GOETHE UNIVERSITÄT FRANKFURT AM MAIN

SENCKENBERG world of biodiversity

AK BIOGEOGRAPHIE 2019

9 – 10 MAY, Frankfurt am Main

Book of Abstracts

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CONFERENCE PROGRAM

Thursday May 9th - all talks/keynotes will be held in the SBiK-F lecture hall

Start	End	Speaker	Institution	Title
08:00	**12:00**	*Workshops*: "Species distribution modelling in R" by Maria Bobrowski (Seminar room Gondwana) & "Introduction to remote sensing for biogeographers" by Hannes Feilhauer (Seminar room Laurasia)		
12:00	**13:00**	*Lunch*		
13:00	**13:10**	*Welcome*		
13:10	**13:30**	Maaike Bader	University of Marburg, Faculty of Geography	Modelling treeline spatial pattern emergence to understand global variation in treeline dynamics
13:30	**13:50**	Maria Bobrowski	Universität Hamburg, Institut für Geographie	Challenges for modelling ecological niches of treeline species in the Himalayas
13:50	**14:10**	Mateus Dantas de Paula	Senckenberg Biodiversity and Climate Research Centre, Frankfurt	Integration of biotic interactions and ecophysiological processes within a dynamic vegetation model: tree hydraulics, trait diversity, seed dispersal and insect herbivory
14:10	**14:30**	David Kienle	Biogeography, University of Bayreuth	Investigating the current and the potential treeline – an remote sensing and modeling approach
14:30	**15:00**	*Coffee break*		
15:00	**15:20**	Alexander Zizka	German Center for Integrative Biodiversity Research (iDiv)	The reliability of species occurrence records from public databases in biogeographic research and conservation assessment
15:20	**15:40**	Pia Eibes	Institute of Physical Geography, Goethe Uni Frankfurt	Lone fighters or team players? How co-occurrence patterns shape the patchy vegetation in arid volcanic environments
15:40	**16:00**	Roland Pape	Department of Geography, University of Bonn	Temperature and soil moisture control microbial community composition in an arctic–alpine ecosystem along elevational and micro-topographic gradients
16:00	**16:20**	Yagya Adhikari	Biogeography, University of Bayreuth	Diversity and composition of vascular epiphytes (orchids and ferns) in two subtropical forests in Nepal
16:20	**16:40**	Adriana Hernández-Rojas	University of Marburg, Faculty of Geography	Distributional patterns of ferns along elevational gradients in the latitudinal context at the transition from tropics to the subtropics.
16:40	**17:40**	*Poster session*		
17:40	**18:40**	*Keynote*: Suzette Flantua	Department of Biological Sciences, University of Bergen, Norway	Long-term perspective on mountain biodiversity, stability, and exceptional research
18:40	**20:00**	*Guided city tour*: Thomas Hickler, Senckenberg Biodiversity and Climate Research Centre, Frankfurt: "Kings, wars and a 10.000-year flood"		
20:00	**open end**	*Conference dinner (Daheim im Lorsbacher Thal)*		

CONFERENCE PROGRAM

Friday May 10th - all talks/keynotes will be held in the SBiK-F lecture hall

Start	End	Speaker	Institution	Title
09:00	**10:00**	*Keynote*: Tobias Kuemmerle	Conservation Biogeography, Humboldt University Berlin	The Geography of Threats to Biodiversity
10:00	**10:30**			*Coffee break*
10:30	**10:50**	Renske Onstein	German Center for Integrative Biodiversity Research (iDiv)	Fruit colour determines the broad-scale distribution and diversity of colour vision in frugivorous primates
10:50	**11:20**	Dagmar Hanz	Institute of Physical Geography, Goethe Uni Frankfurt	Functional diversity of the flora of the Canary Islands
11:20	**11:40**	Dikko Gafna	Karlsruhe Institute of Technology, Germany	Medicinal plant assemblages and their capacity to supply medicinal services in Samburu, Kenya
11:40	**12:00**	Rafaella Canessa	University of Marburg, Faculty of Geography	Climatic and plant functional-trait effects on litter decomposition in the Chilean Coastal Cordillera
12:00	**12:20**	Mirjam Pfeiffer	Senckenberg Biodiversity and Climate Research Centre, Frankfurt	Plant traits, functional diversity, and vegetation patterns – how trait-based dynamic vegetation modeling can contribute to questions in biogeography
12:20	**14:00**			*Lunch*
14:00	**14:20**	Samuel Hoffmann	Biogeography, University of Bayreuth	Climate change impact inside terrestrial protected areas across the globe
14:20	**14:40**	Stefan Hohnwald	Pedology, Geobotany and Nature Conservation, HAWK, Göttingen	Biogeographic Lessons from Romanian Beech-Oak Forest Ecotones for the Future of German Forests– The NEMKLIM Project
14:40	**15:00**	Bernd Berauer	Department of Disturbance Ecology, University of Bayreuth	How to adapt land-use regimes of montane grasslands with ongoing climate change
15:00	**15:20**	Paul Lyam	Leipzig University	Palaeodistribution and range dynamics of Africa's *Senegalia senegal* (L.) Britton from the Quarternary into the present
15:20	**15:40**	Nishtha Prakash	Institute of Physical Geography, Goethe Uni Frankfurt	Lost in Transformation: Forest Mammals and their Changing Habitats
15:40	**15:50**			*Goodbye*

HOW TO GET THERE

Venue location:

Senckenberg Biodiversity and Climate Research Centre (SBiK-F); Georg-Voigt-Straße 14, 60325 Frankfurt am Main, Germany

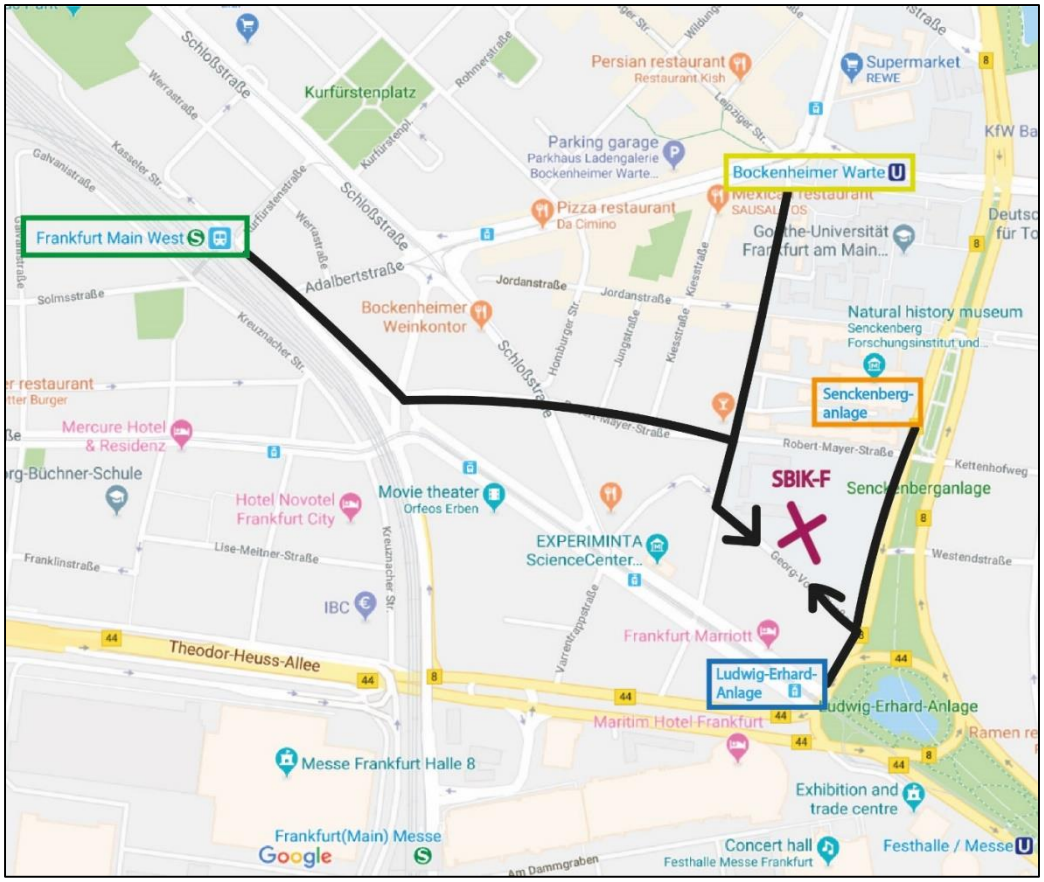
By public transport

- **S-Bahn:**
  S3, S4, S5 and S6 – Station "Westbahnhof" (twelve minutes walking distance)
- **U-Bahn:**
  U4, U6 and U7 – Station "Bockenheimer Warte" (seven minutes walking distance)
- **Bus:**
  Line 75 – Station "Senckenbergmuseum" (five minutes walking distance)
- **Tram:**
  Line 16 and 17 – Station "Ludwig-Erhard-Anlage" (four minutes walking distance)

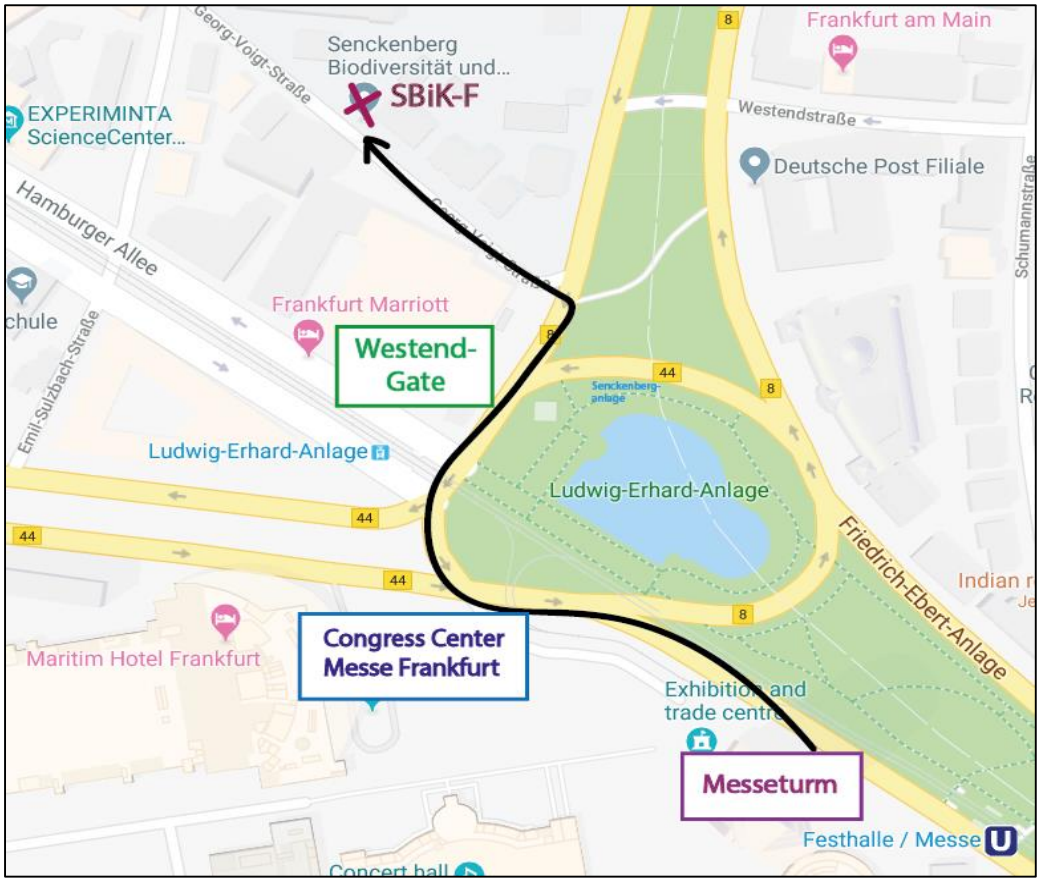
By car

- **From south to east**
  Drive over the Frankfurter interchange to the western interchange ("Westkreuz-Frankfurt"), then go on to the A 648 (direction "Stadtmitte" – B8/44) up to the trade fair ("Messe"), go into the roundabout and turn left (direction "Ginnheim / Eschersheim" – B8/40).
  Make a U-turn after about 600 meters in front of the Senckenbergmuseum, pass the museum and turn into the second street to your right ("Georg-Voigt-Straße").
- **From north to west**
  Drive over the northwest interchange Frankfurt ("Nordwestkreuz") on the A 66 (direction "F-Miquelallee / Stadtmitte"), before the freeway stops go right (direction "Hauptbahnhof / Messe" – B8/40), and follow the major road ("Zeppelinallee").
  Pass the Senckenbergmuseum and turn into the second street to your right ("Georg-Voigt-Straße").
- **Parking**
  Please be aware that there are no exclusive parking spots available!
  You can park nearby in public parking spots (you have to pay):
  - Car park **"Congress Center Messe Frankfurt"** (Maritim Hotel); Theodor-Heuss-Allee 3-5; open 24 hours
  - Car park **"Messeturm"**; Friedrich-Ebert-Anlage 49; open 24 hours
  - Underground car park **„WestendGate"**; Hamburger Allee 2; open 24 hours
  - In front of the western entrance of the building (No. 16) there are two handicapped parking spots available.

Map of public transport:



Map of car parks:



GUIDED CITY TOUR AND CONFERENCE DINNER

On the way to dinner Thomas Hickler will guide us through Frankfurt, all the way from Bockenheim to Sachsenhausen. He will spoil us with historical facts and utter fascination about "Kings, Wars and a 10.000-year flood".

➔ **Thursday, May 9th, 6.40 pm – 7.40 pm guided city tour from Bockenheim to Sachsenhausen**

The conference dinner is taking place in the Frankfurter-Apfelwein-Wirtschaft "Daheim im Lorsbacher Thal" in Sachsenhausen. This restaurant is one with tradition as it opened in 1803 and is still owned by the founding family. This restaurant offers typical Frankfurter food and you will probably find dishes like "Grie' Soß", "Ahle Worscht", "Handkäs" or "Schneegestöber" on the menu. You might also like to try a "Schoppe" of the famous Apfelwein here, as this locality offers the (probably) largest Apfelwein menu in the world, with over 250 choices!
Of course vegetarian options will be available. Prices range from 5-29 € for food.

➔ **Thursday, May 9th, 7.45 pm – open end in "Daheim im Lorsbacher Thal"**

Conference dinner location:
Daheim im Lorsbacher Thal
Große Rittergasse 49
60594 Frankfurt am Main
https://www.lorsbacher-thal.de/

LUNCH OPTIONS

Low price range

- Cafeteria Bockenheim V
  (Bockenheimer Landstraße 133, 60325 Frankfurt am Main)
  Offers different dishes and sides every day for a low price. If the weather is nice you can sit outside in the garden and enjoy your food. It is a Mensa, though: https://www.studentenwerkfrankfurt.de/essen-trinken/speiseplaene/cafeteria-bockenheim/
- Da Ciminio
  (Adalbertstraße 29, 60486 Frankfurt am Main)
  Supposedly the best Pizza in town, what do you think?
- Cinellis (H)Eis & More
  (Kiosk am Kreisel, Grüneburgweg 102, 60486 Frankfurt am Main)
  Ice Cream Rolls, Breakfasts and Snacks, a trendy kiosk close to the wonderful Grüneburgpark!

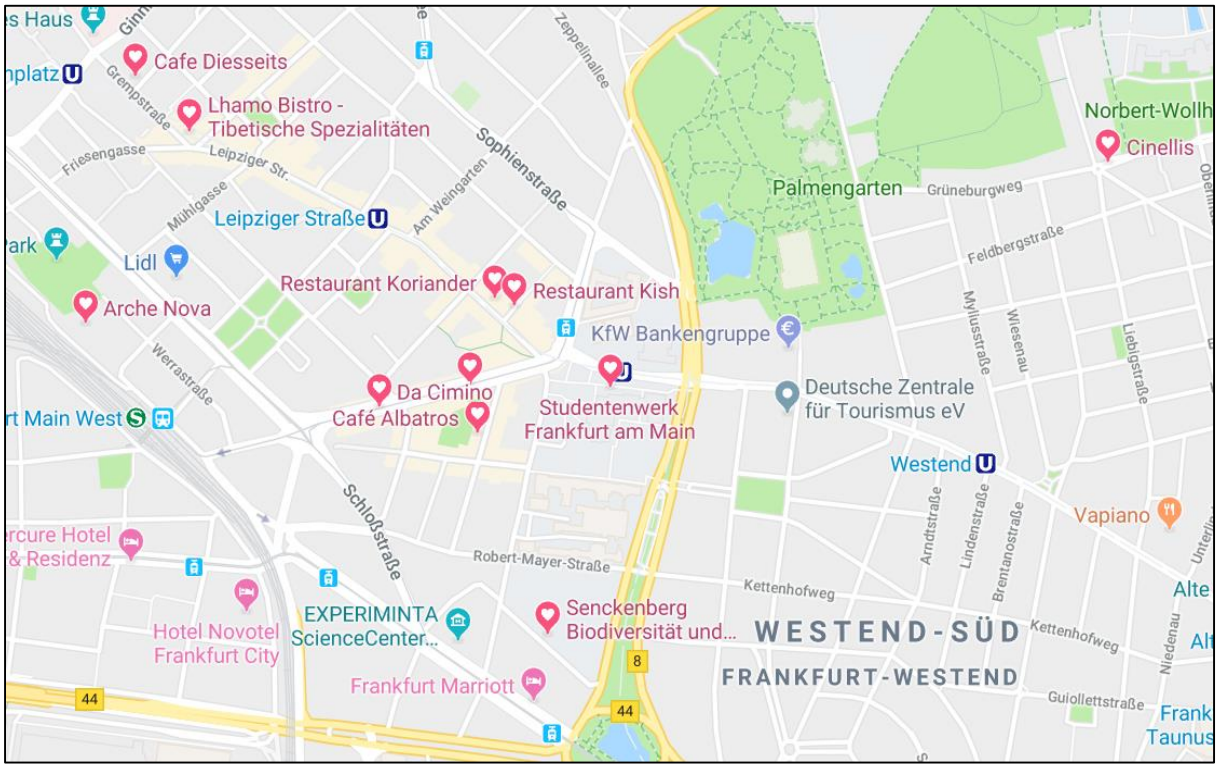
Medium price range

- Senckenberg Bistro
  (Senckenberganlage 25, 60325 Frankfurt am Main)
  Café of the Senckenberg museum, with outdoor area
- Restaurant Indian Flavours
  (Robert-Mayer-Straße 17, 60486 Frankfurt am Main)
  Indian restaurant with special lunch offers
- Frankfurt and Friends V
  (Jordanstraße 1, 60486 Frankfurt am Main)
  Restaurant with Pasta, Burger, typical Frankfurter food, Vegan Dishes, Salads and more…
- Café Albatros
  (Kiesstraße 27, 60486 Frankfurt am Main)
  A well-loved Café with a beautiful garden offering typical Frankfurter food and other snacks.
- Koriander
  (Leipziger Str. 20A, 60487 Frankfurt am Main)
  A typical Italian place with excellent Salads, Pasta, Pizza and several meat choices: https://www.koriander-ffm.de/
- Kish V
  (Leipziger Str. 16A, 60487 Frankfurt am Main)
  If you fancy lovely Persian food Kish is the place to go! They offer a lunch buffet and in the end you decide what you want to pay for it. They usually offer plenty of vegan options during lunch: http://www.kish-restaurant.de/
- Lhamo
  (Grempstraße 2, 60487 Frankfurt am Main)
  This restaurant offers excellent Tibetan food (try the Momos!). It is a little further down in Bockenheim, but definitely worth the walk!
- Arche Nova V
  (Kasseler Str. 1, 60486 Frankfurt am Main)
  Arche Nova specializes in vegetarian and vegan dishes and has a weekly changing lunch menu: http://archenova.de

- gramm.genau V
  (Adalbertstraße 11, 60486 Frankfurt am Main)
  gramm.genau is a small and lovely zero-waste café and shop with (mostly sweet) snacks and cakes: https://www.grammgenau.de
- Café Diesseits
  (Konrad-Broßwitz-Straße 1, 60486 Frankfurt am Main)
  This Mediterranean bar and café offers various menus (e.g. huge and fresh salads): http://www.cafe-diesseits-ffm.de

All of the restaurants are vegetarian friendly. Restaurants that offer vegan options are marked with a V.

See a list of where to find these places here: https://goo.gl/maps/RA3Q8A4Aw3UNP2aU8



WORKSHOPS

WORKSHOP 1: **SPECIES DISTRIBUTION MODELLING IN R**

BY: **Dr. Maria Bobrowski**

Institution: **University of Hamburg**
Biodiversity and Landscape Ecology

Research focus: **Animal Ecology**
Vegetation Ecology
Biogeography
Habitatmodeling

➔ **Thursday, May 9th, 8.00-12.00 am in seminar room „Gondwana“**

WORKSHOP 2: **INTRODUCTION TO REMOTE SENSING FOR BIOGEOGRAPHERS**

BY: **Prof. Dr. Hannes Feilhauer**

Institution: **University of Berlin (FU)**
Remote Sensing and Geoinformatics

Research focus: **Remote Sensing**
Geoinformatics & Spatial Analysis
Biogeography
Conservation Ecology

➔ **Thursday, May 9th, 8.00-12.00 am in seminar room “Laurasia”**

KEYNOTES

KEYNOTE 1: **LONG-TERM PERSPECTIVE ON MOUNTAIN BIODIVERSITY, STABILITY, AND EXCEPTIONAL RESEARCH**

BY: **Dr. Suzette Flantua**

Institution: **University of Bergen (Norway)**
Department of Biological Sciences

Research focus: **Biodiversity and Biogeography**
Climate Change
Mountain Belts
Vegetation Ecology

➔ **Thursday, May 9th, 17.40 - 18.40 pm in the SBiK-F lecture hall**

KEYNOTE 2: **THE GEOGRAPHY OF THREATS TO BIODIVERSITY**

BY: **Prof. Dr. Tobias Kuemmerle**

Institution: **Humboldt University Berlin**
Conservation Biogeography

Research focus: **Biodiversity**
Sustainability
Environmental Impact Assessment
Conservation Biogeography

➔ **Friday, May 10th, 09.00 – 10.00 am in the SBiK-F lecture hall**

ORAL PRESENTATIONS

Modelling treeline spatial pattern emergence to understand global variation in treeline dynamics

Maaike Y. Bader[1], Hannah L. Buckley[2], Bradley S. Case[2]

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Keywords: alpine treeline ecotone, climate change, pattern-based modelling

Abstract

Alpine treeline ecotones are transition zones occurring globally and showing a wide variety of spatial patterns and dynamics. Although treeline position can be predicted very well at the global scale based on temperature and growing-season length, the more local variation in position and spatial pattern are harder to predict. We hypothesise that spatial patterns indicate controlling processes and hence can help to predict climate-change responses. We therefore aim to understand these pattern-process relationships by modelling tree population dynamics at treeline in an individual-based spatial model. The goal of this model is to recreate essential dimensions of spatial patterns at alpine treelines around the world, thus exploring the processes and parameter values that determine these different patterns. As the model is not yet fully implemented, we will present the conceptual model and are open for discussions. The implementation aims at creating a versatile tool to study local treeline processes, to understand global patterns in treeline functioning, and to predict treeline shifts as a result of climatic changes.

Challenges for modelling ecological niches of treeline species in the Himalayas

Maria Bobrowski[1]

[1] *Institute of Geography, CEN, University of Hamburg*

Contact details: maria.bobrowski@uni-hamburg.de

Keywords: *Betula utilis*, ecological niche models, Himalaya, modelling challenges, treeline

Abstract

In the course of climate change, it is postulated that treelines may shift to higher elevations. To quantify potential shifts, the analysis of the underlying factors and precise modelling of the treeline ecotone under current climatic conditions are of great importance. These models serve as a baseline for models, that project the distribution under future climatic conditions.

Modelling ecological niches across vast distribution ranges in remote, high mountain regions like the Himalayas remains a challenging task. Challenges include, first and foremost, large-scale sampling of species occurrences and acquisition of sufficient high quality, fine scale environmental parameters.

In many studies, the investigation and evaluation of input parameters are neglected. Often, standardised statistically derived parameters do not fully reflect the species' physiological needs and habitat requirements, and therefore lead to poor modelling results. However, abiotic and biotic data derived from remote sensing may open up new opportunities for analysing and modelling species' distributions, since they provide response and predictor variables.

The results of this study provide a comprehensive analysis of the underlying environmental factors (climatic patterns, topography and phenological traits) determining the ecological niche of *Betula utilis* in the Himalayan region under current climate conditions.

Integration of biotic interactions and ecophysiological processes within a dynamic vegetation model: tree hydraulics, trait diversity, seed dispersal and insect herbivory

Mateus Dantas de Paula[1], Thomas Hickler[1]

[1] *Senckenberg Biodiversity and Climate Research Centre (SBiK-F)*

Contact details: mateus.dantas@senckenberg.de

Abstract

Dynamic vegetation models (DVMs) are important tools to improve our understanding of the feedbacks from ecosystems on climate, in particular via changes in carbon and water cycling. DVMs often include detailed representations of biodiversity and vegetation dynamics, and new developments have recently made it possible to account for trait variability, and biotic interactions in these models.

The Sub Project (SP) A4 from the RESPECT project which we are conducting aims at integrating results from field measurements on plant functional traits (and their variability), carbon and water fluxes, and biotic interactions, such as seed predation and herbivory, carried out by other SPs with a DVM (the Lund-Potsdam-Jena General Ecosystem Simulator, LPJ-GUESS). Within the general modelling framework of the RU, LPJ-GUESS will also be coupled with an atmospheric model (SP A1) and a hydrological model (SP A2). Thus, the DVM developed and tested here (LPJ-GUESS) will serve as the biological component, LSMBio, and this new combined modelling framework will feature a unique combination of state-of-the-art representations of ecological, biogeochemical, biophysical, micro- meteorological and hydrological processes.

The integrated model will then be used to assess the resilience of mountain rainforests to climate change and feedbacks from ecosystem changes on the regional climate system. We present here our general approach for developing the LSMbio from the LPJ-GUESS, and present the results of our first test simulations of the Ecuadorian forest trait variability implementation, by including data from previous studies.

Investigating the current and the potential treeline – a remote sensing and modeling approach

David Kienle[1], Frank Weiser[1], Mirela Beloiu[1], Severin D.H. Irl[2], Bernadette Menzinger[1], Ole R. Vetaas[3], Carl Beierkuhnlein[1,4]

[1] Biogeography, Bayreuth Center of Ecology and Environmental Research BayCEER, University of Bayreuth; *[2] Biogeography and Biodiversity Lab, Institute of Physical Geography, Goethe University Frankfurt*; *[3] Department of Geography, University of Bergen*; *[4] Bayreuth Institute of Geography GIB, University of Bayreuth*

Contact details: david.kienle@uni-bayreuth.de

Keywords: treeline, global warming, national park, mountain ecology, remote sensing

Abstract

Treelines are a long-time field of research in biogeography and ecology. Several studies analyze treeline elevation, shape and drivers in several local and global studies. Treelines seem to be highly sensitive to climate change; however, the actual treeline respond to environmental changes is not that clear. The treeline either could shift upward because of an increased temperature resulting in an upward shift of the minimum growth temperature. Alternatively, the treeline remains or shift even downwards because the small-patched heterogeneous environment in high elevations becomes more extreme and heterogeneous which hampers tree growth furthermore. Furthermore, a respond of the treeline elevation to climate change might has a delay because dispersal limitations. An upward shift of the treeline decreases the area of the alpine zone above with its highly adapted plants and insects above dramatically. Consequently, an inventory of the potential treeline is necessary to assess future conversation policies for the alpine zone in critical areas. We analyzed the current realized treeline by using Copernicus tree cover data and the potential current and future treeline elevation deviated from the Chelsa climate model. We applied our work on several protected mountainous areas of the European research network ECOPOTENTIAL.

The reliability of species occurrence records from public databases in biogeographic research and conservation assessment

Alexander Zizka[1]

[1]*German Center for Integrative Biodiversity Research*

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Keywords: Bromeliads (Bromeliaceae), GBIF, IUCN Red lists, Orchids (Orchidaceae)

Abstract

Understanding the geographic distribution of species, arguably to facilitate their conservation, is the core of biogeography. However, necessary occurrence information for many taxonomic groups is still scarce across large parts of the world, especially in the Tropics. This lack of knowledge severely hampers biodiversity research and conservation. Digitized collection specimens and citizen science data increasingly available from public databases might help to overcome this issue, but the quality of this data is often unclear. Here, I present the results of case studies from various plant families, including Orchidaceae, and Rubiaceae applying novel bioinformatics tools for automated data cleaning and conservation assessment. The results suggest that automated data cleaning can identify major problems in the geographic accuracy of species occurrences from public databases and significantly speed up the curation of such data to improve the reliability of downstream analyses. Automated conservation assessments, based exclusively on geographic occurrence records can identify threatened species with an accuracy of around 80% and hence are a valuable tool to prioritize conservation strategies.

Lone fighters or team players? How co-occurrence patterns shape the patchy vegetation in arid volcanic environments

Eibes, Pia[1]; Chiarucci, Alessandro[2]; Eisenbacher, Judith[3]; Field, Richard[4]; Irl, Severin[1]; Köhler, Tina[3]; Vetaas, Ole[5]; Beierkuhnlein, Carl[3]

[1] Institute of Physical Geography, Goethe University Frankfurt; [2] Department of Biological, Geological and Environmental Sciences, University of Bologna; [3] Department of Biogeography, University of Bayreuth; [4] School of Geography, University of Nottingham; [5]Department of Geography, University of Bergen

Contact details: eibes@geo.uni-frankfurt.de

Keywords: facilitation, oceanic island, plant-plant interactions, stress-gradient-hypothesis, volcanic substrate

Abstract

Biotic interactions are suggested as one of the main drivers of patchy vegetation at semi-arid environments. The role of positive interactions between species (often referred to as *facilitation*) is even expected to increase with harshness and might thus have apparent impact on species composition of vegetation patches with harshness. However, differentiating facilitative interactions from further underlying mechanisms is a non-trivial task. In this study we analyzed the co-occurrence relationships of vascular plant species that form a patchy vegetation in arid lapilli fields (tephra) from recent volcanic eruptions on La Palma, Canary Islands, considering respective microsite particularities. Assuming a harshness gradient negatively correlated with elevation because aridity is high at low elevations, we expected pronounced co-occurrence (indicating positive biotic interactions) within patches close to the coast in contrast to more benign sites at higher elevations. Of the analyzed 1280 shrubby vegetation patches at 64 elevational sampling points (0 – 700 m.a.s.l.), 400 patches consisted of more than one species. Despite our expectations, we did not find the presumed harshness gradient towards coastal sites. This might rather highlight the homogeneity of the environmental conditions on dry lapilli fields on La Palma, even over long distances, than reject the predictions of the stress-gradient hypothesis.

Temperature and soil moisture control microbial community composition in an arctic–alpine ecosystem along elevational and micro-topographic gradients

Frindte, K.[1], Pape, R.[2], Werner, K.[3] Löffler, J.[2] & C. Knief[1]

[1] Institute of Crop Science and Resource Conservation (INRES), University of Bonn; [2] Department of Geography, University of Bonn; [3] Beuth University of Applied Sciences

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Keywords: microbial diversity, biogeographic patterns, environmental controls

Abstract

Microbial communities in arctic–alpine soils show biogeographic patterns related to elevation, but the effect of fine-scale heterogeneity and possibly related temperature and soil moisture regimes remains unclear. We collected soil samples from different micro-topographic positions and elevational levels in two mountain regions of the Scandes, Central Norway. Microbial community composition was characterized by 16S rRNA gene amplicon sequencing and was dependent on micro-topography and elevation. Underlying environmental drivers were identified by integration of microbial community data with a comprehensive set of site-specific long-term recorded temperature and soil moisture data. Partial least square regression analysis allowed the description of ecological response patterns and the identification of the important environmental drivers for each taxonomic group. This demonstrated for the first time that taxa responding to elevation were indeed most strongly defined by temperature, rather than by other environmental factors. Micro-topography affected taxa were primarily controlled by temperature and soil moisture. In general, 5-year datasets had higher explanatory power than 1-year datasets, indicating that the microbial community composition is dependent on long-term developments of near-ground temperature and soil moisture regimes and possesses a certain resilience, which is in agreement with an often observed delayed response in global warming studies in arctic–alpine regions.

Diversity and composition of vascular epiphytes (orchids and ferns) in two subtropical forests in Nepal

Yagya Adhikari[1,2], [2]Anke Jentsch, [1]Carl Beierkuhnlein

[1] Chair of Biogeography, BayCEER, University of Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany; [2] Disturbance Ecology, BayCEER, University of Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany

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Keywords: environmental factors; vascular epiphytes; large trees; Indicator species; multivariate and univariate analyses

Abstract

Vascular epiphytes (orchids and ferns) are an important part of biological diversity in the canopy of tropical and subtropical forest ecosystems. It is therefore essential to understand their distribution pattern and related processes. Here, we scrutinize patterns of species richness, abundances and species composition of epiphytic orchids and ferns in two subtropical forests in Nepal. We also study the relationship between dominant host plants (e.g. *Schima wallichii* and *Quercus lanata*) and epiphytes. Data were collected in community forest (CF) and national forest (NF) in Shivapuri Nagarjun National Park close to Kathmandu. Orchid species abundance is found to be significantly higher in CF compared to NF hinting at an influence of management. Orchid species richness and abundance increased with increasing southern aspect whereas it decreased with increasing canopy cover. Fern species richness increased with host bark roughness. Orchid abundance was positively correlated with bark pH-values, stem size, tree age and tree height and negatively correlated with increasing steepness of the site. Likewise, fern abundances were high in places with high canopy cover, trees that were tall and big, but decreased with increasing altitude and southern aspect. The composition of the orchid and fern species was affected by biotic variables and forest management types. The most important pre-requisite for a high epiphyte biodiversity is the presence of old tall trees, independent of the recent protection status.

Distributional patterns of ferns along elevational gradients in the latitudinal context at the transition from tropics to the subtropics

Hernández-Rojas Adriana[1], Kluge Jürgen[1], Miehe Georg[1], Krömer Thorsten[2], Carvajal-Hernández Cesar[2], Silva Mijangos Libertad[2] & Kessler Michael[3]

[1] Biogeographie und Hochgebirgsforschung, Philipps Marburg Universität; [2] IBB & CITRO, Universidad Veracruzana, Mexico; [3]Institut für Systematische und Evolutionäre Botanik, Universität Zürich

Contact details: adric.rojas@gmail.com

Keywords: Rapoport's rule, range size, endemism, climate, seasonality

Abstract

The latitudinal gradient in species richness is paralleled by the Rapoport's rule that hypothesizes that the latitudinal range of species distributions is greater at higher latitudes or that tropical species tend to have smaller ranges allowing more species to coexist in tropical versus temperate regions. A prediction of this rule is that organisms from low latitudes have narrower tolerances for stressful climatic conditions than do high-latitude species. Along elevational gradients, it should thus be assumed that with increasing elevation climatic conditions become unfavorable like along latitude towards the poles, and species ranges therefore also become wider. However, evidence shows that towards high elevations species tend to show narrower ranges and endemic species agglomerate at mountain tops. To prove these hypotheses in ferns we analyzed their distributional patterns using the spatial range sizes along eight elevational gradients, located at different latitudes inside of the Mexican transition zone. We asked, whether spatial ranges of species assemblages vary with latitude and elevation and related these changes to climatic conditions. We found that range sizes increase with latitude and decreases with elevation and that low climatic variability promotes endemism, namely constant humidity represented by a constant cloud cover and less seasonality of both, precipitation and temperature.

Fruit colour determines the broad-scale distribution and diversity of colour vision in frugivorous primates

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Keywords: Coevolution, macroecology, macroevolution, plant-frugivore interaction, structural equation model

Abstract

A long-standing paradigm in ecology and evolution states that trichromatic colour vision (i.e. the ability to distinguish green from red) in frugivorous primates evolved as an adaptation to detect conspicuous (i.e. reddish) fruits. Here, we test this hypothesis by combining global phylogenetic, distribution and colour vision data for >400 primate species with fruit colour data for >1700 palm and >85 fig species, i.e. keystone resources for tropical frugivores. Our macro-evolutionary analyses indicate rapid and synchronous radiations of African trichromats and their conspicuous food plants from 10 Million years ago. Furthermore, structural equation models show that species richness of trichromats increases with the availability of palm and fig species that have conspicuous fruits, especially in the African subtropics. Our results suggest that the Late Cenozoic loss of African rainforests and the concurrent increase in seasonal climates may have triggered the co-diversification of frugivorous trichromatic primates and their conspicuous food plants.

Functional diversity of the flora of the Canary Islands

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Keywords: biogeography, Canary Islands, endemism, functional traits, plant functional diversity

Abstract

Plant traits that determine under which environmental conditions plants can survive and reproduce have gained increasing interest in biogeography. However, research on functional traits of island floras has been underrepresented so far. In this study, we measured the functional differences between all endemic and non-endemic spermatophytes of the Canary Islands (n = 2197) in order to identify how environment drives species' distributional patterns. Therefore, we collected data on functional morphological traits associated with resource allocation and dispersal ability. Subsequently, we calculated different measures of functional diversity and analysed the resulting patterns across climatically and topographically-determined zones. Overall, we found that endemic plant species were functionally less diverse and had less extreme trait values than non-endemic plant species. Interestingly, we show that there are only few trait combinations that are exclusively associated with endemism and that many trait characteristics are redundant across endemic and non-endemic plant species. All in all, our results indicate that most endemic species are not functionally unique and are able to occupy a broad environmental niche. We conclude that the adaptation of plant species to isolated island environments yields species with a similar set of functional traits suitable for the occurrence across diverse environmental conditions.

Medicinal plant assemblages and their capacity to supply medicinal services in Samburu, Kenya

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Keywords: Samburu, Kenya, medicinal plant assemblage, supply redundancy, classification, ordination.

Abstract

Pertinent management of medicinal plants (MPs) depends on knowledge of medicinal plant assemblages (MPAs) so that informed choices can be made concerning their conservation. We evaluated the relationship between environmental conditions and medicinal supply provision (MSP) with regard to individual diseases among MPAs. Data was collected from Samburu County, Kenya. Classification and ordination analysis of our vegetation data identified the MPAs and the most significant environmental factors responsible for MSP. The N + 1 redundancy concept was used to analyze the supply redundancy (SR) of the MPAs. We identified four MPAs characterized by the presence and frequency of plants pertaining to different growth forms forming different formations: Bushed grassland, forest, wooded grassland and savanna. The statistically significant natural characteristics associated with MSP among the MPAs were temperature, slope and soil moisture. Grazing pressure was the statistically significant anthropogenic factor. The forest MPA had the highest SR, while the wooded grassland MPA had the lowest SR. Temperature, grazing pressure and aspect negatively influenced MPs supply redundancy while slope, moisture and precipitation positively influenced the MPs supply redundancy. We suggest that the locals should be urged to reduce the number of livestock since grazing pressure had a negative impact on MPs SR.

Climatic and plant functional-trait effects on litter decomposition in the Chilean Coastal Cordillera

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Keywords: climate gradient, functional traits, litterbag, mass loss

Abstract

Vegetation and climate have important effects on decomposition, an important ecosystem process related to the carbon cycle. On the one hand, plant functional traits determine soil carbon inputs through litter quality and quantity. On the other hand, these traits depend on climatic conditions, which in turn directly influence decomposer community composition and activity. To understand the triangular relationship between climate, plant traits and litter decomposition, we developed a reciprocal litter transplant experiment and studied litter decomposition for two years along the Chilean Coastal Cordillera (26° to 38°S). We determined the functional composition of dominant species in six vegetation communities (from the arid desert to temperate forests) and evaluated litter decomposition through time for 30 species. Our results show that decomposition rates of all species increase from north to south, as expected considering the increase of precipitation and moisture. However, our results suggest that the effects of climate and functional traits for decomposition are non-linear and their relative importance varies through time. We will show the relationship between different plant functional traits and decomposition, as well as functional traits and climate interactions affecting the decomposition process.

Plant traits, functional diversity, and vegetation patterns – how trait-based dynamic vegetation modeling can contribute to questions in biogeography

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Keywords: plant traits, aDGVM2, dynamic vegetation modeling, environmental filtering, biome shifts

Abstract

Plant traits shape vegetation patterns and ecosystem functions on a global scale. They determine plant community assembly, adaptation to environmental conditions, and success in plant competition. Nonetheless, most global-scale dynamic vegetation models do not account for plant trait variability. With aDGVM and aDGVM2, we simulate plants as individuals characterized by unique combinations of trait values that determine plant performance, survival, and community assembly. Environmental filtering eliminates non-viable trait combinations while fostering those that provide fitness benefits. Implemented trait trade-offs ensure avoidance of Darwinian demons. Emerging successful trait combinations are passed on to offspring and may be altered through mutation and crossover. This approach allows simulated plant communities to react and adapt dynamically to changes in environmental forcing. Model applications allow addressing a wide range of scientific questions regarding vegetation dynamics, biogeographic patterns, and changes in ecosystem function. We show that i) southern Africa will experience critical biome shifts under future climate change; ii) fire and soil depth explain savanna-forest boundaries in Amazonia; iii) grazing and aridity determine grass-layer composition in agreement with observations; iv) biomes in South Asia occupy distinct regions in the trait space; v) shrub distribution in Africa is linked to fire and water availability. Model results can be used to inform, e.g., conservation management with regard to mitigation and adaptation strategies under future environmental change.

Climate change impact inside terrestrial protected areas across the globe

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Keywords: climate dissimilarity, climate impact, climate vulnerability, biodiversity conservation, protected areas

Abstract

Facing a sixth human-induced mass extinction, the enduring success of protected areas (PAs) for biodiversity conservation is questioned because their static shape conflicts with the dynamic redistribution of biodiversity under climate change. By analysing future climate change inside the entire terrestrial PA on Earth at the finest spatial resolution, we show that climate dissimilarity between present and 2070 is highest inside PAs of the (sub-)tropical biomes and high northern latitudes. Furthermore, high northern ecoregions are more exposed to climate change than (sub-)tropical ecoregions. Globally, PAs indicating severe climatic changes are also biologically unique, but may buffer climate impact as they tend to contain high environmental heterogeneity and low human footprints. That is different inside individual biomes. Identifying climate impact on PAs worldwide is essential to reach global conservation targets.

Biogeographic Lessons from Romanian Beech-Oak Forest Ecotones for the Future of German Forests– The NEMKLIM Project

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Keywords: climate change, Western Carpathians, drought events, dendrochronology, species competition

Abstract

The extreme dry and warm summer 2018 in Germany made it evident for biogeographers, but actually also for the public, what consequences climate change might bring on our environment in the decades to come. So, questions arise such as how Central European mixed beech forests will react to these ecological shifts? Will other tree species alongside beech play a more important role? How will species composition react to the forecasted 2 degrees warmer climate? Such questions are topping the list in forestry and other ecological disciplines. Fortunately, there are already existing mixed beech forests in Central Europe that are exposed to such a warmer climate, for instance, in the western Romanian mountains. Therefore, NEMKLIM investigates these beech-oak forest ecotones in the western Carpathians to derive ecological information and its applicability for the benefit of German forests. In particular, NEMKLIM studies natural forest habitats and biological diversity, while developing new strategies for the sustainable use of renewable energy at the interface of nature conservation issues. It uses the “space-for-time-approach” and dendrochronology to investigate the ecological adaptation of five oak taxa and beech, interspecific competition, and its related ecosystem services. Recommendations for policy, suggestions to forestry, and research perspectives will be elaborated.

How to adapt land-use regimes of montane grasslands with ongoing climate change

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Keywords: climate change, land-use, experiment, community ecology

Abstract

Pastures and meadows are a typical and characteristic habitat for the European Alps. They provide important economic and ecological value. Besides the economic value as production site for cattle or diary fodder, these ecosystems also provide important ecological services such as ground water protection, soil erosion control and maintenance of biodiversity. The continuous agricultural use of these regions in the past has formed and in the future will preserve these semi-natural ecosystems.

However, these ecosystems are exposed to drastic global changes, especially climate and land-use changes. Annual mean temperature is predicted to rise and this trend is expected to be most severe in high altitudes. Additional, precipitation will decrease in mountain regions especially during the growing season. Besides the change of long-term averages, the intra- and interannual variability will increase. All of these climatic changes pressure montane ecosystems and also stakeholders by high ambiguity of their pastures seasonal economic output.

To ensure high yield quantity as well as quality we need to better understand the interplay between land-use regimes and climate change and their influence on the ecosystem services of montane grasslands. Especially the resistance and resilience of these ecosystems is going to be a key aspect in regard to the projected climatic changes.

Palaeodistribution and range dynamics of Africa's *Senegalia senegal* (L.) Britton from the Quaternary into the present

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Keywords: environmental change, species distribution model, palaeodistribution

Abstract

The geographic range dynamics of *Senegalia senegal* that played out during the Quaternary, leading to its present-day distribution throughout Africa, was previously unknown. We used 822 occurrence records for *S. senegal* to model the geographic distribution based on current environmental conditions in Africa. These distribution models were then hindcasted onto historical climatic conditions of the Quaternary, using three time slices spanning the last 130,000 years before present. In addition, we assessed the variation in environmental space using a principal component analysis (PCA). The hindcasting showed that the geographic extent of *S. senegal* was broader from the LIG to LGM, with a dramatic decline during the mid-Holocene and consequent recovery at terminal Holocene, indicative of a range expansion from mid-Holocene to present distribution. Our PCA results further reveal criptic environmental space differentiation – a key indication of a wide ecological amplitude exhibited by the species. The findings of this study can improve our knowledge of the historical distribution and further assist in predicting future responses to anthropogenic climate change.

Lost in Transformation: Forest Mammals and their Changing Habitats

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Keywords: extinction risk, forest mammals, forest loss, mammalian orders, threatened body mass

Abstract

Intrinsic and extrinsic factors predisposing species to extinction and, therefore, leading to their red-listing by IUCN have been studied at regional as well as global scales. We analysed to what extent the extrinsic factor, habitat improvement or deterioration, that is, forest gain or loss between 1996-2012 correlates with improvement or deterioration, as in, the *change in the Red List Status (RLS),* of forest-dwelling mammalian species. We further examined in which taxonomic orders and body mass categories and in which regions of the world the species' RLS improved or deteriorated. About 75% species experienced an average net forest loss of 2% in their ranges. A statistically non-significant though positive correlation exists between net forest gain/loss and 2,172 species' RLS improvements/deteriorations. The RLS of species with body mass 3-10 kgs deteriorated the most, especially in the wake of forest loss – most of them being primates, with majority residing in the tropical and sub-tropical moist broadleaf forests of South-East Asia. These forests are increasingly being converted to cropland. Big-sized mammals (≥100 kgs) showed most RLS improvement. Whether species improved or deteriorated, most were victims of illegal hunting, which is as grave a risk as habitat destruction and transformation, if not more. Our study suggests that compared to bigger mammals (primarily Cetartiodactyla species), mid-sized mammals (particularly Primates) might be too small for effective conservation monitoring and yet too big to be attractive for hunting, snaring, and pet trade. It also indicates that life histories of mid-sized species might be too slow to produce new offspring to keep their populations stable or increasing, more so in the face of habitat change; and yet too fast to leave them enough time to adapt to habitat destruction and transformation.

Island biogeography of alien species – Considering temporal change

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Keywords: neobiota, propagule pressure, global, source pools

Abstract

Islands constitute an ideal study system due to their distinct boundaries and their huge diversity and distribution. Islands and the number of species living on islands have therefore been under investigation by ecologists since a long time. The classical model of island-biogeography by MacArthur and Wilson predicts a declining rate of introduction of new species. Worldwide, the number of alien species, which represent those species introduced by humans, has increased continuously during the last centuries, with islands being particularly vulnerable to the introduction of alien species. In contrast to the predictions by the MacArthur and Wilson model, the introduction rate of alien species increased distinctly over time. One of the fundamental assumptions of the model, that the species-area relationship and thus the underlying processes driving colonization remain constant in time, does not seemed to hold for alien species. A number of processes shaping the spread and establishment of alien species varied considerably in time. We show that the number of introduced individuals (propagule pressure), the likelihood of establishment and the source pool of candidate species increased continuously during recent decades. Taking this into account the classical MacArthur and Wilson can explain the observed dynamics also for alien species.

POSTER PRESENTATIONS

How the amount of habitat relates to species richness and functional traits in a tropical fragmented landscape?

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Keywords: tropical forests, functional traits, habitat amount hypothesis, landscape ecology

Abstract

As tropical forests continue to be cleared, forest remnants are increasingly isolated within agricultural and urban landscapes. Understanding how forest cover impacts on species and functional diversity is essential to identify the minimum amount of habitat required for biodiversity maintenance in human-modified landscapes. The habitat amount hypothesis (HA) establishes that “patch size” and “isolation” can be replaced by a single predictor variable: the amount of habitat found in a local landscape; and that the amount of habitat is the main driver of species distribution in patchy systems. Few tests of the HA have been done, in particular for tree species in tropical forests. In this study, we investigated how the amount of habitat is related to tree species richness and community-weighted mean (CWM) traits, considering two important traits associated with tree growth rate and light capture - wood density and maximum adult stature - in a highly fragmented landscape in the Brazilian Atlantic Forest. Specie richness, CWM for wood density and maximum adult stature were not predicted by the amount of habit. Across the forests small fragments had similar species richness to medium and large size fragments, highlighting that other factors need to be accounted in order to understand the drivers of species and functional diversity in these landscapes.

A global assessment of the genus *Pinus* L. traits

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Keywords: functional traits, fire resistance, interspecific variability, *Pinus*

Abstract

34% of the world conifers are threatened on The IUCN Red List. With a high species diversity, the genus *Pinus* L. is distributed in the northern hemisphere. Pines play a key role in numerous ecosystems of various altitudes. They developed ecological adaptation to cope with forest disturbances in order to assist individual survival. In particular, pine resistance at fire intensity arise from traits, such as bark thickness, needle thickness or deep rooting system. However, so far there are no biogeographical summaries based on all species, but only on the whole genus. Our aim is to assess the interspecific variation in morphological traits of the Pinus species and to compare species traits with environmental variables at a global level. From a variety of individual publications, a global traits database was created. Base on native distribution maps of 113 Pinus species and their morphological traits, the interspecific relationship between key functional traits was calculated. The study highlights the strong relationship between fire resistance species and certain traits and also the association of species traits with environmental variables.

African shrub distribution emerges via a trade-off between height and sapwood conductivity

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Keywords: plant life-form, aDGVM2, savanna, shrubs, trait trade-off

Abstract

Aim: Shrubs are a successful growth form in many ecosystems globally. However, they are, in contrast to trees, often understudied both in empirical and modelling studies. We define shrub and tree strategies by a trade-off between water uptake capacity and height growth and aim to explore if this trade-off allows us to explain shrub distribution.

Methods: We improve a dynamic vegetation model, the adaptive Dynamic Global Vegetation Model version 2 (aDGVM2), to simulate shrubs as multistemmed woody plants, based on a trade-off between rapid height growth in single-stemmed trees and efficient water uptake in multistemmed shrubs.

Results: We show that, in aDGVM2, (a) the implemented trade-off allows a multi-stemmed shrub strategy to emerge and is sufficient to simulate the broad distribution of shrubs in African savannas; (b) fire and aridity promote shrubs at the expense of trees and grasses; and (c) the presence of shrubs influences competitive interactions between grasses and woody vegetation.

Conclusions: We provide a novel approach to simulate shrubs in a dynamic vegetation model, which enhances our understanding of shrubs distribution. Further work is required for arid and Mediterranean shrublands. Introducing fundamental trade-offs between growth forms into vegetation models can improve vegetation representation.

How does climate change shift the grassland-savanna-forest biome boundaries in South Asia? A dynamic vegetation modelling approach

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Keywords: Asian savanna, climate change, woody-encroachment

Abstract

South Asian vegetation is a complex mixture of forest, savanna and grassland. Studies have documented a long history of C_4 plant communities. Yet, savannas in South Asia have often been misinterpreted as degraded dry tropical forests which are threatened by land-use changes, including conversion to agriculture and governmental afforestation initiatives. South Asia is likely to experience drastic climatic changes in the future, but the consequences for vegetation patterns and diversity are highly uncertain. Therefore, the distribution and diversity of forest-savanna-grassland systems under different climate scenarios need to be explored.

We used the dynamic vegetation model aDGVM2 to simulate the future vegetation state of South Asia. Simulations show a general trend of woody encroachment that can be explained by increasing atmospheric CO_2 concentrations and CO_2 fertilization of woody vegetation. Changes in woody cover translate into biome shift towards forest. Yet, our results indicate that misclassification of Asian savannas as degraded dry forest under-predicts critical biome shifts and that classifying biomes correctly is important for our understanding of potential climate change impacts on vegetation. Therefore, we argue that there is an urgent need to recognize and correctly classify ecosystem states and accordingly prioritize the conservation measures and strategies.

Spatial pattern of Geometrid moth community in Mongolia and the potential distribution of some endemic moth species (Geometridae)

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Keywords: Geometridae, species diversity, species distribution modeling, spatial pattern, Mongolia

Abstract

Background. In Mongolia, though there are several endemic species of geometrid moth, e.g. *Tephrina kaszabi*, however, there is no species checklist or spatial distribution information of Geometridae available, which makes it difficult to investigate species diversity. To fill this knowledge gap, in this study we are aiming at: 1) providing moth species checklist for Mongolia; 2) analyzing spatial pattern and species richness of geometrid moths; 3) predicting the potential current and future distribution of two endemic and rare species (*Tephrina kaszabi*, *Phibalapteryx virgata*).

Material and Methods. Species occurrence locations of moth were compiled from the literature, mainly from the Russian and Hungarian sources. A total number of 359 moth species have been recorded from 77 geographical locations. To model the current distribution and project the future distribution we applied, *Maxent*, a species distribution model which is well-accepted for its good performance.

Results/conclusions. For the species *Tephrina kaszabi* the suitable conditions are loctated mostly in the eastern and northern part of Mongolia. As a result of projected distribution modeling the distribution of this species is currently shrinking and shifting to the northern part of Mongolia. Summer temperature and summer precipitation were the main environmental variables associated with distribution of *T. kaszabi.*

Same same, but different… – Morphological and genetic diversity in *Crataegus* L.

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Keywords: *Crataegus*, morphometry, flowcytometry, apomixis, microsatellites/SSRs

Abstract

25 years past the revision of the old-world hawthorns by Christensen (Christensen, K. (1992): Revision of *Crataegus* Sect. *Crataegus* and. Nothosect. *Crataeguineae* (Rosaceae-Maloideae) in the Old World. Systematic Botany Monographs, Vol. 35: 1-199.) the genus *Crataegus* L. (Rosaceae) remains a group of critical taxa. To unravel the relationship between these morphological characterized species and their phylogeny more than 200 individuals from across Germany were scored morphological with 24 parameters and genetic via SSRs. Data shows a more or less distinct clustering according to the morphology. Genetic analyses are pending. With cross-pollination experiments as well as flowcytometric analyses and another field season ahead we want to have insight in the groups reproduction biology. The combination of all parts of the project shall testify the species concept used so far and based on morphological data only.

From Cretaceous to Holocene: the biogeographic history of the ziziphoids (Rhamnaceae Juss.)

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Keywords: long-distance dispersal, Gondwanan breakup, molecular dating, *Paliurus*, vicariance

Abstract

In two studies, we investigated whether the fossil-rich and cosmopolitan ziziphoid lineage (Rhamnaceae) was influenced by vicariance events following the Gondwanan breakup. We focused on the ziziphoid lineage and the small ziziphoid genus *Alphitonia* Reissek ex. Endl., because extant taxa are predominantly distributed in the Southern Hemisphere (Australia, Africa, and South America), with a few, but in parts very old taxa (fossils dating back to the Cretaceous) occurring in the Northern Hemisphere. We analysed two data sets (ziziphoids and *Alphitonia*) based on up to 26989 bp of DNA and nine internal fossils. We used BioGeoBEARS in R to reconstruct ancestral areas. Our studies highlight that a taxon´s distribution throughout the Northern Hemisphere can be the result of vicariance, but this process can be obliterated by the taxon's more recent biogeographic history. Our studies also support the "out of Australia" hypothesis for the wet-adapted tropical tree genus *Alphitonia*, and its most closely related genera. Finally, our studies also highlight that taxa disjunctly distributed on Southern Hemisphere continents might constitute inappropriate models to investigate the impact of Gondwana-driven vicariance.

Why are bryophytes so little abundant in tropical lowland forests and what will happen with future climate change?

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Keywords: tropical lowlands, bryophyte, carbon balance, modelling, climate change

Abstract

While climate change already affects species geographic ranges, we are still missing much fundamental research to explain current biogeographical patterns. This is particularly true for tropical bryophytes (liverworts, hornworts and mosses). This neglected, poikilohydric plant group plays an important role in ecosystems and shows strong elevational gradients in the tropics with a particularly low abundance in the lowlands.

By developing a simulation model of carbon balances, together with the results of an in situ experiment in the tropical lowlands of Costa Rica, we are studying how temperature determines bryophyte biomass in tropical lowlands.

In our experiment with heated open-top chambers, no physiological acclimation to increased temperature was detected. This suggests that species in tropical lowlands will face reduced carbon gain due to superoptimal temperatures for net photosynthesis. Additionally, faster drying may reduce carbon gain.

The carbon balance model consists of two modules: water dynamics and carbon dynamics. Both are modelled based on empirical data on drying speed and CO_2 exchange in dependence of environmental factors (RH, light, temperature, and atmospheric CO_2.

Combing experimental and modelling results, we are aiming to provide insights into the ecophysiology, biogeography, and climate-change sensitivity of tropical lowland bryophytes.

A multi-trait assessment of species' vulnerability to climate change along a tropical elevational gradient

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Keywords: adaptive capacity, frugivorous birds, global warming, sensitivity, vulnerability assessment

Abstract

Recent climate change influences biodiversity worldwide and communities in mountains will likely be strongly affected. The vulnerability of species to climate change is determined by their sensitivity and adaptive capacity, which are influenced by species' traits. For 215 frugivorous bird species co-occurring along a tropical elevational gradient, we here studied regional spatial patterns of (1) traits that capture different vulnerability aspects and (2) an integrated vulnerability metric. We estimated species' sensitivity based on species' climate niche breadth and species' adaptive capacity by traits related to mobility and dietary niche breadth and by habitat niche breadth. We found that across species, climate niche breadth increased with increasing elevation, while mobility and dietary niche breadth decreased with increasing elevation. In contrast, the mean vulnerability of species changed only marginally along elevation indicating that trade-offs among the different vulnerability components at community-level lead to a relatively constant overall vulnerability in frugivorous bird communities along this elevational gradient. Such knowledge about regional patterns of species' vulnerability to climate change can enhance the understanding of potential future community changes and resulting consequences for biodiversity.

Vegetation-environment relationships along an altitudinal gradient in the Sikkim Himalaya, India

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Keywords: altitudinal zonation, biogeography, Khangchendzonga National Park, species composition

Abstract

Due to comparatively fast changes in geodiversity components (e.g. soil and climate.) with increasing elevation, altitudinal gradients are highly suitable to analyze vegetation-environment relationships. Although being a representative part of the eastern Himalayan biodiversity hotspot, the vegetation of the Sikkim Himalaya has rarely been studied in detail so far. Our study provides a short introduction into the vegetation along the Dzongri and Goecha La trek in the Khangchendzonga National Park (KNP) between elevations of c. 1800 and 4600 m a.s.l. We collected vegetation data in March 2015 using the Braun-Blanquet method with 10 m x 10 m plots as relevés, focusing on woody and perennial plant species. In addition, we comprehensively analyzed soil samples. We assigned our relevés to seven altitudinal vegetation zones. In the two lowest sampling sites (1883 and 2532 m a.s.l.) we found a dominant tree cover of *Castanopsis hystrix* and *Quercus lamellosa* representing transition zones between subtropical and temperate forest. At mid-elevations, *Rhododendron* spp. and coniferous species dominated the vegetation, extending upslope to the treeline and the transition zone to the krummholz belt with alpine *Rhododendron* and dwarf shrub heaths. Vegetation at the uppermost sampling sites was characterized by a high diversity of dwarf shrubs on morainic substrates as well as by extensive *Kobresia nepalensis* meadows. We present conclusions on diversity-environment relationships, functional aspects of community assembly, vegetation composition and altitudinal zonation.

Floristic affiliation and diversity patterns of African tropical mountain forests

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Keywords: tree diversity, Afromontane vegetation, forest plot database

Abstract

African mountains vary considerably in their geological age and origin, size, spatial isolation and climate. These differences affect the floristic composition of Tropical Mountain Forests (TMFs) in Africa, which harbor high levels of endemism both at mountain resolution and across groups of mountains. TMFs are under threat from human activities, and so understanding floristic affiliations and spatial patterns of diversity and endemism is essential to target conservation efforts effectively. However, African mountains are under-represented in existing forest plot databases, and thus are not well captured by global or continental analyses of forest biodiversity, carbon or threats. To address this gap, we created the African Mountain Forest Plot Database (AfriMoDa), which collates forest plot inventories from individual researchers and links these with environmental layers, with standardized controls on disturbance and nomenclature. AfriMoDa contains data for over 900 tree species from 500 plots spanning 25 mountain ranges. Using these data, we will: (1) assess floristic relationships and tree diversity patterns of TMFs at continental scale; and (2) investigate the extent to which these patterns are explained by factors such as mountain size, isolation and climate. Our results will yield new insights for mountain ecology and inform forest conservation and management strategies.

Classification of argan trees (*Argania spinosa*) using UAV-based remote sensing, Morocco

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Keywords: argan tree, remote sensing, UAV, browsing intensity, SfM photogrammetry

Abstract

The endemic argan tree is particularly widespread in the catchment area of the Oued Souss. Due to the high grazing pressure, it shows various species-specific browsing features. The overall appearance ranges from trees with large, round crowns and clearly visible trunks to heavily condensed cone-shaped cushions. An intensification of the grazing pressure is accompanied by an intensification of the feature characteristics.

The focus of this study is the classification of argan trees into different browsing intensities using unmanned aerial vehicle (UAV)-based remote sensing. Which criteria identifiable in small-format aerial photographs (SFAP) and photogrammetrically derived products are applicable to the classification of argan trees? How many stages of degradation for *Argania spinosa* can be distinguished using SFAP? Which parameters analysed by GIS techniques may be used to differentiate between them?

For this purpose, 3D point clouds, digital surface and terrain models (DSMs/DTMs) as well as canopy height models (CHMs) are generated by means of Structure-from-Motion (SfM) photogrammetry. The argan trees appearing in the DSMs are analysed and evaluated with regard to individual structural parameters (crown shape, curvature etc.). The objective is to develop a classification method that will make it possible to map argan-tree browsing intensity solely using UAV-based remote sensing.

Mapping functional composition of potential forests

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Keywords: remote sensing, distribution modeling, plant functional types, machine learning, forest restoration

Abstract

Restoration of trees and forest ecosystems across the world is one of the most mature and effective strategies for climate change mitigation. Recent research has revealed how many additional trees could potentially be supported by terrestrial ecosystems under current climate conditions. However, we still lack the basic understanding of what types of trees could be restored at these locations. Here, we used ~30,000 direct photo-interpretation measurements of Plant Functional Types (PFTs) from protected areas to map the global potential tree coverage of the four main tree PFTs using a machine learning algorithm. We show that additional 328 ha of Broadleaf Deciduous Trees, 179 ha of Broadleaf Evergreen Trees, 174 ha of Needleleaf Deciduous Trees and 227 ha of Needleleaf Evergreen Trees could be restored to the natural state. These are mostly found in tropical grasslands, boreal forests, temperate forests and tropical moist broadleaf forests. This map will provide guidance for restoration projects and will help to quantify the potential effect of restoration projects on the climate.

Spatio-Temporal Variability of Tree Cover and Vegetation Biomass on Socotra Island (Yemen)

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Keywords: land degradation, sustainable land use, ecological landscape classification, GIS, remote sensing

Abstract

Land degradation in arid regions is caused by the interaction of climate and land management change. It determines a progressive reduction of the cover and productivity of the natural vegetation, which can be assessed with appropriate models and tools. We present two approaches to assess the spatio-temporal variability of tree and biomass cover on the Socotra Island. In the first one we assessed the spatial variability of tree cover and density by sampling 3598 plots of 0.5 ha across the island using an innovative methodology defined as augmented visual interpretation, based on a free and open source software. This software, named Collect Earth, allows access to very high spatial and temporal resolution imagery archives. Spatial variability of tree cover and density was analysed assessing the effect of relevant environmental variables such as edaphic and climatic factors. In the second approach we analysed the relationship between biomass cover from field surveys and remotely sensed vegetation indices/environmental data in order to estimate the biomass cover of different vegetation types in two seasons characterized by different climatic conditions. Data and maps produced with these approaches will support the establishment of a land monitoring scheme and strategy and provide a baseline for the Sustainable Land Use and Land Degradation.

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