despite that bats (Chiroptera) constitute a large portion of the mammalian species in Sweden, we know little about their annual cycle, e.g., the winter-whereabouts of most of the Swedish bats is largely unknown. In census counts from mines, fortresses, and caves only fractions of the individuals of the total population of bats can be accounted for, which prompts the question where they instead choose to hibernate. Visual sightings at rock screes in other parts of Scandinavia may act as a clue of where they choose to go into torpor. It has recently been shown that the Northern bat (*Eptesicus nilssonii*) is declining in Sweden, where one study showed a 60-percent decrease over the last 30 years, and one of the ecological factors that may have influenced the trend could be hibernation. Thus, it is of the utmost importance to

clarify how the hibernation takes place. With autoboxes (i.e., passive-sampling audio-recorders) at rock screes and controls audio-sampling was performed in the pre-hibernation period and post-hibernation period. Other variables were also collected, such as temperature and humidity within screes, rock size, leaning direction of the scree slope to explain any northern bat activity to the features of the site. Statistical tests were performed in SPSS. 77 recordings of Northern bat were recorded (72 at screes and 5 at controls), although no statistically significant difference could be found between the treatments. None of the measured habitat features could predict the bat activity ($p > 0.05$). although no difference could be detected, there are real implications that point to rock screes as important habitats for hibernating bats. The activity of Northern bats strengthen the results coming out of Finland and Norway, making way for a new habitat for hibernation of Northern bats and this study prompts for a more studies on hibernating bats in temperate regions.

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Biogeography of two freshwater fish communities in South Pacific Costa Rica: Evaluating non-invasive census methods for effective conservation

Linnéa Svensson (Conservation Biology, 60 hp)

Supervisors: Leon Green, Biological and Environmental Sciences, GU &
Oscar Brenes, Science Director at Reserva Playa Tortuga
Examiner: Staffan Andersson

The neotropics contain the largest diversity of freshwater fish species on earth, with the distribution, ecology and life history of many species still poorly known, and new species continuously discovered. At the same time, freshwater ecosystems are facing unprecedented loss of biodiversity. To reverse this decline and facilitate successful conservation for central- and south American fishes, there is a need for baseline data and knowledge of how fish communities in this region are related to environmental variables, and thus might respond to anthropogenic and climatic changes. Resources for conservation are often scarce, so there is also need for cost- and time efficient methods. The aim of this study was to explore the use of Baited Remote Underwater Videos (BRUVs) in two rivers of south pacific Costa Rica, to obtain baseline data of their fish community and understand how environmental variables are related to their diversity. The results showed that BRUVs captured a higher species richness than cast nets in deep and slow-flowing sections, but a lower richness and abundance than electrofishing in rapid and shallow sections. Evaluation of bait types and adjustments of the sampling effort may improve the BRUVs performance in rapids. Out of eighteen species observed in the study, BRUVs captured sixteen. The species richness of the community correlated negatively with river mouth distance, with fewer species further upstream in the rivers. Also, the length of several species was related to mouth distance, suggesting that different parts of the rivers are important for different life stages. The results of this study can be used as a baseline reference for future studies and monitoring of this area. They highlight the importance of connectivity and habitat variability, and the conservation challenges of higher richness in downstream areas, where human disturbance is often more prominent.

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Role of Androgen receptor signaling in the differentiation and activation of human plasmacytoid dendritic cells

Faiza Tahsin Rashid (Physiology & cell biology, 60 hp)

Supervisor: Mattias Svensson, Rheumatology and Inflammation Research, GU
Examiner: Malin Celander

Androgens are steroid hormones that are essential for the development and maintenance of male reproductive organs as well as secondary sexual characteristics. Plasmacytoid dendritic cells (pDCs) are immune cells that act as the first line of defense against viral infections. These cells have specialized receptors such as the toll-like receptors (TLR7) that allow them to recognize viral nucleic acids and initiate the production of antiviral cytokines such as Type I interferons (IFN-α1 and IFN-α2). Androgen signaling mediates the functions of the pDCs by increasing their activation and maturation in response to viral infections via the androgen receptor (AR), a nuclear hormone receptor on their surface that binds to hormones such as testosterone, an androgen hormone. Androgens have also been shown to promote the replication and intensity of some viruses, most notably SARS-CoV-2. Understanding the mechanism of androgen signaling is critical for developing effective antiviral therapies. In light of this, we stimulated human poly-blood mononuclear cells (PBMCs) with TLR7 agonists such as Gardiquimod, R1881, and Testosterone propionate. These compounds are used to activate the androgen receptor in order to assess its role in interferon production. An antagonist such as the G15, a G-protein coupled estrogen receptor was also used. Furthermore, qPCR was used to examine the gene expression of IFN-1, IFN-2, IRF7, and MX1 using GAPDH as the endogenous control. Flow cytometry was also performed after the cells were stained with BDCA2, CD3, CD19, and CD123 to evaluate the pDC population and interferon production. The results demonstrated an increase in IFN response when stimulated by Gardiquimod and the agonists, with individual differences. To date, relatively few studies have been conducted on the role of androgens in immune system regulation. Further research can generate effective treatment targets and lessen the impact that certain infections have on human health.

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Behavioural toxicity of conventional vs. biobased and marine recycled polymers in European perch and netted dog whelk

Christopher Liechti (Physiology & cell biology, 60 hp)

Supervisor: Bethanie Carney Almroth, Biological and Environmental Sciences, GU
Examiner: Kristina Snuttan Sundell

Plastics are of growing concern as their production is set to increase from today's 370 million tonnes to 600 million tonnes by 2050. However, the extent of the problems that they cause in the environment remain largely unknown. Plastics can affect the environment in numerous different ways. Large pieces of plastic (macroplastic) cause issues such as blockages, suffocation, and entanglement, while microplastic particles and plastic chemical leachate are still under scrutiny. Numerous solutions to plastic pollution have been suggested, from increased use of bioplastics to recycling of legacy pollution like abandoned, lost and discarded fishing gear (ALDFG). In this study, two common Swedish species, European perch (*Perca fluviatilis*) and netted dog whelk (*Tritia reticulata*) were used to assess the impact of these types of pollution. For the microplastic particles, a 6-month feeding exposure trial was carried out using juvenile perch to monitor changes in behaviour. Such changes could occur from

ingestion of preproduction fossil-fuel based versus biobased microplastic particles. The Dog whelks were exposed to a leachate of chemicals from recycled marine polymers from ALDFG. This was done to measure differences in behaviour, imposex and reproductive success. The fish's behaviour showed no significant change from the exposure to any of the particle types. However, the snails exposed to plastic leachate showed a decrease in emergence in response to a food cue. Also, significant changes in reproductive output were observed in the leachate-exposed group. These included a decrease in the number of capsules laid per female, number of eggs per capsule, and total number of capsules laid per tank. This indicates that the chemical cocktail comprising the leachate contained chemicals that impeded normal behaviour and reproductive output.

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Heart rate as an indicator of stress in Gotland's Russ horses

Isidora Dundjerovic (Physiology & cell biology, 45hp)

Supervisors: Lynne Sneddon, Biological and Environmental Sciences, GU & Linda Thelin, Slottsskogen
Examiner: Catharina Olsson

Animal welfare concerns both the physical and mental wellbeing of animals. Welfare assessment of animals kept in captivity, for example zoos, is important and necessary both legally and ethically. Good welfare is especially vital when breeding endangered species as stress impairs reproductive investment. As zoos often have high numbers of visitors, it is important to know if humans and the associated noise might influence the animals' wellbeing. The aim of this study was to investigate whether the presence of visitors and activities offered to the visitors caused stress in horses housed in a city park in Gothenburg, Slottsskogen. This was done by measuring heart rate in eight Gotland Russ horses with Polar belts during three different treatments; resting, exercise, and during a playground event, where horses are in close contact with humans. The results showed that horses were neither stressed by humans and other animals in the park, nor by vehicles. The average heart rate was significantly different amongst all treatments. At rest, the average heart rate was 42.5±3.2 bpm, 85±10.4 bpm during exercise, and 51±7.2 bpm at the playground. Despite statistically significant differences in heart rate during different treatments, the difference did not indicate that the playground event was stressful in these horses. This knowledge is valuable for this park as many human activities occur there throughout the year, and gaining a better understanding of how the animals are affected by such events is essential for good animal welfare.

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The Bzzt of Friends: Interspecific competition in Arctic plants for pollination services

Malin Olsson (Conservation biology, 60 hp)

Supervisor: Anne Bjorkman, Biological and Environmental Sciences, GU
Examiner: Håkan Pleijel

The Arctic is a challenging environment for the flora and fauna that inhabit it. The ruling abiotic factors have created a unique environment with low biodiversity. This creates a potential challenge for the plants that inhabit the region, where the essential pollinators for outcrossing are scarce. Alternative reproduction modes, such as autogamous selfing could be more

common with insufficient pollination services. Strategies to attract pollinators are likely to create interspecific competition in the plant community. The aim of the study was to see if interspecific competition in Arctic plants changed over regions and how dependent the plants were on pollination services. Plant-pollinator networks from the High Arctic Svalbard and the subarctic eastern mountain of Tväråklumparna, Sweden, were described by catching pollinators that were interacting with flowers. In addition, a pollination experiment was performed at the sites. The study revealed two general plant-pollinator networks. The level of interspecific competition was higher at Svalbard, compared to the site at Tväråklumparna. The mountain avens (*Dryas octopetala*) appeared to be a strong competitor that attracted many of the local pollinators. Pollinator dependence seemed to be occurring in the species but while being able to reproduce by autogamous selfing, the selfing rates at Svalbard were relatively low. This is raising the question of a relationship between a species' reproductive assurance and the selfing rate. Further research is needed to investigate if there is a connection between the two.

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Invasive plant species in Southwest Sweden - Evaluating methods of removal by empirical study and literature review

Carl-Johan Dekker (Conservation biology, 60 hp)

Supervisor: Håkan Pleijel, Biological and Environmental Sciences, GU & Mattias Lindholm, Västkuststiftelsen
Examiner: Anne Björkman

Invasive alien species (IAS), are one of the five biggest threats to biodiversity worldwide. An instrument for biodiversity protection in Sweden is the establishment and management of nature reserves. The goal of nature reserves is to protect valuable nature and rare species to preserve biodiversity. All over the planet, invasive alien species affect protected areas. Despite an abundance of studies on biological invasions, fairly little is known about which methods have been used to control these invasive plants. In this master thesis, three different studies were conducted to evaluate the most effective methods in removing invasive alien plants from nature reserves using a field experiment, literature review and survey. Two different removal methods were tested in the field to remove the study species *Lysichiton americanus.* In method 1 the root of the plants was destroyed. In method 2, the whole plant was removed with a spade. The literature review included research on the study species *Lupinus polyphyllus* & *Impatiens glandulifera* to find the most effective removal method for each species. The current situation of combating IAS in Sweden were reviewed by sending out a questionnaire to authorities and stakeholders, to understand what the incentives and motivations are for combating invasive alien species. The field experiment resulted in no significant difference between treatment methods. The results from the literature review show that there might not be one single most effective removal method *for I. glandulifera* and *L. polyphyllus*. The methods recommended to use are mechanical (cutting, mowing, hand-pulling and hot water). Combating invasive plants was deemed by the survey to be of high importance and that the work with invasive alien plants should be of an even higher priority than it currently is. Improved knowledge of effective removal methods of invasive alien species was needed in most municipalities in Västra Götaland.

Keywords: Invasive alien species, management, nature conservation, biodiversity

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Investigating the use of olfactory cues to re-direct African savannah elephant pathways: a potential conflict mitigation tool

Vera Ruijs (Evolutionary & behavioural ecology, 60 hp)

Supervisors: Søren Faurby, Biological and Environmental Sciences, GU & Kate Evans, Elephants for Africa
Examiner: Mats Olsson

Human-elephant conflict resulting from for example crop raiding behaviour poses a significant threat to the conservation of African savannah elephants. These conflicts can lead to fatalities in both humans and elephants in the Makgadikgadi Pans National Park and elsewhere in Africa. To mitigate these problems, this study investigated the potential of using olfactory cues in elephant pathway soil. It was examined whether these cues can be used to artificially re-direct elephant pathways away from crops and human settlements. In an attempt to manipulate elephant movement, a treatment of soil with olfactory cues was placed on the side that was initially used less in pathway branching events, aiming at stimulating the usage of these less used sides. The 1500 elephant sightings captured by camera traps on pathways towards the Boteti River provided information into the pathway usage by elephants in the study, as there was considerable variation in pathway usage by individual elephants and groups, as well as in usage during the day and night. However, a logistic regression in a time series analysis revealed no significant immediate or sustained effect of the treatments on pathway usage. This could be due to the pre-existing olfactory cues on established pathways overshadowing the treatments, or to elephants having a better understanding of the park than previously assumed. Additionally, the elephants may have smelled the Boteti River water nearby, reducing their attention to the soil treatments. Furthermore, the study found that elephants have an even greater preference for the initially more used pathways during darkness. This suggests that the elephants have a stronger dependence on olfactory cues during the night. Overall, this study is the first step in creating a new method to mitigate human-elephant conflict, and it highlights that factors influencing elephants' movement patterns should be explored more.

Keywords: African savannah elephants – conflict mitigation – human-elephant conflict – olfactory cues – elephant pathways

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African elephants' effect on temporal use of elephant highways by predator and prey

Rebecka Relfsson (Biodiversity & systematics, 60 hp)

Supervisors: Søren Faurby, Biological and Environmental Sciences, GU & Kate Evans, Elephants for Africa
Examiner: Mats Olsson

African elephants (*Loxondonta africana*) are the world's largest land-mammal and are considered a keystone species in its natural habitat. The effect they have on vegetation and their environment is well known, but their effect on other animal species is less studied. Knowledge about a species and its effect on other species is important for conservation work and human-wildlife conflict management alike. This study investigates how elephant presence on the so-called elephant highways affects the presence of other herbivore species as well as predator species. Additionally, it examines if the elephants are used as predation avoidance

by other herbivores. This is done using approximately four years of data from camera traps that were set up along the elephant highways near the Boteti River in the Makgadikgadi Pans National Park in Botswana. The herbivore species included in the study were giraffe, greater kudu, and impala. The predators were investigated as a group (consisting of the five largest African predator species). Lions were also examined, separately from the other predators. Logistic regression models testing the presence of each of the herbivore species on the elephant highways against the presence of elephants and predators showed that elephants affected the presence of giraffes positively, the presence of kudu slightly but positively, while the presence of impala were unaffected. The presence of predators was almost exclusively non-significant, although almost none of the herbivore species were caught on the camera traps close in time to a predator. Logistic regression models testing predator presence against elephant presence showed that predators are positively affected by elephant presence. The study shows that species favoured as prey by lions tend to be drawn to elephants, which might support the idea that elephants are used as predation avoidance by other herbivores, although further studies need to be done to confirm this.

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Estimating historic ranges of extinct scavenging birds from North America during the late Pleistocene using co-occurrence data from the fossil record

Melissa Miranda (Biodiversity & systematics, 30 hp)

Supervisor: Søren Faurby, Biological and Environmental Sciences, GU
Examiner: Bengt Oxelman

The aim of my study was to estimate and compare the historic range of nine scavenging birds from North America that went jointly extinct with their mammalian megafaunal prey in the late Pleistocene. Although the severity and timing of their co-extinction are strongly correlated, there has been little analytical support in providing estimates for the possible geographic distribution of scavenging birds prior to the extinction event. To build an estimate of their historic range, I utilized rasters depicting the range of the mammal and bird species that co-occurred alongside the scavengers at different fossil sites. Using co-occurrence data to reconstruct the historic distributions of extinct scavenging birds was the selected approach because many extinct scavengers are known from very few fossil sites. Results showed that the estimated range size for extinct scavengers, based on avian co-occurrence data, was generally larger than the range estimates using mammal data. To measure the relationship between the distribution of scavengers and their prey, I compared the estimated ranges to the present-natural range of North American mammals using linear and spatial autoregressive models. The analysis revealed that both estimated ranges, using avian or mammalian co-occurrence data, were significantly positively correlated with and are significant predictors of present-natural mammalian diversity, but estimates based on mammals exhibited a stronger effect size and are thus a better predictor of present-natural mammalian diversity compared to using avian species. The results of this study determined a significant relationship between the extinct scavengers estimated distributions and present-natural mammalian diversity, providing biogeographic corroboration in support of the theorized co-extinction event in which the decline in mammalian prey was the causal link affecting scavenging bird declines. Future studies could employ similar methods and further test the procedure of using co-occurrence data from the fossil record to approximate the distribution of data-limited extinct species.

Examining plant trait plasticity and implications for future community dynamics in response to warming in the high arctic

Stina Skånhoff (Conservation biology, 60 hp)

Supervisor: Anne Bjorkman, Biological and Environmental Sciences, GU
Examiner: Johan Uddling

The impact of recent climate warming on plant phenology and ecosystem processes, particularly in Arctic regions, has been substantial. Temperature increases in the tundra are occurring at a rate twice as fast as the global average. In this study, we examined plant trait plasticity in response to warming using data from an established ITEX site located in Endalen, Svalbard. We focused on five specific traits (leaf area, leaf specific area, height, nitrogen, and leaf dry matter content) for the most abundant species in the plots. We compared data from plots subjected to experimental warming using Open Top Chambers to control plots. The warming treatment had an overall positive effect on the leaf area and height of the studied plant species. Among the nine species analyzed, eight species exhibited increased leaf area under the warming treatment, with statistically significant increases observed in *Bistorta vivipara* (p<0.001), *Equisetum arvense* (p<0.01), and *Dryas octopetala* (p<0.05). Additionally, the warming treatment resulted in decreased nitrogen content in eight out of the nine species examined, with statistically significant reductions observed in *Bistorta vivipara* (p<0.05) and *Equisetum arv*ense (p<0.05). The effects of warming on specific leaf area varied across species, with a significant decrease observed in *Cassiope tetragona* (p<0.01). Further, no significant results were found for leaf dry matter content. *Equisetum scirpoides* and *Salix polaris* experienced an increase in abundance (p<0.01) and decrease in abundance (p<0.001) respectively, however displayed no other significant trait plasticity. Our findings align with previous studies, indicating that the effects of warming in the Arctic are complex and dependent on various factors such as species interactions, competitive balance, and habitat suitability. To gain a more comprehensive understanding of how plant communities in the tundra are adapting to a changing climate, it is crucial to gather functional trait data for all species across multiple regions.

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Taxonomic overview of common valerians (*Valeriana officinalis* aggr.) in Sweden: A preliminary study

Daniel Bäck

Supervisor: Åslög Dahl, Biological and Environmental Sciences, GU
Examiner: Bengt Oxelman

Common valerian (*Valeriana officinalis* L.) is a species of flowering plants native to Europe, the roots of which have been used in folk medicine for centuries. But due to high diversity in morphology and chromosome numbers, different populations in *V. officinalis sensu lato* have been variously treated as their own species, resulting in a complex taxon aggregate. A stable taxonomy with clearly delimited species is important for conservation biology since a species cannot be protected unless it has a name. It is also important for research into the evolution of potentially useful traits in groups of related species. Both of these positives are relevant in the case of plants in the *V. officinali*s aggregate due to their potential for plant-derived medicines. In Sweden, plants in the aggregate are classified into two species (*V. officinalis*

sensu stricto, and *Valeriana sambucifolia* J. C. Mikan), with the latter being further split into two subspecies (subsp*. sambucifolia*, and subsp*. salina*). To test this hypothesis, we have performed a preliminary study using collected specimens stored in Herbarium GB. Due to constraints in time and resources no specimens from other herbaria were used, and only quantifiable morphological data was considered. Given that previous taxonomic research had focused on leaf morphology, this became the primary focus. This data was analyzed using the PCA method to summarize the variance amongst examined specimens. In addition, the localities in which the specimens had been collected were used to generate a distribution map for geographic and ecological data. Whilst the limited scope of the study makes the results inconclusive, we found evidence indicating that a taxon considered synonymous to *V. officinalis sensu stricto* (*Valeriana baltica* Pleijel) might represent a distinct species. Further research is needed and would require data from a larger number of specimens as well a molecular data.

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Phylogeny and evolution of flower symmetry of *Posoqueria* (Rubiaceae)

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The genus *Posoqueria* is a Neotropical group of shrubs and trees in the coffee family Rubiaceae, which is phylogenetically poorly understood and presents several internal taxonomical difficulties. Previous molecular studies using limited loci and taxa suggest the species in *Posoqueria* could be split in two monophyletic groups based on the presence and absence of a unique specialized pollination system known as the Pollen Catapult Mechanism (PCM), which would imply the resurrection of the genus *Stannia*. Here, I used samples from 15 species and a high-throughput sequencing strategy to target-capture 353 nuclear loci, from which 177 genes were chosen to generate a phylogeny of *Posoqueria* using the multispecies coalescent (MSC) method. The study confirms the monophyly of most *Posoqueria* taxa, provides evidence of the phylogenomic distinctiveness of species such as *P. mutisii, P. longiflora, P. maxima, P. grandiflora,* and *P. williamsii,* and questions the current circumscription of *P. chocoana* and *P. costaricensis.* Particularly, the phylogeny supports the re-circumscription of *P. latifolia*, suggesting that populations from Central America and Colombia belong to an undescribed species in the genus. This phylogenomic study indicates that flower symmetry and the unique catapult mechanism linked to zygomorphic flowers in *Posoqueria* is the product of several evolutionary transitions and is therefore non-monophyletic. These results challenge the hypothesis that this trait played a significant role in the diversification of the genus and put an end to a long-standing debate about the taxonomy of *Posoqueria* and its synonym *Stannia*, dating back to the 1850s, by showing that resurrecting *Stannia* as a valid taxon is not justified. However, some phylogenetic relationships were recovered with moderate to weak support, requiring further investigation that could include designing a customized target-capture bait panel that allows to resolve recent diversification events in *Posoqueria.*

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