XIX International Colloquium on Soil Zoology

XVI International Colloquium on Apterygota

26th to 30th August 2024
Cape Town | South Africa

Abstract book

www.icsz2024.org

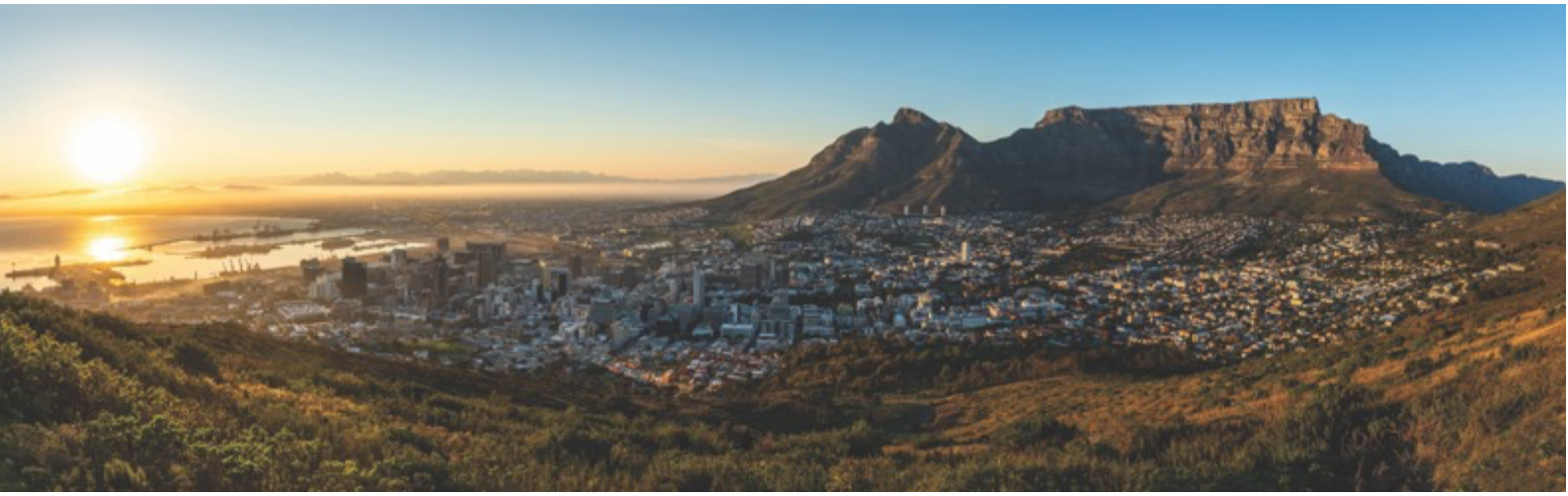
Table of contents

Conference Sponsors

The hosting of ICSZ & ICA 2024 has been made possible by the generous support of the following sponsors:

Exhibitor tables will be located next to the entrance of the building (Entomological Society of Southern Africa (ESSA); Inqaba; DIPLOMICS; Zeiss). We thank Frank Ashwood and Amy Liu for the use of their photos for the cover and website.

Welcome Message



Welcome to Cape Town

We are delighted to welcome you to the XIX International Colloquium on Soil Zoology (ICSZ) and the XVI International Colloquium on Apterygota (ICA) here in Cape Town, South Africa. This is the first ICSZ & ICA meeting on the African continent, which is an important milestone for the growth of soil biodiversity knowledge globally.

Cape Town is one of the most picturesque cities in the world guarded over by Table Mountain and located in the Cape Floristic Region, a hotspot of endemism and diversity. We are happy to welcome you to our beautiful country and city and hope you will have a fun and productive meeting!

Dr Charlene Janion-Scheepers & Dr Juliette Chassain

Local Organising Committee

Department of Biological Sciences, University of Cape Town

Committees

Local Organising Committee

Charlene JANION-SCHEEPERS AND Juliette CHASSAIN - University of Cape Town, South Africa

Scientific Committee

- Maria J. I. BRIONES - University of Vigo, Vigo, Spain
- George G. BROWN - Brazilian Agricultural Research Corporation (EMBRAPA), Brasília, Brazil
- Mac A. CALLAHAM - USDA Forest Service, Southern Research Station, Athens, Georgia, United States
- Jan FROUZ Charles University, Prague, Czech Republic
- Konstantin B. GONGALSKY A. N. Severtsov Institute of Ecology and Evolution, Moscow, Russia
- Nobuhiro KANEKO Yokohama National University (emeritus professor)/Fukushima University, Japan
- Maria A. MINOR Massey University, Palmerston North, New Zealand
- Helen R.P. PHILLIPS German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany
- Anton POTAPOV Senckenberg Museum of Natural History, Görlitz, Germany/German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany/International Institute Zittau, TUD Dresden University of Technology, Zittau, Germany
- Olaf SCHMIDT UCD School of Agriculture and Food Science, University College Dublin, Dublin, Ireland
- Julia SEEBER Eurac Research, Bolzano, Italy
- Michael STEINWANDTER Eurac Research, Bolzano, Italy
- Alexei V. TIUNOV A. N. Severtsov Institute of Ecology and Evolution, Moscow, Russia
- Andrey S. ZAYTSEV Senckenberg Museum for Natural History, Görlitz, Germany/A. N. Severtsov Institute of Ecology and Evolution, Moscow, Russia

Organisers

Conference Organisers: Deidre Raubenheimer, Yvonne Brown, Meagan Whyte, Cindy Maree and Lihle Khetshane, Janet Sirmongpong

General Enquiries:

Deidre Raubenheimer,

Email: Deidre.Raubenheimer@uct.ac.za

Telephone: +27 21 406 6167

Mobile: +27 78 642 6244

Presentation Enquiries:

Yvonne Brown

Email: Yvonne.Brown@uct.ac.za

Telephone: +27 21 650 3915

Mobile: +27 60 803 3640

Venue and contacts

Conference venue

UCT Graduate School of Business, Academic Conference Centre, Portswood Road, V&A Waterfront, Cape Town, South Africa.
Wi-Fi codes will be available at the Conference registration desk.

Parking

Very limited parking at the UCT Graduate School of Business is available on a **'first come first served' basis**.

Registration desk

The registration desk will be situated on the Ground floor foyer of the UCT Graduate School of Business Academic Conference Centre and will be open on:

Monday 26th August from **08h30** to **17h00**.
Tuesday 27th August from **08h30** to **17h00**
Wednesday 28th August from **08h30** to **17h00**
Thursday 29th August from **08h30** to **17h00**

Conference bags and name badges will be available for collection at the registration desk. Please always wear your name badge during the conference.

WhatsApp community

Join our WhatsApp community using this QR code. Once you get access to the community, you can decide which discussion group(s) you want to join: General, Social or Early career. We request all participants to join the "General" group as announcements can be made for the conference.

ICSZ & ICA 2024 🇿🇦
WhatsApp community

Social Functions

Welcome cocktail

Monday 26 August, 18:00-20:00

Venue: Rooftop, UCT Graduate School of Business Conference Centre

Early career networking function

Tuesday 27 August, 18:00

After the Early Career Researcher Workshop

Venue: to be confirmed (V&A Waterfront)

Gala dinner

Wednesday 28 August, 19:00-23:00

Venue: GOLD restaurant

Address: 15 Bennett St, Green Point, Cape Town, 8005

GOLD Restaurant in Cape Town offers an authentic and immersive experience of African cuisine and culture.

Transport there and back:

Please make your own way to and from the venue, preferably by Uber. Walking is not recommended at night.

Coffee and lunch breaks

All breaks and lunch will be served on the ground floor. Check the timetable for allocated times as these may vary daily.

Special requirements

Every effort has been made to ensure delegates with special requirements are catered for. Should you need any assistance, please contact the Registration Desk to enable us to make your attendance at the conference a pleasant and comfortable experience.

Transports & mobility

Car rental: you can rent a car at one of the rental agencies located at the Cape Town airport or in the city centre. Uber is a safe and easy option, widely used in South Africa even for short distances and daily commutes.

Bus: you can use the MyCiti bus, or the Red bus for city sightseeing (it provides a Hop-on Hop-Off option with stops to the most touristic places).

City and mountain safety

There will be security on-site, however, please do not leave any valuables (cell phones, laptops) unattended. Like many places in the world, please be vigilant when walking in the city, in particular at night. It is not advised to walk alone at night, rather take an Uber. The V&A Waterfront is a fairly safe area with lots of visible security, however, we ask that you be vigilant when walking between the Waterfront and the Hotel, especially at night. For more details please visit https://www.capetown.travel/travelwise/safety-in-cape-town/.

Cape Town has wonderful hikes to offer. Please do not hike alone and take extra water and warm clothes as the weather can be unpredictable with poor visibility. Please note the Table Mountain cableway is closed for upgrades until the 1st of September. For this reason, hiking routes under the cableway are also closed, but there are many other beautiful hikes available. For up-to-date details on hiking routes please visit https://www.sanparks.org/parks/table-mountain/what-to-do/activities/hikes-walks-trails.

Sightseeing: Please go to https://www.capetown.travel/ for great ways to explore Cape Town! Don't forget the wonderful winelands!

Weather: You can experience four seasons in a day in Cape Town, so check the weather here and plan ahead.

Presentation guidelines

We welcome five keynote speakers, 59 presentations and 52 posters at the conference. The main sessions are in the auditorium on the lower ground floor of the conference centre. Parallel sessions are in Venue 1 and posters in Venue 3 are on the ground floor. Keynote presentations are 45 min for ICSZ and 30 min for ICA.

All posters and presentations should be sent to the organizers using this link: https://docs.google.com/forms/d/e/1FAIpQLSfZjXPMfTby9doHj9s-43wcKWwCMTiub6bV5bTekrDUL6P7hg/viewform

Guidelines for ORAL PRESENTATION:

10–12 min for your presentation, followed by ~3 min of questions (total of 15 minutes). Please keep to the time.

All presentations are to be in 16:9 aspect ratio and PowerPoint/PDF Format.

All videos are to be embedded in the presentations (please do not add a link).

Please refrain from adding URLs in the presentation.

Please hand your presentation to the AV technician in the presentation venue or email it to Yvonne Brown (yvonne.brown@uct.ac.za) at least one session before your presentation takes place.

Guidelines for ONLINE PRESENTATIONS:

You can present and answer questions online in real-time. Please send a pre-recording of your presentation using the link above in .mp4 format to be used in case of a technical glitch.

Poster guidelines

Guidelines for POSTERS:

Posters must be A1 size (594 x 841 mm).

All posters are displayed in a dedicated room on the ground floor of the conference centre and are available at all times.

Posters can be printed at the Wizardz Print & Design shop in the V&A Waterfront, near the conference centre.

A short presentation video (max 3 min) should be provided in an .mp4 format. Please upload your video using the link on our website by 19 August 2024 or as soon as you are able to do so.

You have been allocated to poster session 1 or 2, so that you know when you need to be available to answer questions next to your poster. Check the program for the poster numbers.

Best student presentation and poster awards

Thanks to generous donations, prizes will be awarded for the best student oral presentation (Diana Wall award) and the best student poster (Erwin Meyer award).

Overall poster winner

You can vote for your favourite poster by following the QR codes in the poster venue.

Workshops

Please register in advance for all workshops using this form:
https://forms.gle/QBBorbpxJXKt92At6

Workshop 1 — Monday 26, 16:00-18:00

Soil biodiversity data integration and recycling for the next generation of global soil ecological research

Organizer: Andrey ZAITSEV (Senckenberg Museum of Natural History Görlitz/IEE RAS)

Background: Properly structured, integrated, harmonized and scientifically reliable data on soil biodiversity, if collected in large volumes, will help researchers to address burning problems related with soil functionality and health sustainability at the global scale. If coupled with the modern ICT approaches to data collection, management and recycling, traditional soil zoological and ecological knowledge accumulated in our expert community may dramatically increase reliability, quality and relevance of predictions and analysis in the interests of decision- and policy-makers.
Workshop Objectives: Basing at the recently successfully accomplished Pan-European project on developing the soil biodiversity warehouse Edaphobase and its integration with a multi-year practice-oriented research initiative BonaRes, we aim at discussing further development of data integration strategy across researchers, countries, taxa and biomes to efficiently respond to the current global needs related to soil. The workshop participants are welcomed to share their thoughts and ideas on the existing gaps in soil biodiversity and functions data, possible approaches to data management organization at the global level and potential IT and AI-tools that would support research based on the collected recycled data. In the end some principles of further stimulating data owners to contribute for such activities can be discussed.
Anticipated results: We anticipate to come-up with the draft action plan on scaling-up the existing trend in the soil zoological expert community to consolidate, harmonize and integrate soil biodiversity data for being able to tackle next generation global challenges like soil health and sustainability in a changing world, increasing resilience of belowground communities globally, etc. This draft plan may be the starting point for a joint peer-review publication to be prepared by the workshop participants.

Workshop 2 Tuesday 27, 16:00-18:00

OniscidBase, a worldwide database on terrestrial isopods

Organizer: Konstantin GONGALSKY (A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences) & Pallieter DE SMEDT (Ghent University, Belgium)

Woodlice are among the key destructors of dead organic matter and drivers of soil food webs. There is a lack of unified information regarding the biomass and abundance of these soil-dwelling organisms. A worldwide database on terrestrial isopods (woodlice) will be presented. The database will have a taxonomical backbone gathering as much scientific literature as possible to create regional, national and worldwide checklists. In addition, the database will compile data on isopod distribution, abundance and biomass across the world. Such a dataset will bring our current knowledge in one place for further analysis and synthesis. This work can then lead to several significant papers including a data paper, which describes the dataset itself, as well as follow-up papers. Usually, all substantial contributors become co-authors of the data paper, and will have access to the dataset to test their own hypotheses. This session will increase awareness of our work and unite more people in order to coordinate their efforts.

Early Career Workshop Tuesday 27, 16:00-18:00

Early Career Workshop

Organizer: Shanali GOVENDER (University of Cape Town, South Africa)

We are delighted to host a workshop focused on early career researchers. We would be happy to welcome students and postdocs, but also more advanced researchers or professionals. Everyone is invited to take part, whether to reflect on your future career or to give advice to new generations of researchers.

Workshop 3 Wednesday 28, 16:00-18:00

Soil BON Foodweb: a global monitoring of soil animal communities

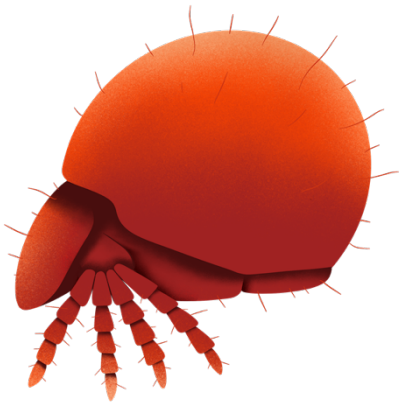
Organizer: Anton POTAPOV (Senckenberg Museum of Natural History Görlitz/German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig)

Little is known about the status and trends of global soil biodiversity and related soil functions. This hampers our understanding of the biosphere functioning and nature conservation for life in soil. Soil BON is a voluntary initiative that targets long-term monitoring of soils properties, functions, microbiomes and fauna globally using novel standardized assessments. Currently, Soil BON joins researchers from about 90 countries, while the Soil BON Foodweb Team (extended network for soil fauna assessment; https://soilbonfoodweb.org) covers 35 countries. The aim of the workshop is to present state-of-the art of Soil BON activities and discuss challenges and opportunities for expanding Soil BON Foodweb network in Africa and other currently underrepresented regions. Participants (1) will get an overview of the available data, running activities, and future plans of Soil BON; (2) can join the initiative and contribute to the discussion on the challenges and opportunities. The main outcome will be increased awareness of our research community about the global monitoring activities and standardized assessment methods as well as opened networking opportunities especially for the researchers in Africa and between researchers in the Northern and the Southern hemispheres.

Timetable

Time slot	Start	Monday 26 August	Tuesday 27 August		Wednesday 28 August	Thursday 29 August	Friday 30 August
9:00-10:45	09:00	Registration	Keynote - Hannah KARURI *Auditorium*		Keynote - Louis DEHARVENG *Auditorium*	Keynote - Nokuthula MBANYANA-NHLEKO *Auditorium*	Excursions
	09:15				ICA_1 Janion-Scheepers		
	09:30	Opening *Auditorium*			ICA_2 Badenhorst		
	09:45		ICSZ_S3_1 Peres	ICSZ_S1_6 Frouz	ICA_3 Palacios Vargas	ICSZ_S6_1 Munyai	
	10:00	Keynote - Zoë LINDO *Auditorium*	ICSZ_S3_2 Mamabolo	ICSZ_S1_7 Fouche	ICA_4 Takaesu	ICSZ_S6_2 Flórián	
	10:15		ICSZ_S3_3 Chassain	ICSZ_S1_8 Mahlobo	ICA_5 Erasmus	ICSZ_S6_3 Pronina	
	10:30		ICSZ_S3_4 Homet	ICSZ_S1_9 Chakravorty		ICSZ_S6_4 Fujii	
10:45-11:15	10:45	Coffee break	Coffee break		Coffee break	Coffee break	
	11:00						
11:15-12:30	11:15	ICSZ_S1_1 Ross	ICSZ_S3_5 Delcourt	ICSZ_S1_10 He	Keynote - Daoyuan YU *Auditorium*	ICSZ_S6_5 Gongalsky	
	11:30	ICSZ_S1_2 Shashkov	ICSZ_S3_6 Briones	ICSZ_S1_11 Danilova		ICSZ_S6_6 Gardini	
	11:45	ICSZ_S1_3 De La Fontaine	ICSZ_S3_7 Kóninger	ICSZ_S1_12 Devetter	ICA_6 Kasai	ICSZ_S6_7 Van Der Vegt	
	12:00	ICSZ_S1_4 D'hervilly	ICSZ_S3_8 Zaitsev	ICSZ_S1_13 Šustr	ICA_7 Cortet	ICSZ_S6_8 Saifutdinov	
	12:15	ICSZ_S1_5 Edlinger	Group photo		ICA_8 Jacobs	ICSZ_S6_9 Quigley	
12:30-14:00	12:30	Lunch break (12:30-14:00)	Lunch break (12:30-13:30)		ICA_9 Gaju-Ricart	Lunch break (12:30-14:00)	
	12:45				ICA_10 Striuchkova		
	13:00				Lunch break (13:00-14:00)		
	13:15						
	13:30		ICSZ_S4_1 Phillips				
	13:45		ICSZ_S4_2 Blasbichler				
14:00-15:30	14:00	ICSZ_S2_1 Steinwandter	ICSZ_S4_3 De Smedt		ICSZ_S5_1 Potapov	ICSZ_S6_10 Hugo-coetzee	
	14:15	ICSZ_S2_2 Schlaghamerský	ICSZ_S4_4 Hoeffner		ICSZ_S5_2 Korobushkin	ICSZ_S6_11 Visagie	
	14:30	ICSZ_S2_3 Ndaba	ICSZ_S4_5 Guseva		ICSZ_S5_3 Zuev	ICSZ_S6_12 Martínez Navarro	
	14:45	ICSZ_S2_4 Küçükkaragöz	Poster session 1 *Ground floor-Venue 3*		Poster session 2 *Ground floor-Venue 3*	ICSZ_S6_13 Vermaak	
	15:00	ICSZ_S2_5 Seeber				ICSZ_S6_14 Tilikj	
	15:15					ICSZ_S6_15 Zaitsev	
15:30-16:00	15:30	Coffee break	Coffee break		Coffee break	Coffee break	
	15:45						
16:00-18:00	16:00	Workshop 1 Global biodiversity data *Auditorium*	Workshop 2 OniscidBase *Auditorium*	Early Career Workshop *Ground floor -Venue 1*	Workshop 3 SoilBON Foodweb *Auditorium*	Closing *Auditorium*	
	16:15						
	16:30						
	16:45						
	17:00						
	17:15						
	17:30						
	17:45						
18:00-19:30	18:00	Welcome cocktail *Rooftop*					
19:00-21:00	19:00				Gala diner *GOLD restaurant*		

Oral presentations



Keynote Speakers

ICSZ_Keynote 1

Monday 26 August, 10:00-10:45

The Threat-work: A network of threats to soil biodiversity

Zoë LINDO

Western University, Ontario, Canada

Soils are home to more than half of the biodiversity on our planet, encompassing a rich spectrum of genes, organisms and functions that play a crucial role in many ecological processes, such as nutrient cycling, organic matter decomposition, and the creation of a well-structured soil matrix. However, soils encounter many threats and stressors that significantly challenge their functionality and biodiversity. Confronting these threats necessitates a comprehensive understanding of the mechanisms that lead to soil biodiversity loss. These can be identified as interconnected distal and proximal effects through various physical, chemical, and biological mechanisms that form a network of threats (the threat-work). Disentangling the threat-work will help us identify priority areas of restoration, remediation, and reclamation and potential best practices to conserve and enhance soil biodiversity.

Soil biodiversity for healthy soils and agricultural sustainability

Hannah KARURI

Department of Biological Sciences, University of Embu, Kenya

Soil biodiversity enhances soil health, improves agricultural productivity and provides key regulatory, supportive and provisioning ecosystem services. With the bludgeoning global population, demand for food has resulted in agricultural intensification that is affecting soil biodiversity. Loss of biodiversity threatens agricultural productivity and food security. Concerted stakeholder efforts can contribute towards development of agricultural systems that sustainably produce food while maintaining soil biodiversity within a framework that incorporates synergies and trade-offs between various ecosystem elements. While global goals and targets advocate for protection of soil biodiversity, development and implementation of policies and legislations is often fragmented across economies. Cross-border policies on soil biodiversity are critical especially for developing nations where farming systems face challenges arising from internal and external factors. Greater investment in research on the nexus between soil biodiversity, health, agriculture and the role of nature-based solutions is also required. Most importantly, small-holder farmers who are key actors in the agricultural sector of developing nations should be involved in research and development of practices that promote soil biodiversity and enhance soil quality and health.

Diversity and biogeographic patterns of ants in southern Africa (Hymenoptera, Formicidae)

Nokuthula MBANYANA-NHLEKO

Iziko Museums of South Africa, Cape Town, South Africa

Ants emerged during the Cretaceous Period more than 100 million years ago and diversified independently on different landmasses following the Early Cretaceous fragmentation of Pangaea. Today, ants represent one of the most ecologically successful groups globally, and their diversity far exceeds that of other social insects. They occur in almost all terrestrial habitats and are not uniformly distributed across regions, biomes and continents. As with all other taxa, historical abiotic factors have played a major role in their diversification and biogeographic structure, including climatic changes and the necessity to adapt to new environmental conditions. An understanding of how these processes produced the current biodiversity patterns is important for management and conservation, given the challenges faced by global biodiversity. Many global areas still lack data on regional biodiversity and the historical processes that may have shaped it. This is particularly so for southern Africa, where such information on the region's ant fauna is still relatively poorly known.

Lifeforms and traits in edaphic versus subterranean springtails

Louis DEHARVENG

Muséum national d'Histoire naturelle, Paris, France

During last decades, morphological traits and lifeforms of springtails have been increasingly used as proxy of life style or as habitat characteristics in local ecological studies. They have been also considered as evolutionary markers in phylogenetic studies. Their patterns remain however poorly known in a global geographical and taxonomic context. We address here this issue, focusing on the morphological diversity of traits and life forms across different Collembolan groups living in soil and caves, the two ecosystems where they are the most frequently advocated in support to ecological or evolutionary inferences. In introduction, the meaning and the history of these two intimately linked concepts are briefly summarized. The patterns of expression of the most relevant morphological traits in the context defined above are described, embracing their between-taxa and within taxa diversity. The combination of different traits recognized to be statistically associated during evolution and assumed to be correlated to habitat are then re-examined more in-depth among Collembola. Traits that characterize a same life form across the whole class of Collembola evolve in parallel, but at different intensity and following different modalities, resulting in very diverse life form expressions that reflect complex underlying adaptive process. This diversity is summarized in conclusion in the characterisation of the lifeforms that can be recognized among high level taxa of Collembola, beyond the basic euedaphomorphic, hemiedaphomorphic and troglomorphic concepts.

Phylogenomic insights into Collembola evolution: Recent progress and future needs

Daoyuan YU

Nanjing Agricultural University, Nanjing, China

Collembola, among the most ancient lineages of terrestrial arthropods, are abundant and diverse in nearly all land ecosystems. Their evolutionary history thus mirrors the historical succession of Earth's terrestrial environments. However, their evolution over hundreds of millions of years in varied habitats has led to extensive autapomorphies and significant genetic diversity among collembolan taxa. Consequently, despite substantial research efforts, the phylogenetic relationships within Collembola remain elusive. In our recent study, we used phylogenomic approaches to improve the resolution of Collembola phylogeny. We sampled whole-genome data representing all major collembolan lineages and employed various data extraction, locus sampling, and signal filtering strategies to generate matrices. We also applied a diverse array of tree-searching and rate-modelling methods to reconstruct the phylogeny. Our analyses successfully resolved some recalcitrant nodes in previous trees based on Sanger markers or mitochondrial genomes. The results provide new insights into the ecological evolution of collembolan taxa and traits, and suggest the need for future taxonomic revision of certain groups. We expect that future phylogenomic studies involving global cooperation and worldwide taxon sampling will further enhance our understanding of the systematics, ecology, and biogeography of this important group of animals.

ICSZ Session 1 - Ecology and ecosystem functioning

ICSZ_S1_1

Monday 26 August, 11:15-11:30

Soil faunal indicators of soil health across land-use types, intensities and pedo-climatic zones (SOB4ES project)

Giles Ross[1]

[1]Nioo-knaw, Wageningen, Netherlands

Soils are an essential component of terrestrial ecosystems that provide food, water purification and buffering effects of climatic change. The need for standardised protocols that bring together aspects of soil biodiversity and ecosystem services is essential for a robust approach to soil health monitoring. Here, we introduce the SOB4ES project, an EU-Horizon 2020-funded consortium including 15 EU partner organisations that aims to develop and promote holistic approaches to soil monitoring, combining molecular DNA and morphological taxonomic approaches on a range of soil fauna. These will be applied to measure the abundance and diversity of Earthworms, Enchytraeids, Mites and Springtails and Nematodes, alongside microbial populations across 9/15 EU pedoclimatic zones, 5 Land-Use types and an intensity gradient. Linking these data with detailed measures of ecosystem services such as nutrient availability, soil physico-chemical properties and microbial activity provides a solid framework upon which vary over explicit spatial and temporal scales. Our findings indicate shifting patterns of variation and potential indicator taxa in alternate land-use types and intensities that will help focus indicator selection and advance the synergy of molecular and morphological identification methodologies. The aim to provide cost-effective indicators of soil health will contribute to conservation and land-management strategies, whilst also providing a platform that can be applied to a range of ecosystem types.

Modelling of earthworm distribution ranges on the European part of Russia

Maxim Shashkov[1], Sergey Ermolov, Natalya Ivanova

[1]Institute of Mathematical Problems of Biology RAS, Pushchino, Russian Federation

The goal of the research was to reveal environmental variables that drive distribution and evaluate the pattern of the common European earthworm species at the regional scale. Five species were considered: *Aporrectodea caliginosa* (Savigny, 1826), *Dendrobaena octaedra* (Savigny, 1826), *Lumbricus rubellus* Hoffmeister, 1843, *Lumbricus terrestris* Linnaeus, 1758, and *Octolasion lacteum* (Örley, 1881). The area of interest was defined as European Russia, excluding the Southern mountainous territory, islands, and exclaves. We used earthworm occurrences available through the Global Biodiversity Information Facility network. As the volume and quality of these data were not enough, we also collated occurrences from 159 Russian-language scientific papers. Data from the citizen science system iNaturalist were also used after thorough data quality checking. As a result, about 100-300 occurrence points were obtained for each focal species. For model predictors, we used bioclimatic variables available as the WorldClim dataset, and soil climate layers were generated based on long-term data obtained from the Russian national weather station network. Multicollinearity issues were examined for each focal species by Pearson correlation with threshold value of 0.7. The following WorldClim variables showed a suitable collinearity: annual mean temperature and precipitation, mean diurnal temperature range, maximum temperature of warmest month, mean temperature of driest quartal, and precipitation seasonality. Maximum entropy (MaxEnt) method and logistic regression provided comparable results, with more uneven occurrence probability distribution for MaxEnt. The significant predictors were annual mean temperature and annual precipitation in most models, sometimes, predictors reflecting climatic variables varying. According to the area under the curve (AUC) measure, the best model performance of 0.78 was for the *Lumbricus terrestris* model. In general, obtained regional models provide a reliable distribution pattern. For modelling at the more fine scale, we should use soil properties, and land cover classification that reflects main biome types and land use regimes.

Are larger termite mounds more resistant to fire? A study of two southern African termites

Benjamin de la Fontaine[1], Shelley Edwards[1]

[1]Rhodes University, Makhanda, South Africa

The effect of fire on insects is an under-studied area of ecology, especially in southern Africa. This study focusing on two termite species, *Trinervitermes trinervoides* and *Amitermes* sp., aimed to determine whether fire survival in termites is related to mound size. Two hundred and seven termite mounds were sampled across four sites in the Eastern Cape, South Africa. Each sampling site consisted of a pair of plots, either recently burnt (< 1 year or ~2 years since fire) or unburnt (> 2 years since fire). Mound size and the presence and species of termites were recorded by invasive sampling. Mound size (above-ground volume) was a significant predictor of live termite colonies of both species in burnt plots but not unburnt plots in generalized linear models, suggesting a relationship between size and fire survival. This was further supported by live mounds being significantly larger than dead mounds in burnt plots, but not unburnt plots. Mounds of *Amitermes* sp. appear to be more resilient to fire than *T. trinervoides* relative to their much smaller average size. The size-survival relationship in termite mounds is likely influenced by density and degree of insulation from heat, but indirect effects of fire on later food availability may also affect recovery in the long term.

Looking for interactions between saprophagous macrofauna from different ecological categories in presence and absence of plants

Camille D'Hervilly[1], Jan Frouz[2], Alena Peterková[2], Lucie Hüblová[2]

[1]Umeå University, Department of Ecology And Environmental Science, Umeå, Sweden, [2]Institute for Environmental Studies, Charles University, Prague, Czech Republic

Saprophagous macrofauna is diverse and associated with different ecological categories. Woodlice and epigeic earthworms feed on litter material at the soil surface, while endogeic earthworms feed on organic particles mixed with soil. How interactions between diverse fauna affect decomposition remains poorly known, especially in the presence of growing plants, while it might play an important role during ecosystem restoration. We tested the effect of the combined presence of woodlice (*Porcellio scaber*), epigeic earthworms (*Dendrobena veneta*) and endogeic earthworms (*Aporrectodea caliginosa*) in an ex-situ pot experiment. We used soil from a post-mining area and corn litter in repeated additions. We added plants in half of the pots. We measured changes in fauna biomass, litter removal, soil carbon accumulation and microbial properties. We hypothesized facilitation of *A. caliginosa* activity by the litter-feeders, and interactive effects on decomposition. We also predicted that these effects would differ in the presence of plants. Preliminary results after the first growing season show that the presence of plants strongly affected all measured variables. Earthworm survival decreased in the presence of plants, probably due to competition for water, while isopods survived better in the presence of plants. However, the presence of other fauna species did not affect final fauna biomass. Litter removal was increased in the presence of all earthworm species in all cases, while woodlice influenced litter removal only in the presence of plants. In pots with plants, earthworm presence facilitated the growth of herbaceous plant species over nitrogen-fixing ones and decreased microbial biomass. Less than cumulative effects were observed in the presence of a combination of fauna. This suggests that if all fauna can individually feed on the litter, their activity is influenced by the simultaneous presence of other fauna. Coming results about soil organic carbon and microbial communities will allow to precise these interpretations.

Quantifying earthworms' role in soil water infiltration - Insights from a data synthesis across Europe

Anna Edlinger[1], Morgane Roquier[2], Guenola Peres[2], Cristina Aponte[3], Jack Faber[1]

[1]Wageningen Environmental Research, Wageningen University and Research, Wageningen, Netherlands, [2]UMR SAS, Institut Agro Rennes-Angers, INRAE, Rennes, France, [3]Instituto de Ciencias Forestales ICIFOR-INIA, CSIC, Madrid, Spain

Soil biota, constituting approximately 60% of global biodiversity, are integral to numerous ecosystem services, such as water regulation. Specifically earthworms, recognized for their roles as ecosystem engineers, facilitate soil water infiltration through their burrowing activities. Despite this recognition, the influence of earthworm community structure and the specific contributions of distinct earthworm species to water infiltration in real-world soil ecosystems remain largely unexplored. To fill this knowledge gap, we assembled data covering about 400 field observations relating water infiltration measurements to earthworm communities in arable fields and grasslands, spanning nine countries in Europe. Here, we are going to present first results from this data synthesis, identifying the most important earthworm community proxies indicative for soil water infiltration across various biogeographical contexts. Using different types of statistical models, we will provide estimates on the quantitative contribution of the most important earthworm indicators to soil water infiltration, and discuss the potential of promoting management practices to facilitate earthworm-supported soil water infiltration. Finally, we will provide an outlook on the importance of establishing ecological production functions to underscore the contribution of soil biota to ecosystem services and to inform future conservation strategies for soil ecosystems.

Soil (macro) fauna incorporate important amount of C in soil, globally their effect increase with actual evapotranspiration and litter quality

Jan Frouz[1]

[1]Charles University, Praha, Czech Republic, [2]Biology centre, České Budějovice, Czech Republic

Here I summarized global mesocosm experiment aimed to estimate amount of litter which is incorporated in soil by soil fauna bioturbation. Mesocosms containing litter and mineral soil in two separate compartments were exposed in the soil litter interface. These mesocosm were either accessible to soil macrofauna fauna or not accessible to meso- and macrofauna which allowed to measure the removal of litter from soil surface as well as accumulation of litter in mineral soil as well as overall loss of litter from the mesocosm. Mesocosms were supplied with local litter. The mesocosm experiment was conducted in 23 locations in all major biomes of the Northern Hemisphere from tundra to tropical rainforest. Only some experiments allow full C budget which show that fauna may in some cases decrease C loss from soil. C accumulation can be measured in all experiments. Overall fauna significantly increased carbon accumulation in mineral soil. The effect was higher in temperate and tropical climates and lower in cold and dry biomes. Amount of carbon incorporated by fauna into mineral soil significantly positively correlated with actual evapotranspiration and negatively with CN ratio of litter. In comparison with previous studies of litter consumption, it can be estimated that about half of litter consumed by soil fauna is incorporated in mineral soil. To put this together it appears that in natural ecosystems about half of annual litter fall is consumed by soil fauna and half of that fauna incorporate into mineral soil. This makes soil fauna important players in global carbon cycle.

Biological control of aflatoxin in soil by earthworms under different temperature and moisture conditions

Tanya Fouche[1], Mark Maboeta[2]

[1]University Of South Africa, Unisa Science Campus, Florida, Gauteng, South Africa, [2]North-West University, Potchefstroom, South Africa

Aflatoxins are well-known fungal toxins produced by soil fungi (*Aspergillus* sp.). Aflatoxin contamination in the production and food industry is one of the most important threats to food safety and human health, with recent studies suggesting that it might become a bigger problem in the future. The prevention and biological control of aflatoxin contamination at pre-harvest stages provide the greatest opportunity for immediate mitigation and limit synthetic post-harvest strategies that might affect product quality. Biological control of aflatoxin in the soil is mainly achieved through displacement by non-toxigenic fungal populations and biodegradation by microbial populations. The aflatoxin degradation potential of other important soil organisms involved during decomposition processes is not frequently considered. Earthworms affect essential soil processes, including protection against harmful toxins and plant pathogens while creating and maintaining favourable habitats for microbial activity. This study investigated the role of earthworms in the biological control of aflatoxins in soil under different temperature and moisture conditions. Laboratory experiments were conducted to assess the degradation of aflatoxins in the presence and absence of earthworms at different combinations of air temperature (21 and 26 °C) and soil moisture (30 and 50% water-holding capacity). A standardised soil medium was used in which earthworms (*Eisenia andrei*) were exposed to two aflatoxin concentrations (10 and 100 µg/kg), representing environmentally relevant soil concentrations. Total aflatoxin concentrations were monitored over four weeks using enzyme-linked immunosorbent assays. Temperature and moisture altered the aflatoxin regulatory potential of earthworms. Aflatoxin degradation increased in the presence of earthworms under increased temperatures (26 °C) and was attributed to the earthworm activity and excretions that stimulated higher microbial activity. The most significant degradation potential was observed in the higher moisture treatments (50%). This study highlighted the potential of earthworms to contribute to the biological control of aflatoxins under favourable environmental conditions.

Impact of the invasive alien *Gleditsia triacanthos* (Fabaceae) on ground-dwelling arthropod in South African grasslands

Thandeka Mahlobo[1], Grant Martin[3,4], Caswell Munyai[2], Nontembeko Dube[1]

[1]Department of Zoology and Entomology, University Of The Free State. P.O. Box 339, Bloemfontein, South Africa, [2]School of Life Science, University of KwaZulu-Natal, Scottsville, South Africa, [3]Centre for Biological Control, Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa, [4]Afromontane Research Unit and Zoology Department, University of the Free State, QwaQwa campus, Phuthaditjhaba, South Africa

Ground-dwelling arthropods are essential for maintaining soil structure, health, and functioning by playing crucial roles in litter decomposition, nutrient cycling, and population within ecosystems. Their high diversity, abundance, and sensitivity to environmental changes make arthropods the perfect group to assess the impact of invasive alien plants. This study aimed to investigate the impact of the invasive plant *Gleditsia triacanthos* on the grassland ecosystem in South Africa. Arthropods were collected across five grasslands in sites invaded by *G. triacanthos* and adjacent uninvaded grasslands in the Free State province using pitfall traps. Overall, arthropod species diversity and community structure differed between invaded and uninvaded sites in all the sampled grasslands. In all the sampled locations, diversity and abundance were higher in the uninvaded grasslands, which also hosted more unique species. 141 families from 21 orders were identified from the uninvaded grasslands, compared to 113 families from 18 orders identified from the site with *G. triacanthos*. This study highlights the impact of *G. triacanthos* on arthropods and, thus, the health and functioning of grasslands in South Africa. The results of this study will motivate the prioritisation of biocontrol measures against *G. triacanthos* in South Africa and serve as a baseline for monitoring ecosystem recovery after that.

Relative toxicity of lead and nickel on acidphosphatase, alkaline phosphatase acetylcholinestarase and metallothionein in earthworm *Eisenia fetida*

Partha Pratim Chakravorty[1]

[1]Raja Narendra Lal Khan Women's College (Autonomous), Midnapore, India

Among all soil fauna, the earthworms are not only acting as bioindicator to determine soil pollution but also, they provided with some specific enzymatic biomarker to decode the soil contamination. In the present heavy metal toxicity study, the LC50 of lead (Pb) and nickel (Ni) were determined in both artificial and natural ground soil by acute toxicity test (14 days) in *Eisenia fetida*. Low observed effective concentration (LOEC) of mixture of both metals (Pb and Ni) were also determined through repetitive experimental acute toxicity test. In the chronic toxicity test (28 days), the experimental set up had been arranged as control (C), T1 (1506.25 mg Pb), T2 (3012.5 mg Pb), T3 (193.75 mg Ni), T4 (387.5 mg Ni), T5 (753.125 mg Pb and 96.875 mg Ni) and T6 (1506.25 mg Pb and 193.75 mg Ni) per kg of dry soil. After end of chronic periods, life history parameters, such as change in biomass, clitellum development, cocoon production, hutching success, and juveniles production were estimated and the mean difference of these life history parameters showed a significant negative correlation ($P<0.05$) and specific activity of acid phosphatase, alkaline phosphatase, acetylcholinestarase and metallothionein were determined in the earthworm tissue. The mean difference of recorded specific activity values of all enzymes was significant ($P<0.05$) and also showed a significant negative correlation ($P<0.05$) between the specific activity both enzymes.

Ecological preferences and community dynamics of tardigrades in selected Australian soils

Ziyang He[1], Hang-Wei Hu[1], Bao-Anh Thi Nguyen[1], Qing-Lin Chen[1], Anthony Weatherley[1], Michael Nash[2], Li Bi[1], Keren Wu[1], Ji-Zheng He[1]

[1]School of Agriculture, Food and Ecosystem Sciences, Faculty of Science, The University Of Melbourne, Melbourne, Australia, [2]Department of Ecology, Environment and Evolution, School of Life Sciences, La Trobe University, Melbourne, Australia

Tardigrades, also known as 'water bears' or 'moss piglets', inhabit diverse environments ranging from marine to freshwater and terrestrial habitats. They occupy various trophic levels in the micro-food web attributed to their different feeding preferences and different predators, which also heralds the complexity of their ecological functions. Therefore, understanding the ecological preference of tardigrades and their interactions with other organisms is crucial for discovering the changes in ecosystem functions performed by these organisms under future scenarios of climate change. Here, we investigated the diversity and community composition of tardigrades, and their driving factors from 194 soil samples across southern and eastern Australia, based on amplicon sequencing of 18S rRNA gene. We further validated the presence or absence of tardigrades in selected soil samples using morphological detection. Eleven tardigrade genera were observed in 53 samples, predominantly from coastal soils, with *Eremobiotus* as the most dominant one. Notably, mean annual temperature (MAT) was the most important factor influencing the presence of tardigrades, revealing a decreased relative abundance of tardigrades as MAT increased. Other abiotic factors, including soil pH, total nitrogen, and mean annual precipitation, as well as biotic factors, including bacteria, fungi, protists, algae and nematodes, were also critical to the distribution of tardigrades, as revealed by structural equation modelling. Morphological identification broadly aligned with our molecular findings; it also illustrated the sporadic distribution pattern of tardigrades. Taken together, our findings provide the first empirical evidence for the relationships between soil tardigrades and environmental factors using environmental DNA and demonstrate the importance of both biotic and abiotic factors in shaping the large-scale distribution patterns of soil tardigrades. Additionally, our findings imply a certain degree of feasibility for soil tardigrade research using environmental DNA, and highlight the potential risk of a decline in tardigrade communities in the face of increasing global temperatures.

Community structure and biodiversity of soil microfauna in relation to soil moisture gradient

Margarita Danilova[1]

[1]A.N. Severtsov Institute of Ecology and Evolution Russian Academy of Sciences, Moscow, Russian Federation

Soil microfauna plays a critical role in terrestrial ecosystems by contributing significantly to bacterial biomass turnover, mineralization processes, and the enhancement of soil quality. While vertical distribution patterns of soil microfauna have been extensively studied, horizontal distribution trends, particularly concerning moisture gradients from surface water bodies remain unknown and neglected. This study aims to fill this knowledge gap by investigating the influence of freshwater lakes on the abundance, diversity and community taxonomic and functional composition of soil microfauna, with a specific emphasis on ciliates. The methodology involved sampling soil at varying distances from the lake shoreline (0, 5, 10, 30, and 50 meters) near five natural lakes in European Russia. Standard soil zoology techniques were employed for samples collection, while specific protozoology and microbiology methods were used for the extraction and identification of ciliates. Identified species were further classified into trophic groups based on existing literature. The findings revealed a decrease in ciliate abundance with increasing distance from the shoreline, with the highest densities observed at the distance of 0 and 5 meters. This pattern is most likely attributed to gradients in soil moisture and food resource availability according to statistical analysis. A decline in the occurrence of species feeding on green algae and diatoms was observed at greater distances from the littoral zones, while bacterivorous species predominated at 30 and 50 meters. Research on the spatial distribution and community composition of soil microfauna serves as a promising approach for assessing and monitoring changes in terrestrial ecosystems near lakes. This research was supported by the Russian Science Foundation (Grant No: 23-14-00201).

Fire and water: Effect of forest fires on soil hydrobionts from the long-term perspective

Miloslav Devetter[1], Marek Renco[2]

[1]Biology Centre, Czech Academy of Sciences, Ceske Budejovice, Czech Republic, [2]Institute of Parasitology, Slovak Academy of Science, Kosice, Slovakia

Hydrobiont communities are very common and abundant in all soils, even in those that frequently dry out. All groups of hydrobiont microfauna are well adapted to desiccation with anhydrobiosis. Dry forests on sandstone rocks are susceptible to forest fires, which occur relatively frequently in the Bohemian Switzerland National Park in the Czech Republic. We studied the effects of such disturbances on different groups of soil fauna on a chronosequence of burnt areas ranging from recent to more than a hundred years old. The abundance of rotifers varied between 104 and 106 individuals m-2, and that of nematodes between 105 and 107 individuals m-2. All traditionally recognized feeding traits were present, such as bacterivores, fungivores, omnivores, predators and plant parasites. Among the rotifers, bdelloid rotifers dominate, but monogononts were also regularly represented. The results indicated that although the rotifer community was severely affected after a fire, it recovered within a short time and that the age of the plot had minimal long-term effects on it. In contrast, nematode communities responded considerably to fires of high severity. There were significant decreases in mean abundances, plant parasites, omnivores and predators, species number, and nematode diversity, but an increase in the abundance of bacterivores immediately after the fire. Full recovery of communities was found approximately 20 years after the disruption. Overall, our results showed that fire severity was a considerable element affecting soil nematode communities immediately after events, as well as the time needed to recover communities' structure during post-fire chronosequence. Some species avoid burnt plots more than unburnt ones. We conclude that a severe fire strongly changes the conditions in the soil profile, mainly by removing the upper litter layer, which in turn affects the microfauna community.

Metabolic temperature response of microfauna living under stenothermal conditions in cryoconites on Arctic glaciers

Vladimir Šustr[1], Michala Tůmová[1], Miloslav Devetter[1]

[1]Institute of Soil Biology and Biogeochemistry, Biology Centre CAS, České Budějovice, Czech Republic

Cryoconites on glaciers represent small bodies of water in contact with a large mass of ice. It is an environment in which the temperature remains at zero degrees centigrade. Tardigrades and rotifers live in the cryoconites on the glaciers of the Svalbard. Both groups have adaptations that enable them to survive extreme conditions in an inactive state. In Arctic cryoconites, however, we can observe active communities. Do microfauna from cryoconites need metabolic adaptations for an active life at the freezing point? To measure the metabolism of the microfauna, a micromethod for measuring oxygen consumption was developed. The respiratory activity of the soil hydrobionts was measured in 3.5 µL of water enclosed in a capillary sealed airtight from below with solid paraffin and from above with paraffin oil. The tip of the oxygen microsensor was lowered into the water using a micromanipulator. The system was thermostatted to a measured temperature with an accuracy of 0.01°C. The respiration of rotifers of the genus *Philodina* and tardigrades of *Hypsibius* was measured in the temperature range 5 - 35°C during a one-hour exposure at each temperature. Species from Arctic cryoconites and temperate soils were compared. All curves increase from 5°C and peaks at 20-25°C (Tardigrada) or 30°C (Rotifera). Greater differences were observed between the two taxonomic groups than between their Arctic and temperate representatives. The respiration is always low at 5°C, and its value is similar in temperate and arctic species. At a temperature close to habitat conditions, the metabolic rate of temperate species is higher than that of Arctic species. It does not confirm the hypothesis of cold metabolic compensation in Arctic cryoconite microfauna. The study represents a first attempt to compare the thermal response of respiration rate in the microfauna species of Arctic cryoconites and their counterparts in temperate soils.

ICSZ_S2_1 Monday 26 August, 14:00-14:15

Biodiversity in mountain soils above the treeline: A global review

Michael Steinwandter[1], Nadine Praeg[2], Davnah Urbach[3,4,5], Mark A. Snethlage[3,4,5], Bettina Weber[6], Paul Illmer[2], Julia Seeber[1,7]

[1]Institute for Alpine Environment, Eurac Research, Bozen/Bolzano, Italy, [2]Department of Microbiology, Universität Innsbruck, Innsbruck, Austria, [3]Global Mountain Biodiversity Assessment (GMBA), University of Bern, Bern, Switzerland, [4]Institute of Plant Sciences, University of Bern, Bern, Switzerland, [5]Centre Interdisciplinaire de Recherche sur la Montagne, University of Lausanne, Bramois/Sion, Switzerland, [6]Institute of Biology - Division of Plant Sciences, University of Graz, Graz, Austria, [7]Department of Ecology, Universität Innsbruck, Innsbruck, Austria

Mountain soils fulfil fundamental ecosystem functions and services, also for the surrounding lowland, but little is known about their soil biota diversity. Therefore, we as the working group "Mountain Soil Biodiversity" of the GMBA aim to evaluate its current state of knowledge and identify future research needs. We performed a systematic literature research to collate available papers focusing on biodiversity in global mountain soils above the treeline (i.e. alpine soils) for cryptogams, soil microorganisms, and soil fauna. To guarantee consistency, we included only papers available in English. We assessed the paper densities of eleven alpine mountain regions, and allocated the three main taxonomic groups within them. Further, we describe what shapes diversity distribution patterns, adaptation strategies, and research trends. Alpine soil biodiversity studies are available mainly for Central Asia and Southern & Central Europe (261 and 232 papers, respectively), followed by Northern Europe (71). Therefore, many alpine mountain regions remain widely understudied (e.g. the Andes (26) and the Caucasus (17)). Biodiversity is still high at high-elevation soils, with many specialist taxa that have developed adaptations (e.g. omnivory, life under snow, and extension of life-history) to cope with the extreme environmental conditions, short growing seasons, and limited food sources. We conclude that knowledge on alpine soil biodiversity is still sparse and/or not always freely accessible, especially outside Europe and Central Asia. Further, more studies exist but are available in local languages only. Therefore, with our global review, we want to bring more attention to these sensitive but biodiverse habitats, as they are currently threatened by climate and land-use change, but are a relevant livelihood for many people, also outside the mountainous regions. Our review opens research questions and gives recommendations for future studies and for policymakers to better understand and preserve alpine soil biodiversity.

Microannelids (Enchytraeidae, Naididae, Parergodrilidae) along a 4000 m Afrotropical elevational gradient on Mount Cameroon

Jiří Schlaghamerský[1], Rüdiger Schmelz[2], Jiří Doležal[3,4], Miloslav Devetter[5]

[1]Masaryk University, Faculty Of Science, Brno, Czech Republic, [2]Enchylab, A Coruña, Spain, [3]Institute of Botany, Czech Academy of Sciences, Průhonice, Czech Republic, [4]University of South Bohemia, Faculty of Science, České Budějovice, Czech Republic, [5]Biology Centre, Czech Academy of Sciences , České Budějovice, Czech Republic

Knowledge on the enchytraeid fauna of sub-Saharan Africa is based on a few specimens collected in West, East and South Africa during the 20th century, often described as new species. Neither quantitative data, nor other annelids belonging to soil mesofauna have been reported. We conducted our study to explore diversity and densities of soil-dwelling microannelids in a wide range of Afrotropical habitats, sampling an elevational gradient on the south-western slopes of Mount Cameroon (4040 m a.s.l.) from lowland rain forest at sea level, across montane forests and savanna to afro-alpine grassland at 4000 m a.s.l. in 2013 (at the transition from wet to dry season). At 11 elevations, three soil cores were taken at each of three different sites. Microannelids were extracted (wet funnel), counted and identified as far as possible. We recorded 329 specimens of ca. 16 enchytraeid species in six genera (*Buchholzia*, *Enchytraeus*, *Fridericia*, *Hemienchytraeus*, *Henlea*, and *Xetadrilus*), *Pristina* cf. *jenkinae* (Naididae) and the "polychaete" *Parergodrilus heideri* (Parergodrilidae). *Fridericia cf. bulboides* (confirmed by molecular barcoding as close to *F. bulboides* from Europe) was most abundant (126 specimens), followed by *P. heideri* (67 specimens) and *Henlea perpusilla s.l.* (44 specimens). For *P. heideri* (at montane forest elevations) this is the first record from the tropics and Africa. *Xetadrilus* was represented by up to seven small species, new to science and yet to be formally described. Mean microannelid densities (ind./m2 ± SE) ranged from 0 in savanna at 3100 m a.s.l. (very dry soil) to 4178 ± 876 in Afroalpine grassland at 4000 m a.s.l. Densities in lowland forests at 0 and 350 m a.s.l. were 356 ± 194 and 133 ± 77, respectively. Species richness was considerable, densities were much lower than in colder climates, comparable with those of the few other tropical sites for which data are available.

Impact of long-term climate change and elevation on ant diversity

Abusisiwe Ndaba[1], Nokuthula Mbanyana-Nhleko[2], Simon van Noort[2], Charlene Janion-Scheepers[1]

[1]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa, [2]Iziko Museums of South Africa, Cape Town, South Africa

Arthropods provide vital ecosystem services and are important indicators of ecosystem changes as they are sensitive to environmental changes. Recent studies show alarming rates of decline in insect biomass. These declines are mainly attributed to climate change, habitat transformation, pollution, and invasive species. However, studies for Africa have been mainly focused on short-term rather than long-term studies, which are crucial for understanding the key global change drivers affecting arthropod diversity and assemblages over time. Studies suggest that the Fynbos in the Cape Floristic Region (CFR) is likely to be highly sensitive to climate change, and the Fynbos biome, in particular, will lose large areas of its natural vegetation near its northern limits, especially those along the west coast and in the Cederberg mountains. Most conservation policies for the CFR focused on plants and larger animals, while arthropods are underrepresented. For example, although ants are vital for fynbos seed dispersal and are affected by land transformation and climate change, their distribution and taxonomy are understudied in the CFR. This study aims to assess changes in ant assemblages over a 20-year period. A total of 17 altitudinal bands were sampled at 200-m altitudinal intervals across a historical altitudinal transect in the Cederberg Wilderness Area. Four replicates of 10 pitfall traps were laid at every 200-m interval, totalling 680 pitfall traps per season. Vegetation cover and height at each pitfall trap were recorded and soil samples were collected for soil analysis. Temperature was measured using i-buttons from 2002 until 2022. In this talk, we will present preliminary results of changes observed in ant assemblages over 20 years. This study's findings will aid in managing and conserving biodiversity in a major biodiversity hotspot that is vulnerable to global change drivers.

Beetles through space and time, the importance of long-term observational studies

Coşkun O. Küçükkaragöz[1], Korben van der Vendt[1], Abusisiwe Ndaba[1], Charlene Janion-Scheepers[1]

[1]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa

Insects are excellent indicators of ecosystem health, especially in biodiversity hotspots. Several studies have shown that nearly half of the world's insect species could become extinct over the next few decades due to climate change. This potential insect decline and its environmental drivers are especially understudied in the Southern Hemisphere. In this study, long-term sampling was conducted in a biodiversity hotspot, the Cape Floristic Region. The study aimed to assess changes in ground-dwelling beetle assemblages across an altitudinal gradient over a 20-year period. Following the same methodology and locations as historical studies, four replicates of 10 pitfall traps were placed at each of the 17 altitudinal bands across a historical altitudinal gradient in the Cederberg Wilderness Area. Soil composition and vegetation cover were recorded during each sampling event. Additionally, temperature was measured continuously for over 20 years using i-Buttons. Overall, beetle abundance has decreased compared to historical data, whereas changes in species richness varied widely. Mean plant litter cover has increased by 282% and vegetation cover by 29%. Consequently, bare ground cover has decreased by 39%. The soil composition shows a 168% increase in clay, a 43% increase in silt, and a 38% decrease in rocks. The changes in the beetle assemblages, along with the potentially associated environmental factors, demonstrate that the effects of climate change might be causing a decline in beetle abundance. These results could suggest that similar environmental changes are affecting other less-studied locations and taxa within South Africa. The availability of a reproducible study providing historical data was crucial for this project, highlighting the importance of conducting long-term studies. These time-series comparative studies can help to determine ecosystem health, thereby guiding conservation efforts.

Diversity of soil invertebrates and their associated microbiota in an Alpine Grassland Ecosystem

Julia Seeber[1,2], Helene Blasbichler[1], Michael Steinwandter[1], Theresa Rhezak[2], Nadine Praeg[2], Giulio Galla[3], Heidi C. Hauffe[3], Paul Illmer[3]

[1]Eurac Research, Bolzano, Italy, [2]Universität Innsbruck, Innsbruck, Austria, [3]Fondazione Edmund Mach, San Michele all'Adige, Italy

The study of soil biodiversity is becoming increasingly important in the context of global change. Traditional approaches to studying diversity consider individual components or taxa within a given habitat (e.g. bacteria, earthworms), but often neglect the existence of complex interactions between invertebrates and microbial communities. The diversity of ground- and soil-dwelling invertebrates in grassland was investigated using soil core samples and pitfall traps along an elevation gradient from 1000 to 2500 m a.s.l. Additionally, the prokaryotic and fungal community composition of different sample types, including bulk soil, the rhizosphere soil of *Carex* spp. and *Festuca* spp. as well as members of the microfauna (bacterial-feeding nematodes), mesofauna (collembola) and macrofauna (earthworms, ground and rove beetles) were analysed by amplicon sequencing. The abundance and diversity of invertebrates decreased with increasing elevation. Each of the soil, rhizosphere and faunal samples exhibited unique microbial communities, although these overlapped to varying degrees depending on functional traits, trophic relationships and elevation. Predatory rove and ground beetles exhibited a low associated microbial diversity. Our study provides the first insights into the complex interactions between soil animals and the microbial community.

ICSZ Session 3 - Soil biodiversity for sustainable agriculture

ICSZ_S3_1 Tuesday 27 August, 09:45-10:00

Why is soil conservation agriculture a relevant lever to enable the restoration of soil biodiversity and functions?

Guenola Peres[1], Cécile Richard[1], Laurence Carteaux[1], Kevin Hoeffner[2], Daniel Cluzeau[2]

[1]Institut Agro Rennes-Angers, Rennes, France, [2]University of Rennes, Paimpont, France

At farm scale, soil conservation agriculture includes several agricultural practices (reduced mechanical soil disturbance, cover crops, long crop rotation, organic matter management). Many studies worldwide have analyzed the impact of these systems on different soil properties, but most of them focus on isolated properties (physical, biological or chemical properties). Moreover, many studies have used Long Term Experimental sites, where the effect on one or at least two practices (e.g. reduced mechanical disturbance, organic matter management) is assessed, while an integrated view of the impact of all practices is still lacking, especially at the farm level. In this study (SoilMan project) we assess how soil conservation agriculture impacts soil biodiversity (earthworm community, microbial biomass), soil properties (aggregate stability, nutrient content, hypha length) and ecosystem services (water regulation, yield). Twelve fields managed by farmers and located in Brittany (France) were studied, allowing the comparison of direct seeding and conventional ploughing systems. The results highlighted that, despite the heterogeneity of soil texture, direct seeding systems positively impacted earthworm abundance, biomass and diversity as well as anecic earthworm abundance. These systems also improved microbial biomass, nitrogen and carbon rates in the first 10 cm of soil. They increased aggregate stability at both depths [0-10; 10-20cm] linked to microbial biomass, carbon content, and length of hypha. Regarding provisioning service, wheat yields obtained in direct seeding systems were not lower than those under conventional ploughing systems. In conclusion, comparing to conventional systems, direct seeding systems by improving several soil functions and several ecosystem services (soil biodiversity conservation, nutrient cycling, soil structure maintenance) present a higher resilience capacity. Moreover, by maintaining yield, it reinforces the idea that these agroecological systems based on three major pillars (no mechanical disturbance, length and diversification of crop rotation, better organic matter management) give a real opportunity for developing sustainable practices.

Unravelling the effects of vineyard ground cover management practices on soil fauna community structure

Emogine Mamabolo[1], James Pryke[1], René Gaigher[1]

[1]Department of Conservation Ecology and Entomology, Stellenbosch University, Stellenbosch, South Africa

The management of ground cover, either in the form of planted cover crops and/or natural vegetation, has become a popular component of sustainable viticulture management. Ground cover in vineyards has potential to provide important resources to beneficial arthropods in the form of shelter and alternative food sources, such as nectar or pollen. Thereby leading to enhanced ecosystem services. Understanding the impacts of different ground cover management practices on soil biodiversity and ecosystem functions can provide important information to support the design of sustainable and biodiversity-friendly viticulture. The study aimed to understand how ground cover (e.g. cover crops or spontaneous vegetation) influence soil fauna community structure in vineyards. Small-scale environmental variables which could be possibly be responsible for shaping soil fauna responses were also measured. The study was conducted at 24 sites spread across commercial wine farms within the CFR in the Stellenbosch area, Western Cape, South Africa. Sampling was conducted following the methodology of the Tropical Soil Biology and Fertility (TSBF). Generalized linear mixed models (GLMMs) were used to examine the effects of ground cover treatment (cover vs no cover) soil fauna species richness, abundance, and functional diversity. The results revealed that ground cover significantly improved the community assembly of beetles, and spiders, however it had no significant effects on ants. The overall results highlight the significance of sustainable ground cover management and associated landscape factors for sustaining ecosystem services.

Soil biodiversity in sugarcane fields: Sweet dreams for soils in southern Africa

Juliette Chassain[1], John S. Terblanche[2], Charlene Janion-Scheepers[1]

[1]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Rondebosch, Cape Town, South Africa, [2]Department of Conservation Ecology and Entomology, Stellenbosch University, Stellenbosch, South Africa

Sugarcane cultivation is taking up large areas in southern Africa, where it has an important role in employment and represents a substantial part of farming income. Maintaining soil quality in these areas is essential to prevent environmental and social damage following long-term cultivation. However, soil quality in sugarcane fields is defined through physical and chemical properties, overlooking the importance of the biological components. Indeed, soil biodiversity is poorly studied in sugarcane fields in southern Africa. For the first time, this study focuses on soil biodiversity in sugarcane estates in Zambia, Malawi and Eswatini. Using a combination of taxonomic, molecular, ecological, and stable isotope tools, it aims to assess soil biodiversity in sugarcane fields subjected to different management (conventional versus regenerative agriculture) and harvesting (green cane versus field burning) practices. Among other methods, pitfall traps are used to assess the activity-density of organisms at the soil surface, while C and N stable isotope ratios are determined to characterize trophic niches of the most abundant soil fauna groups. Preliminary results on samples collected in Zambia provide a first estimate of the activity-density of soil organisms and shed light on the trophic functional diversity of decomposers and soil predator-prey relationships in sugarcane fields. Overall, this study could help to understand the composition and resilience of soil biodiversity in sugarcane cultivation areas while also providing baseline information on soil biodiversity that is still understudied in Africa.

Sustainable farming practices boost soil biodiversity and functionality in rainfed cereal cropping systems

Pablo Homet[1], Marta Rodriguez-Reyes[1], Javier Alejandre[2], Maria del Mar Alguacil[3], Manuel Delgado-Baquerizo[4], Gema del Río[2], Luna Medrano[4], Jose Antonio Pascual[3], Antonio David Prior-Rivas[5], Margarita Ros[3], Daniel Sacristán[6], Antonio Rafael Sanchez Rodriguez[5], Raúl Ochoa-Hueso[1]

[1]University Of Cadiz, Instituto de Investigación Vitivinícola y Alimentaria, Puerto Real, Spain, [2]Gabinete Técnico, Unión de Pequeños Agricultores y Ganaderos. , Madrid, Spain, [3]Centro de Edafología y Biología Aplicada del Segura (CEBAS) CSIC, Murcia, Spain, [4]Laboratorio de biodiversidad y funcionamiento ecosistémico. Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS) CSIC, Sevilla, Spain, [5]Unidad de edafología, Departamento de Agronomía, Campus Universitario de Rabanales, Universidad de Córdoba, Córdoba, Spain, [6]Departamento de Biología Vegetal, Universidad de Valencia, Burjassot, Spain

Soil biodiversity is key to the functioning and health of agroecosystems, including rainfed cereal systems, playing a central role in the processes involved in the recycling of organic matter. Farming practices affect soil biodiversity, thereby affecting the long-term health and sustainability of crops. Rainfed cereal crops are one of the agroecosystems most threatened by climate change in the Iberian Peninsula and constitute the most widespread production sector in Spain. Representing ~44% of the total agricultural surface area (~12 million hectares), rainfed cereal crops have great economic and environmental importance. In this study, we characterised the abundance and diversity of soil micro- and mesofauna, as well as soil functioning (enzymatic activities) across 291 plots distributed throughout the Iberian Peninsula under three types of management (conventional, organic, and no-tillage). Compared to organic and no-till farming, conventional farming resulted in the reduction of soil micro- and mesofauna diversity and richness, as well as the absence or lower abundance of some common groups such as oribatid mites and some nematode families. Other fauna groups such as Prostigmatid mites (predators) were significantly more abundant in organic farming than in other agricultural practices. Furthermore, soil enzyme activity increased in response to organic and no-till farming. Our data highlight the negative effects of conventional agriculture on soil fauna and soil enzyme activity and underscore the potential of sustainable management practices, particularly organic farming, to restore the complexity of soil food webs and soil functioning in one of the most widely distributed and economically important agroecosystems in Mediterranean regions, rainfed cereal crops.

ReCROP: Effect of different alternative practices on soil biodiversity in Mediterranean agro-systems

Ninon Delcourt[1], Alan Vergnes[1], Susana Pereira[2], Helena Moreira[2], Paula ML Castro[2], Ángeles Prieto-Fernandez[3], Carmen Trasar Cepeda[3], Lur Epelde[4], Ali Boularbah[5], Leila Benidire[5], Fatima-Zahraa El Balghiti[5], Ali Sahli[6], Mohamed Allani[6], Luigi Paolo D'Acqui[7], Sara Di Lonardo[7], Jérôme Cortet[1]

[1]CEFE, Univ Montpellier, Cnrs, Ephe, Ird, Univ Paul Valéry , Montpellier, France, [2]Universidade Católica Portuguesa, CBQF — Centro de Biotecnologia e Química Fina, Laboratório Associado, Escola Superior de Biotecnologia, Rua Arquiteto Lobão Vital, Apartado 2511, 4202–401, Porto, Portugal, [3]Instituto de Investigaciones Agrobiológicas de Galicia (IIAG), Consejo Superior de Investigaciones Científicas (CSIC), Avda. de Vigo s/n, Santiago de Compostela 15705, Spain, [4]NEIKER-Tecnalia, Basque Institute of Agrarian Research and Development, c/Berreaga 1, E-48160, Derio, Spain, [5]FSTG - Faculté des Sciences et Techniques, Université Cadi Ayyad, Morroco, [6]INAT-Tunisian National Institute of Agronomy, Carthage University, Tunisia, Tunisia, [7]IRET-CNR - Istituto di Ricerca sugli Ecosistemi Terrestri, Italy

Conventional agriculture are the prevailing agricultural system referring practices such as extensive tillage, monoculture and monovarietal systems with high levels of chemical inputs to achieve increasing productivity objectives. These intensive management methods have significant negative externalities on soil physico-chemical and biological properties such as physical (erosion, compaction) and chemical (pesticides, fertilisers, herbicides) disturbance of the soil, resulting in a consequent loss of nutrient and water availability, as well as with the decline in soil biodiversity related to these agro-systems. It is thus essential to encourage agricultural practices that contribute to the improvement of soil biodiversity, as a key attribute of a sustainable agricultural system. In this context, ReCROP is a European project that aims to identify sustainable and resilient agricultural production systems in the Mediterranean region through the combined use of biotechnological tools, such as bioinoculants, and environmentally friendly agronomic practices. Three types of local crops (i.e. vineyards, maize and aromatic/medicinal plants) subjected to a wide range of practices (organic farming, bioinoculant, mulching, compost), were investigated in various Mediterranean countries (Italy, Spain, France, Portugal, Morocco and Tunisia,). A multi-taxa approach (i.e. springtails, ants, spiders and carabids beetles) was used to assess the influence of these practices on the abundance, diversity as well as structure community of soil fauna. A positive effect of compost on the abundance of collembola and epigeous macrofauna was observed in soil from vineyards and aromatic crop. In vineyards, a change in the community structure of ants and spider was observed when mulching was applied. In maize crop, lower abundances of carabid beetles were observed in organic farming, probably linked to the intensity of tillage. Soil

biodiversity are essential for ecosystem processes leading to essential functions, this work will contribute to identify which practices are beneficial for soil fauna, thus improving the functioning of Mediterranean agricultural soils.

Large-scale soil biodiversity monitoring across different pedoclimatic regions: Challenges and opportunities

Maria J.I. Briones, the SOB4ES consortium[1]

[1]University of Vigo, Vigo, Spain

The EU-funded project SOB4ES aims to make soil biodiversity and its contribution to ecosystem services visible to society. A major issue for soil biodiversity integration into EU policies is finding and testing indicators of soil biodiversity. We will achieve this by providing a comprehensive understanding of the spatial and temporal dynamics of soil biodiversity, and analysing its functioning through foodweb and network analysis in response to different land use types and intensities. By focusing on nine major pedoclimatic (soil type-climate) regions and land uses, including soils from urban, agriculture, forest, (semi)-natural, wetlands, drylands, industrial and mining environments, SOB4ES will cover most relevant EU climate-soil type-land use conditions. Accounting for landscape and habitat heterogeneity together with the dynamic changes in soil properties and organismal activities create several challenges in soil monitoring and when translating the data to policy-makers. The SOB4ES approach has been designed to harmonise the protocols to sample soils and the targeted soil organisms, to ensure that (i) spatial and temporal variability is included and (ii) climatic differences (latitudinal gradients), habitat specificities (e.g., forest floors vs. mineral soils) and land uses (natural vs. anthropogenic systems) are integrated. Here, we present an overview of our experiences of soil biodiversity monitoring at the European level by describing our field sampling strategies, and a summary of the data and metadata that is being collected. Finally, we will discuss how we are going to address the interoperability of our analyses and databases, and their potential use in the new European soil monitoring legislations, as well as in National initiatives of soil biodiversity monitoring.

Pesticide impact on soil biodiversity across Europe

J. Kóninger[1], M. Labouyrie[2,3], C. Ballabio[3], F. Romero[2], P. Panagos[3], A. Jones[3], F. Franco[3], L. Tedersoo[4], M. Bahram[4,5,6,3,7], A. Orgiazzi[3], M.J.I. Briones[1], M.G.A. van der Heijden[2]

[1]University of Vigo, Vigo, Spain, [2]Agroscope, Zürich, Switzerland, [3]Joint Research Centre, Ispra, Italy , [4]University of Tartu, Tartu, Estonia , [5]Swedish University of Agricultural Sciences, Uppsala, Sweden, [6]Aarhus University, Denmark , [7]European Dynamics, Brussels, Belgium

Despite the widespread distribution of pesticides in soils, their impacts on soil biota are not fully understood. Here, we examined the effects of pesticides on soil biodiversity across 373 sites in 26 European countries, covering woodlands, grasslands, and croplands. In total, 118 synthetic pesticide residues and their metabolites were measured using multi-residue LC-MS/MS and multi-residue GC-MS/MS methods. Soil biodiversity was assessed using DNA metabarcoding methods including DNA sequences of archaea, bacteria (16S), fungi (ITS), protists, nematodes and arthropods (18S) as part of the EU-wide LUCAS soil biodiversity survey. The results showed that 63 different pesticides were detected in 70% of the investigated sites, including 12 pesticide residues not currently approved for use in the EU. This pesticide occurrence was significantly correlated with the diversity and richness of soil biota, and the strongest effects were observed on plant parasitic protists, bacterivorous nematodes, herbivorous nematodes, and arbuscular mycorrhizal fungi. Our results also evidenced that pesticides were more persistent at sites with less leaching risk, higher nutrient retention and in compacted soils. The combined diversity index (multidiversity index) could not describe the overall effect of any given product on specific organisms, which highlights the need to consider several taxonomic and functional groups when assessing the effects of pesticides at large spatial scales. Our results emphasise the urgent need for testing and integrating multiple pesticide effects on the entire soil food web across ecosystems in regulatory decision-making.

Earthworm contribution to sustaining soil fertility: Current challenges and spatial analysis prospects

Andrey Zaitsev[1], Birgit Lang[1], Bibiana Betancur-Corredor[1], Gabriel Salako[1], David Russell[1]

[1]Senckenberg Museum of Natural History Görlitz, Görlitz, Germany

Human population growth and respective demand in food creates unacceptable risks to soil ecosystems that cannot be compensated by excessive application of chemicals without devastating trade-offs. Despite existing positive cases of using earthworms to improve soil quality, spatially explicit analysis covering larger territories has not been performed so far. In our study we reviewed the role of earthworms in soil bioturbation, feeding activity and carbon stabilization across different temperature, moisture and soil textures typical for German agrolandscapes. Our meta-analysis proved that earthworm feeding rates and casting activity are highest at medium organic matter content appeared to stimulate substrate ingestion. Feeding rates surprisingly turned to have been somewhat reduced at soil temperature between 18- and 22-degrees in the field. This unexpected "activity crisis" needs further investigation. It may depend on the species identity and allocation of earthworm species to certain functional guilds. Soil water content showed a moderately positive but still non-linear impact of the earthworm activity with the highest values achieved at 75-80% relative humidity at standard summer temperatures in Germany. Further research is required to properly quantify interactions of all three reviewed factors in the spatial matrix of the studied soil types with potentially involving additional soil parameters. With this respect we found that among others conveyor-belt models with parametrization and embedded causality analysis based on bedrock, land use, physicochemical parameters, earthworm density and species identity, and crop type deliver more robust and realistic results and fit best the objectives of soil quality assessments. Next step would be associated with matching results of the spatial earthworm distribution modelling across the country and resulting representation of earthworms belonging to different ecological groups in assessing their potential to stabilize organic matter in soil. This research was supported by the German Federal Ministry for Education and Research (BMBF) via BonaRes Programme.

ICSZ_S4_1 Tuesday 27 August, 13:30-13:45

Testing the applicability of Regional Red List assessments to soil invertebrates using five Canadian earthworm species

Helen Phillips[1,2,3], George G. Brown[4,5], Sam W. James[6], Jérôme Mathieu[7], John Warren Reynolds[8,9], Maheshi E. Dharmasiri[3], Claire L. Singer[3], Maria J.I. Briones[10], Heather C. Proctor[11], Erin K. Cameron[3]

[1]Helsinki University, Helsinki, Finland, [2]Netherlands Institute of Ecology (NIOO KNAW), Wageningen, Netherlands, [3]Saint Mary's University, Halifax, Canada, [4]Embrapa Florestas, Colombo, Brazil, [5]Federal University of Paraná, Curitiba, Brazil, [6]Maharishi International University, Fairfield, USA, [7]Institut d'Ecologie et des Sciences de l'Environnement de Paris, Sorbonne Université, CNRS, UPEC, INRAE, IRD, Paris, France, [8]Oligochaetology Laboratory, Kitchener, Canada, [9]New Brunswick Museum, Saint John, Canada, [10]Universidad de Vigo, Vigo, Spain, [11]University of Alberta, Edmonton, Canada

Earthworms (Annelida: Clitellata: Crassiclitellata) are prominent members of the soil community, important to many ecosystem functions. Despite this, they are rarely considered in conservation assessments, including the IUCN Red List assessments used to assess species at risk. To investigate the applicability of the IUCN Regional Red Listing protocol to soil invertebrates, we assessed the conservation status of five earthworm species known to be native to Canada using this protocol and all available occurrence records. In Canada, no earthworm species have yet been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Due to the lack of data on population sizes and their trends, all five species were assessed using their Extent Of Occurrence (EOO) (Criterion B). One species was assessed as Vulnerable, two were assessed in non-threatened categories, and two were assessed as Data Deficient. For the majority, the main threats identified were the continuing loss of potential habitat due to land conversion and resource exploitation, as well as the effects of climate change. While the assessments were possible, increasing the amount of data, including but not limited to distribution and habitat preferences, would make the assessment process easier and status decisions better supported. We hope that these Red List assessments for Canadian earthworm species will encourage monitoring of earthworm populations and other soil organisms, both within and outside Canada.

Soil biodiversity in protected, near-natural forests: A transnational monitoring scheme

Helene Blasbichler[1], Michele Bresadola[1], Andreas Hilpold[1], Julia Seeber[1,2]

[1]Eurac Research, Viale Druso 1, 39100 Bolzano, Italy, [2]Leopold-Franzens-Universität, Innsbruck, Austria

Soil biodiversity is immense and includes a large taxonomic diversity of organisms, many of which are still unknown due to the challenges posed by physical inaccessibility and taxonomic gaps. Despite its fundamental role in essential soil processes, such as nutrient cycling and carbon sequestration, comprehensive data on soil biodiversity are still lacking. Therefore, transnational monitoring schemes are urgently needed to define measures for conserving and restoring soil biodiversity. In a pilot study within the Biodiversa+ partnership we investigate and test the necessary steps towards such a monitoring system, using near-natural forests as case study system. In the first year of the pilot project, a step-by-step protocol was implemented to collect and analyse soil samples for their properties, to deploy pitfall traps and extract soil cores to assess invertebrate diversity and take eDNA samples for microbial diversity. A comparison between traditional and molecular species identification methods was made to provide methodological recommendations for a future transnational monitoring system. Here we present first results: The botanical survey grouped Mediterranean and supra-Mediterranean sites together, as well as Alpine and Boreal coniferous forests, and Nemoral beech and oak forests. Soil properties varied significantly among forest types, with coniferous forests having higher humus and total nitrogen, and thermophilous forests showing higher pH values. Invertebrate diversity was lower in thermophilous forests compared to beech forests, while oak and coniferous forests displayed higher diversity. Soil-dwelling invertebrates were significantly more diverse only in oak forests. Comparison of traditional and molecular species identification methods showed little overlap.

An urgent call for policy on the worldwide terrestrial isopod trade

Pallieter De Smedt[1,2], Nathan T Jones[3], Benedikt Kästle[4], Jairo Robla[5], Ivanklin Soares Campos Filho[6], Spyros Sfenthourakis[7], Stefano Taiti[8], Kris Verheyen[1], Katalin Szlavecz[9]

[1]Forest & Nature Lab, Ghent University, Gontrode, Belgium, [2]Spinicornis, Belgian Terrestrial Isopod Group, Bonheiden, Belgium, [3]American Isopod and Myriapod Group, USA, [4]Dept. of Geosciences, University of Tübingen, Tübingen, Germany, [5]Dept. Conservation Biology and Global Change, Doñana Biological Station (EBD-CSIC), Seville, Spain, [6]Universidade Federal de Campina Grande, Campina Grande, Brazil, [7]Dept. of Biological Sciences, University of Cyprus, Aglantzia, Cyprus, [8]Research Institute on Terrestrial Ecosystems, Italian National Research Council, Florence, Italy, [9]Dept. of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, USA

Wild animals traded as pets face an elevated risk of extinction, particularly when adequate policies are lacking. Invertebrates, in particular, are underrepresented in both national and international legislation that aims to regulate the worldwide pet trade. Among these invertebrates, terrestrial isopods—which function as detritivores—have traditionally been kept to clean terraria housing vertebrates and other arthropods. However, over the past two decades, they have gained popularity among hobbyists due to their ease of care, vibrant colours, minimal space requirements, and being harmless. Given this growing interest, we advocate for including terrestrial isopods in national and international regulations. Many traded species have limited distribution areas, sometimes with only a single known locality. Collecting these species in the wild poses a threat to local populations. Species are continuously added to the market. Many, especially from tropical regions such as Southeast Asia, Central and South America, are still to be described scientifically. We propose urgent actions to preserve terrestrial isopod diversity worldwide and to use the precaution principle, regulating the trade of species with an unknown conservation status. In addition to threatening native populations, this trade of live specimens increases the probability of alien species introductions and invasions to new regions.

Modeling and predicting earthworm diversity and distribution in France: A comparative approach using multiple algorithms

Daniel Cluzeau[1], Kevin Hoeffner[1], Abdourahmane Diallo[1], Celine Pelosi[2], Walid Horrigue[3], Maria J. I. Briones[4], Kevin R. Butt[5], Thibaud Decaëns[6], Sylvain Gérard[7], Sarah Guillocheau[1], Mickael Hedde[7], René .C. Le Bayon[8], Bart Muys[9], Helen R. P. Phillips[10], Guénola Pérès[11]

[1]University Of Rennes, UMR ECOBIO, Rennes, France, [2]INRAE, UMR EMMAH, Avignon, France, [3]INRAE UMR Agroécologie, Dijon, France, [4]Departamento de Ecología e Biología Animal, Vigo, Spain, [5]University of Central Lancashire, Preston, United Kingdom, [6]CEFE, Montpellier, France, [7]INRAE UMR Eco&Sols, Montpellier, France, [8]University of Neuchâtel, Neuchâtel, Switzerland, [9]KU Leuven, Leuven, Belgium, [10]University of Helsinki / Netherlands Institute of Ecology , Helsinki / Wageningen, Finland / Netherlands, [11]Institut Agro Rennes-Angers, UMR SAS, Rennes, France

Earthworms, as crucial ecosystem engineers, contribute significantly to various soil functions and ecosystem services such as water regulation, nutrient dynamics, and biomass production. Recognized as sensitive indicators of soil health, their conservation is pivotal for maintaining biodiversity and ecosystem stability. However, the factors influencing their biogeography and community composition are still not well understood. Our study aimed to assess and compare the effectiveness of five modeling algorithms in predicting three key earthworm community parameters: total abundance, total biomass, and taxonomic richness in France. We utilized the LandWorm database (~8000 communities, FRB 2023-2025), which primarily contains data on earthworm communities across mainland France. To enhance our analysis, we integrated environmental variables from additional databases related to climate (temperature, rainfall…) and soil properties (texture, carbon, pH…). The algorithms we evaluated included Generalized Linear Models (GLM), Generalized Additive Models (GAM), Random Forest (RF), Generalized Boosted Models (GBM), and Artificial Neural Networks (ANN). This comparative approach allows us to determine the most effective model for predicting each parameter. Our results highlight that the Random Forest model performed best for predicting earthworm abundance, achieving the highest R^2 of 0.48 with a RMSE of 18 individuals/m^2. Similarly, for taxonomic richness, the Random Forest model yielded the best R^2 of 0.55 with a RMSE of 1.8 taxa. This research not only advances our understanding of earthworm community distribution but also supports the design of targeted conservation strategies, ensuring the protection and sustainability of vital soil functions. By highlighting the effectiveness of diverse modeling algorithms, this study contributes to the broader field of soil biodiversity assessments and the strategic planning of land use and environmental conservation initiatives.

Distribution of enchytraeid functional groups in soils of the Cis-Urals transect

Polina Guseva[1], Daniil Korobushkin[1]

[1]A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, 33, Leninsky Prospect, Moscow, **Россия**

One of the current tasks of modern soil ecology is to study the general change patterns in soil biodiversity. Soil invertebrates, by participating in the decomposition of organic matter, determine microbiological activity, availability of mineral nutrients, and thus soil fertility. Enchytraeids are one of the least studied groups of soil mesofauna, which, nevertheless, play an important role in the decomposition of soil organic matter in the Northern Palearctic. The development of enchytraeid functional groups based on species diversity and abundance dependence on soil parameters can be applied in ecological and agricultural research. This study aimed to determine and assess the influence of physico-chemical soil properties on the abundance, species and functional diversity of soil enchytraeids along a latitudinal Cis-Ural climatic gradient. We collected 180 soil and litter samples within five model sites of the transect. Animals were extracted using the Graefe method. The species were identified based on morphology and molecular methods. The total soil C and N content, pH in aqueous suspension and soil texture were measured. Functional groups were identified based on preferences for soil conditions (based on occurrence and abundance data), feeding guilds were taken from the literature. A total of 35 enchytraeid species were found, with the greatest species diversity observed in the Southern taiga, while the highest abundance was observed in the Broad-leaved forests and Forest-steppe (up to 38579.2 ind./m2). The soil texture is an important factor affecting enchytraeid abundance. We also have identified species sensitive to C/N content and soil acidity (e.g. *Fridericia lacii*, *F. paroniana, Henlea perpusilla*) and assessed their latitudinal distribution. Moreover, some morphological traits as the presence of clitellum and spermatheca are highly depend on latitudinal distribution. Generally, our research provides new information on distribution and ecology of such least studied soil animals as enchytraeids. The study was supported by RSF (grant #23-14-00201).

ICSZ_S5_1 Wednesday 28 August, 14:00-14:15

Structure and functioning of soil animal food webs across temperate and tropical forests

Anton Potapov[1,2,3], Sergey Tsurikov[4], Stefan Scheu[2], Alexei Tiunov[4]

[1]Senckenberg Museum for Natural History Görlitz, Görlitz, Germany, [2]University of Göttingen, Göttingen, Germany, [3]German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany, [4]A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia

The soil food web connects resources, microorganisms and fauna in a single interaction network that underpins soil biological processes. However, variation of soil food web structure and functioning across large environmental gradients remains unknown, hampering generalisations of any suggested links between soil fauna and soil functions. Here, we used two complementary approaches to quantify soil animal food web variation across forest types, from southern taiga to rainforests. First, we applied the energy flux approach to explore patterns of energy distribution across micro-, meso- and macrofauna. We showed that tropical soil food webs have consistently higher energy flux, proportionally higher predation rates (31 vs 18-27% of the total energy flux) and relied more on the plant energy channel (21 vs 10%), but less on the bacterial (5 vs 9-18%) and litter energy channels (14 vs 18-32%), than temperate soil food webs. Second, we compiled a large database (>8000 records) of stable isotope composition of soil animals to see how detritivory and microbivory in soil animal communities change with environmental temperature and litter quality. Despite little effect of temperature, shift in ^{15}N concentrations suggested that in most cases low litter quality (high %C and low %N) resulted in a switch from feeding directly on litter to feeding on microorganisms. Thus, soil animals change their functional role from competitors to consumers of microbes. Our studies show how the functioning of soil animal food webs changes across biomes with different climate and litter quality and summarise the functional roles that animals play in different biomes.

Diverse, but least studied: The trophic guilds of Enchytraeidae and Isopoda species

Daniil Korobushkin[1], Polina Guseva[1], Saifutdinov Ruslan[1], Zaytsev Andrey[2], Maxim Degtyarev[1], Konstantin Gongalsky[1]

[1]A.N. Severtsov Institute of Ecology and Evolution RAS, Moscow, Russian Federation, [2]Senckenberg Museum for Natural History Görlitz, Görlitz, Germany

Species diversity of litter decomposers can be very high, while many of these species are morphologically similar and treated as an ecologically uniform taxa, suggesting the proximity of occupied trophic niches. Such taxa exist both among macrofauna (woodlice) and mesofauna (enchytraeids) primarily due to the difficulty of species identification. Recent studies of collembolans, earthworms and some other saprophages have revealed trophic guilds within these taxa. Enchytraeid and woodlouse species are involved in belowground trophic interactions, which could be distinguished by their morphological characteristics and ecological traits. To quantify this, we analyzed **δ**13C and **δ**15N stable isotopes in 16 enchytraeid and 9 woodlice species across various habitats. Their isotopic niches were compared with different potential food sources and other invertebrates. We found that isotopic niche of enchytraeid species depends on soil stratification and is reflected in the chaeta number per bundle, and, to a lesser extent, on the size or genera identity. These findings enabled us to split enchytraeids into three guilds within the functional group of secondary decomposers: (i) epigeic – include litter-dwelling species that predominantly feed on plant material but also can ingest microorganisms; (ii) epi-endogeic – inhabiting upper humified soil and F-litter horizons, feeding primarily on various microorganisms; (iii) endogeic – consuming old processed humified and dissolved organic matter in lower H-horizon and even mineral A-horizons beneath. The **δ**15N range of woodlice species was twice smaller and didn't reach 4.5‰, thus allowed us to identify woodlice as primary decomposers that split resources via stratification in the soil and microhabitat conditions. Woodlice were divided into fresh-leaves, humified-leaves and soil inhabitants, isotopic position of which may vary depending on the biotopes and the litter quality. Our results are an important step forward in uncovering functions of yet poorly studied soil saprophage taxa. The study was supported by RSF (Grant #23-14-00201).

Mycorrhizal trophic channel in soil foodwebs - blurred or narrow?

Andrey Zuev[1,2]

[1]Senckenberg Museum of Natural History Görlitz, Görlitz, Germany, [2]A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia

Importance of the mycelium of mycorrhizal fungi in the nutrition of soil invertebrates remains a controversial issue. So far, field and laboratory experiments were only able to approve constant trophic relationships with mycorrhizal fungi for a very few taxa of soil invertebrates. Most of known obtained data are indirect: for example, it has been observed that abundance of some invertebrates changed when fungi are experimentally added to the system or mycelium is damaged although is biomass was not reduced. In addition, the preferred consumption of dark-coloured saprotrophic micromycetes by soil invertebrates may lead to an increase in the proportion of mycorrhizal fungi in the soil as they strengthen the competitive advantage. Therefore, we hypothesized that the low impact of soil mycophages on mycorrhizal fungi, and the limited data of soil invertebrate feeding on mycorrhizal fungi, may be related to either the low intensity or low specificity of trophic relationships between soil mycophages and mycorrhizal fungi. In order to explore this hypothesis thoroughly, a comprehensive study incorporating multiple field experiments conducted through traditional methods of soil zoology alongside modern techniques of instrumental analysis was carried out. As a result, the list of soil invertebrate taxa, which are feeding on mycorrhizal fungi have been expanded. Furthermore, we confirmed that the energy received from mycorrhizal fungi is transferred to higher trophic levels of soil foodwebs. Nevertheless, no significant effect of reduced abundance of soil invertebrates on mycorrhizal mycelium biomass was found. Thus, our study showed that despite its abundance, mycorrhizal fungi mycelium is a specific food resource that is utilized only by certain groups of soil invertebrates.

ICSZ_S6_1 Thursday 29 August, 09:45-10:00

Subterranean ants of the KwaZulu-Natal midlands: The first systematic survey for Southern Africa

C. Munyai[1], L.R. Khoza[2], S. Foord[3]

[1]School of Life Sciences, College of Agriculture, Engineering and Science, University of KwaZulu-Natal, Scottsville, Pietermaritzburg, South Africa, [2]Department of Biological Sciences, University of Cape Town, Rondebosch, Cape Town, South Africa, [3]Department of Zoology, SARChI-Chair on Biodiversity Value and Change in the Vhembe Biosphere Reserve, Centre for Invasion Biology, School of Mathematical and Natural Science, University of Venda, Thohoyandou, South Africa

There is no doubt that a substantial number of ants (Formicidae: Hymenoptera) live exclusively in the soil. As with most other invertebrate groups, subterranean ant species are poorly documented and their basic ecology is not known. Considering the phylogenetic significance of this group and the possibility of them being a much more important component of ant ecology, this study presents the first systematic survey of subterranean ants of Southern Africa across three different habitat types (grassland, natural forest and commercial *Eucalyptus* (gum) plantations). We compare diversity between and within these habitats and identify cryptobiotic taxa. Standardised subterranean baited traps were used for ant sampling. A total of 6,453 ant specimens representing five subfamilies, ten genera and 13 species were collected. *Dorylus helvolus* was the most frequently sampled species in subterranean traps, with 58% of total ant abundance. The grasslands had the most species (10, five of which were cryptobiotic), compared to the forest (four, all cryptobiotic) and *Eucalyptus* plantations (five species, two cryptobiotic). *Eucalyptus* plantations had the highest mean (604.8 ± 814.9) abundance compared to forest (567 ± 929.2) and grassland (116.1 ± 178.4) habitats. Six species representing 94% of the total abundance of the sampled ants were cryptobiotic. Ants in the genus *Dorylus* and *Solenopsis* dominated the Natal midlands subterranean ant community. Further studies should explore the impact of seasonal variation on these ant assemblages.

The effects of different forestry treatments on soil mesofauna communities in a deciduous forest

Norbert Flórián[1], Veronika Gergócs-Winkler[1], Miklós Dombos[1], Péter Ódor[2]

[1]Institute for Soil Sciences, HUN-REN Centre for Agricultural Research, Martonvásár, Hungary, [2]Institute of Ecology and Botany, HUN-REN Centre for Ecological Research, Vácrátót, Hungary

Sustainable forest management, facilitated by various forestry technologies, is vital for preserving and enhancing forest biodiversity. These technologies, beyond economic objectives, aim to bolster forest biodiversity and vitality. Soil-dwelling mesofauna, a significant component of forest biodiversity, plays a crucial role in ecosystem services. We examined the impact of five forest management treatments (preparation cutting, clear-cutting, retention tree group, and gap-cutting) on soil mesofauna, in an 80-year-old deciduous forest. Our study focused on the abundance, diversity, and traits of soil mesofauna, particularly Collembola. We followed seasonal changes for a year six years after the treatments across two soil depths (0-10 cm and 10-20 cm). Disturbance levels influenced mesofauna groups primarily in the upper 10 cm, with seasonality showing no interaction with treatments. Open habitats exhibited a reduced abundance of soil macro- and mesofauna, with varying effects across groups (Acari, Collembola, and other mesofauna). Diversity values did not differ among treatments. In the most open habitats (gaps and clear-cutting), we found a decreased abundance of soil-living macro- and mesofauna. Interestingly, trait values related to disturbance resistance increased in the 'preparation cutting' and 'retention tree' groups, suggesting that moderate disturbance and vegetation change might play a role. Seasonality showed more significant differences in soil mesofauna communities than forestry management but the treatments mainly showed correlations with Collembola communities.

Diversity of soil macrofauna in anthropogenically disturbed broad-leaved-coniferous forests (an example from the Tver region)

Nina Pronina[1], Daniil Korobushkin[1], Ruslan Saifutdinov[1], Ksenia Dudova[1,2]

[1]A.N. Severtsov Institute of Ecology and Evolution, Moscow, Russian Federation, [2]Moscow State University, Moscow, Russian Federation

Vegetation and soils in forest ecosystems could be changed by human activities at global and local level. These transformations affect the quantity and quality of ecosystem functions and services (such as soil formation, organic matter decomposition, biodiversity, nutrient cycling). However, studies on the effects of forest ecosystem transformation near cities have mainly focused on vegetation succession and land cover changes, but generally do not address soil biota. For this purpose, soil samples were collected from five disturbed model plots in the Central Forest State Nature Reserve: zonal coniferous-broadleaved forest (control plot); recreational forest; clear-cutting; birch forest; monoculture (spruce) forest plantation. Each forest type was triplicated and four soil samples were collected within each replication. Extraction of invertebrates was performed using Tullgren funnels and further identified mostly to species level. ANOVA was used to assess the effect of forest type on environmental parameters and macrofaunal abundance; NMDS and PERMANOVA were used to assess the taxonomic similarity of macrofaunal communities; CCA was used to assess the effect of environmental parameters on soil macrofaunal communities. After processing all collected data, indices of ecosystem multifunctionality were compiled and compared. We found, that although the mean macrofaunal abundance was doubled in the recreationally disturbed forest compared to the zonal control, no statistically significant differences were found. The mean number of taxa differed significantly between forest types, with the highest number of taxa in the recreationally disturbed forest (19 species) and the lowest in the monoculture spruce forest (seven species). The main parameter explaining the distribution of macrofaunal communities was litter depth. Results also showed that monoculture and zonal forests were taxonomically similar, but there were differences between birch, clear-cut and recreational disturbed forests. Anthropogenic impacts reduce the resilience of ecosystems. This research was supported by the Russian Science Foundation (Grant No: 23-74-01143).

Effects of two key plant trait spectra on soil animal communities through litter layer properties

S. Fujii[1], M. P. Berg[2,3], R. S. P. Van Logtestijn[2], S. Makino[1], J. H. C. Cornelissen[2]

[1]Department of Forest Entomology, Forestry and Forest Products Research Institute, Tsukuba City, Ibaraki Prefecture, Japan, [2]Vrije Universiteit Amsterdam, Amsterdam, The Netherlands, [3]Groningen University, Conservation and Community Ecology Group, Groningen, The Netherlands

Despite a huge amount of research linking invertebrates to soil properties, we still do not know the general principles that determine the composition and dynamics of soil animal communities. In this era of significant environmental change, which could affect belowground organisms and the soil processes they regulate, we urgently need to find key factors that can be used to predict soil animal community assembly. Soil animals live in habitats composed of plant litter, the quality of which depends on trait afterlife effects of the plant community. We hypothesized that the habitat and food qualities of litter for soil animals can be predicted both by physical traits related to litter size and shape spectrum (SSS) and by biochemical traits related to the plant economics spectrum (PES). To test this hypothesis, we conducted a field incubation experiment using leaf litter of 16 temperate tree species and collected all soil meso- and macrofauna. We found these two plant trait spectra accounted for more than 60 % of the variance in litter quality in a principle component analysis. SSS-related traits strongly explained litter layer properties, such as pore ratio and water-holding capacity. These SSS-related litter traits and litter layer properties determined soil animal communities assembled in seven weeks after the experimental set-up, while PES-related traits were less powerful predictors of community assembly. Especially, dominant mesofaunal taxa, such as Collembola, Oribatida and Mesostigmata, were strongly determined by litter size, shape and water holding capacity. We suggest that this approach applying the trait-based framework including SSS and PES has much promise for predicting and assessing soil animal community assembly more widely.

Are cities outposts of biological invasions or refugia for woodlice under climate change?

Konstantin Gongalsky[1], Daria Kuznetsova[2]

[1]A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russian Federation, [2]Unaffiliated, Edinburgh, UK

How much aridization as a result of the recent climatic changes affects the diversity of soil fauna remains obscure. Woodlice are quite abundant and play a crucial role in the utilization of organic matter. There is a tendency for many demographic, behavioural, and genetic traits of species that adapt to new environments to change as cities grow. In particular, the capacity to significantly alter their ecological requirements is a major factor in the success of many species' colonization in urban environments. In contrast to the nearby intact biotopes, the fauna of cities is altering significantly in this regard. Simultaneously, the cities are being actively colonized by the so-called synanthropic species, which are spreading over the Globe. For organisms that are able to penetrate the nearby intact ecosystems, this may act as a sort of outpost. Cities have highly distinct mesoclimates from the surrounding landscapes, yet at the same time. Conversely, this can result in the local fauna's habitats being preserved as a result of climate change, specifically through increased aridization. It is still uncertain to what degree these two urban processes connect to the woodlice case. Thus, under climate change, such as global warming, woodlice have the potential to increase their functional importance in arid areas. We will showcase the findings of our investigation into the distribution and fauna of woodlice in both urban and surrounding natural environments. We evaluate the differences in a collection of microhabitats and several abiotic and biotic parameters between urban ecosystems and undisturbed natural ecosystems. We then assess long-term dynamics (over the previous 70 years) by comparing current data with historical data regarding the fauna and population of woodlice. Lastly, we will provide dynamic maps showing the distribution of the most significant woodlice species in the area under study.

Preliminary assessment of soil arthropod communities across different urban land use types in Rome (Italy)

Pietro Gardini[1,2], Simone Sabatelli[1,2], Simone Fattorini[3], Paolo Audisio[1,2]

[1]Department of Biology and Biotechnology "Charles Darwin", Sapienza University of Rome, Rome, Italy, [2]National Biodiversity Future Center (NBFC), Palermo, Italy, [3]Department of Life, Health and Environmental Sciences, University of L'Aquila, L'Aquila, Italy

Soil represents a fundamental yet delicate ecosystem susceptible to threats and alterations that can significantly impact its biota, especially in urban areas. Soil microarthropods, due to their limited dispersal ability and high sensitivity to soil conditions, may serve as biological indicators of soil quality. The aim of this study is to provide a preliminary investigation on the response of soil arthropod communities to anthropogenic pressures in urban Rome (Italy), a historically complex metropolis. Microarthropods were extracted from soil samples collected at 16 sites, representing four distinct land use types (disturbed unmanaged green spaces, urban parks, urban forests, and natural forests as control sites, within and around the urban area. Soil properties (leaf litter thickness, pH, temperature, moisture, surface compaction, and penetrability) were measured. Values of taxonomic richness (measured as number of taxonomic groups recognised at different taxonomic ranks or morphological groups depending on the organisms), total population density, community diversity (using indices that consider relative abundances), and Soil Biological Quality Index based on arthropods (QBS-ar), were calculated for each sampling site and compared among land use type. Arthropod richness and density decreased from semi-natural or natural forests to highly disturbed urban sites. QBS-ar values significantly differed among almost all land use types, with urban parks exhibiting lower values than unmanaged urban green spaces. No significant differences were observed between urban and natural forests. Leaf litter thickness, soil pH, and soil penetrability appeared to be the most significant factors influencing microarthropod abundance. Our investigation reaffirmed the valuable role of large, forested patches within cities for soil conservation and the preservation of its communities. Additionally, it pointed out the potential of unmanaged green areas integrated into the urban matrix.

Stairway to urban Heaven? Species richness, abundance and traits of ground beetles along urban-rural transects

Wouter van der Vegt[1], Jacintha Ellers[1], Paul van Staalduinen[1], Nienke Schijfsma[1], Olaf van der Woude[1], Joscha Beninde[1], Matty Berg[1,2]

[1]Vu Amsterdam, Amsterdam, Netherlands, [2]University of Groningen, Groningen, The Netherlands

Increasing temperatures and isolation and decreasing habitat sizes as a consequence of urbanization are causing disturbances for organisms worldwide. Soil animals with limited dispersal capacities are expected to adapt to imposed stressors. In urban environments explaining why these animals are found at a specific site is not only done by the three proposed filters from the community assembly theory (dispersal, environment, limiting similarity), but also by the effects of human influence on these filters, which can be either positively or negatively. However, the dominant traits are the most appropriate for the given conditions, but little knowledge on how these traits change over an urban-rural transect exist and how human influences affect the community assembly theory. Carabidae are well-described in the literature on their ecology and traits, they occur both in urban and rural environments, and they are important predators in top-down control on arthropod communities, which making it a fitting group. This study aims to assess the abundance, species richness, and traits of Carabidae along four urban-rural transects divided over four Dutch cities. Per transect eight sites were chosen (four urban, four rural), and at each site five pitfall traps were placed and emptied every two weeks. Individuals were identified to species level. Given that data collection is work-in-progress at the time of writing results are not available yet. However, results on how the community composition and traits differs per city and habitat will be made to assess how urbanization could select for different traits over the transects.

Influence of long-term municipal solid waste deposition on soil mesofauna

Ruslan Saifutdinov[1]

[1]A.N. Severtsov Institute of Ecology and Evolution RAS, Leninskij Prosp. 33, Moscow, 119071, Russian Federation

The accumulation of municipal solid waste (MSW) globally poses a significant challenge to modern ecology and society. The deposition of MSW profoundly impacts terrestrial ecosystems, altering both aboveground and belowground biodiversity. Despite the importance of understanding these alterations on soil faunal communities and ecosystem functions, relevant studies are scarce. To address this knowledge gap, we conducted extensive soil sampling in MSW landfills in the Moscow region of Russia. Sampling was carried out in three distinct areas: the "core impact area" within the landfill itself, a "buffer area" 50 m from the landfill edge, and adjacent forests as control sites. At each area, three sampling sites spaced approximately 25 m apart were established, with three soil samples collected from each site. The abundance of Collembola within the core areas was significantly higher than in control forests, primarily supported by 3-4 species found within the landfills. These species exhibited traits necessary for inhabiting above-soil habitats, such as a full set of ocelli, long furca, and colourful bodies. Genetic analysis of the cryptic species *Parisotoma notabilis* revealed a specific population predominantly exclusive to landfills, with occasional occurrences in control areas. Conversely, the predominant genetic group of *P. notabilis* from control areas were absent within landfills. Our findings highlight landfills as unique ecosystems distinct from natural ones, underscoring the need for further research to understand the role of fauna in ecosystem functioning within these anthropogenic environments. This research was supported by the Russian Science Foundation (Grant No: 23-14-00201).

Decomposition of biodegradable and conventional plastics by soil fauna in field conditions

E. Quigley[1], G.P.F. Macan[2], B.B. Landa[2], J.P. Sousa[3], M.J.I. Briones[1]

[1]University of Vigo, Vigo, Spain, [2]Institute of Sustainable Agriculture (IAS-CSIC), Córdoba, Spain, [3]University of Coimbra, Coimbra, Portugal

Biodegradable plastic mulching films are regarded as sustainable alternatives to conventional plastics, and its use is becoming more widespread in agriculture. However, some concerns remain regarding their dynamics and fate after their application in soils. In this study, we investigated the effects of field soil communities (including microorganisms, meso- and macrofauna) on the fragmentation and degradation of conventional (LDPE) and biodegradable (PLA/PBAT) plastic films. The experimental design consisted of plastic disks in bags of different mesh sizes (100 µm, 1 mm and 5 mm) to selectively exclude one or several body-sized organisms. The bags were buried in field over a 9-month period and regular samplings were carried out in May, September and November 2023 and January 2024. On each sampling occasion, twenty-four bags were retrieved and the abundance and diversity of the organisms inside the bags as well as in the surrounding soil estimated. To assess fragmentation and degradation, we measured the mass loss of the plastic disks, visualized the potential damage using a scanning electron microscope (SEM), and the chemical changes with attenuated total reflectance (ATR) spectroscopy. In addition, amplicon sequencing of 16S rRNA gene was used to estimate bacterial colonization of the plastics' surface. The results suggest that both conventional and biodegradable plastics have visible damage on their surface resulting from soil fauna activities, although mass loss was only detected for the biodegradable disks. Both plastic types showed chemical changes over time, with the ATR spectra indicating variations in functional regions, which depended on the size class of organisms they were exposed to. This study will allow a better understanding of the dynamics of plastics in natural soils and an improved assessment of how different soil organisms impact the integrity of the plastics. The results could also contribute to models of degradation and fate of plastics in soils.

Distribution patterns of marine associated soil mites (Acari, Oribatida) along South Africa's coastline

Elizabeth Hugo-Coetzee[1,3], Tobias Pfingstl[2]

[1]National Museum, Bloemfontein, South Africa, [2]University of Graz, Graz, Austria, [3]University of the Free State, Bloemfontein, South Africa

A comprehensive examination of the intertidal oribatid mite population along South Africa's coastline unveiled the presence of four species from three families, namely *Halozetes capensis* (Podacaridae), *Fortuynia elamellata micromorpha* (Fortuyniidae), *Schusteria ugraseni* and *Selenoribates divergens* (Selenoribatidae). An intriguing biogeographic pattern emerged coinciding with suggested marine biogeographic ecoregions corresponding with the cold Benguela Current on the west coast and the warm Agulhas Current on the east coast. *Halozetes capensis* is confined to the southern cooler warm-temperate Agulhas region, *F. e. micromorpha* and *Sch. ugraseni* to the eastern warmer subtropical Natal Ecoregion and *Sel. divergens* to the north-eastern tropical Delagoa Ecoregion. Furthermore, CO1 gene sequences of *H. capensis* showed isolated populations and a distinct genetic structuring, while *F. e. micromorpha* showed gene flow between all populations and thus no distinct structure. The historical paleoenvironmental context coupled with the influence of ocean currents likely played pivotal roles in shaping these observed patterns. During the last glacial maximum, the cooler climate and weakening Agulhas Current potentially bottlenecked warm-adapted *Fortuynia* populations. However, subsequent global warming facilitated population expansions. Considering the role of ocean currents in species dispersal, the Agulhas Current potentially fosters connectivity among *Fortuynia* populations on the east coast, while its deflection along the southeastern coast might isolate *Halozetes* populations. It is difficult to determine how individual populations may be influenced by climate change, but in general, with induced changes in sea surface temperatures, warm-adapted fortuyniid and selenoribatids can be expected to expand their ranges southward, while cold-adapted podacarid populations might be reduced to a few southwestern coastal areas. Assessing the impact of climate change on species distribution requires ongoing monitoring efforts. A decade-long dataset, bolstered by four years of additional monitoring, promises more definitive insights into the repercussion of climate change on distribution patterns.

Belowground success: Collembola as indicators of restoration progress following active and passive restoration

Marizanne Visagie[1], Karen J. Esler[2], Charlene Janion-Scheepers[1]

[1]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa, [2]Department of Conservation Ecology and Entomology, University of Stellenbosch, Stellenbosch, South Africa

Ecological restoration is an increasingly important topic in conservation, due to the unprecedented transformation of ecosystems resulting from human-driven activity. This is especially important following the removal of alien vegetation. Although most studies to date have investigated the aboveground impacts of restoration, very few studies investigated effects on belowground soil fauna. In this study, we used Collembola as indicators of soil biodiversity and how these communities were affected following the removal of invasive trees and different restoration practices at riparian sites along the Berg River in the Western Cape. Sampling was conducted in three sites during winter (2020) and winter and spring (2021) to consider the seasonal effects. From a total of 250 samples, 77,880 individual Collembola specimens and 34 morphospecies were collected and identified. Environmental variables such as temperature and humidity were measured, and soil chemical analyses were undertaken. Results showed that Collembola assemblages differed significantly among the different restoration treatments, especially between actively restored and invaded sites. The highest species richness of native Collembola was found at Bosplaas farm, which had a longer history of restoration efforts. The results may indicate a lag phase, and that belowground fauna may take much longer to recover after restoration than aboveground plants. Active restoration was the most effective method in restoring belowground communities. Active restoration can be concluded as the most significantly different from invaded sites (Kruskal-Wallis, $p<0.05$; ANOSIM, $p<0.05$ between active and invaded sites) in terms of Collembola community composition, and may therefore be the most effective method in restoring these communities closer to a natural state. Different microhabitat conditions between native and invasive plants were also found to be additional drivers of variance in the distribution of Collembola communities.

History and ecological impacts of an introduced soil dweller in the changing climate of Ireland

Alejandro Martínez Navarro[1], Daniel F Marchán[1], Damhnait Mchugh[2], Carol Melody[3], Marta Novo[1], Olaf Schmidt[3]

[1]Universidad Complutense De Madrid, Madrid, España, [2]Colgate University, Hamilton, USA, [3]University College Dublin, Dublin, Ireland

Prosellodrilus amplisetosus (Lumbricidae) is an endogeic earthworm with a native distribution in SW France and NW Spain. No other Prosellodrilus species has any colonisation reports beyond their native range, so it is surprising that *P. amplisetosus* is found ~1000 km north of its endemic range, at three nearby locations in SE Ireland, and recently at a single location in the UK. There are no other reports of the species beyond these sites despite survey work across Ireland and the UK. In 2012, ~100 ind./m2 were found at Airfield Estate, a Victorian-era farm in suburban Dublin. In 2022, we confirmed the persistence of this population and the species was also found in high numbers around Dowth Estate, Co. Meath, a historically significant site representing some of the oldest farmed land in Ireland. We surveyed the abundance of the species at Dowth; of the 13 earthworm species recorded, *P. amplisetosus* was the most abundant (158 ±108 ind./m2) and significantly higher in density than the 12 co-occurring native species. Stable isotope ratio analysis (C and N) of *P. amplisetosus* and co-occurring earthworms indicate that it is the most extreme mineral soil feeder; in Irish samples, *P. amplisetosus* had the most elevated C (**δ**13C = 9‰) and N (**δ**15N = -26.6‰) isotope ratios indicating that this trophic niche was vacant in Ireland before its arrival. DNA barcode analyses of specimens from Ireland, UK and France showed that two divergent lineages (both present in France) occur at the introduced sites; this suggests repeated introductions from different populations or a single introduction from a very diverse population. We will discuss the implications of our findings for the introduction history and ecological impacts of this species in the context of Ireland's changing climate and historical human activities at the introduction sites.

When thermal performance curves fail: Assessing temperature effects on locomotion in predator-prey interactions

Mia Vermaak[1], Kim Jensen[2], Charlene Janion-Scheepers[3], John Terblanche[1]

[1]Department of Conservation Ecology and Entomology, Stellenbosch University, South Africa, [2]Department of Animal and Veterinary Sciences, Aarhus University, Denmark, [3]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa

Thermal performance curves (TPCs) have become an important part of the thermal biologists' toolbox to understand how organisms may respond to temperature variation. One application of TPCs is in estimating the outcome of predator-prey interactions for soil-dwelling ectothermic invertebrates in a warming world. This study aimed to investigate the utility of TPCs to predict species movement responses using soil arthropods Collembola (prey) and Acari (predators) to infer potential interaction rates under diverse environmental conditions (for example summer and winter). Locomotion performance of four species of Acari and three species of Collembola was estimated across seven test temperatures for each species individually through automated camera tracking under controlled laboratory conditions. Both Acari and Collembola showed a non-significant relationship between distance travelled and temperature ($p=0.23$) and between maximum speed and temperature ($p=0.96$). Amongst Collembola, *Parisotoma* sp. ($p=0.21$), *Ceratophysella* sp. ($p=0.55$) and *Folsomia candida* ($p=0.36$) did not show a positive relationship between distance travelled and temperature. Amongst Acari species, Laelapidae demonstrated a weak positive relationship between walking speed and temperature ($p=0.07$). Bdellidae exhibited no movement at any temperature. The unknown Acari species showed no effect ($p=0.55$) while *Linopodes* sp. showed a weak positive relationship between walking speed and temperature ($p=0.07$). Generally, TPC's failed to describe the patterns of locomotion responses to temperature. Among the Acari species tested, only *Linopodes* sp. showed a typical TPC. Among Collembola, none of the species showed a typical TPC. Predator-prey interaction rates of these groups are poorly captured by a TPC approach, with 'sit-and-wait' predators being especially prone to underestimation of the temperature dependence of locomotion. Suites of several functional traits may be required to better capture ecological and evolutionary relevant outcomes of predator-prey interactions of soil invertebrates, and better understand the utility of TPCs.

When earthworms hit the pause button: Unravelling the molecular secrets of earthworm aestivation

Natasha Tilikj[1], María Conejo[2], Ana Riesgo[2], Daniel Fernández Marchán[1], Marta Novo[1]

[1]Complutense University of Madrid, Madrid, Spain, [2]National Museum of Natural Sciences (CSIC), Madrid, Spain

Carpetania matritensis is an earthworm inhabitant of the sandy soils of Madrid. In unfavourable environmental conditions this earthworm species builds a protective chamber and undergoes a dormant state called aestivation. Research into the details of this survival mechanism is becoming increasingly important in the current scenario of climate change. Whole body samples were used for RNA sequencing to analyze expression across the transcriptome after one month and one year of aestivation. During aestivation, earthworms fine-tune their stress response, regulate neurotransmission, get creative with their food sources and oxygen use. Inclusion of two sampling times has allowed us to study how biological processes for aestivation change over time, as well as demonstrate that one year aestivation is possible via genes for DNA repair and cellular checkpoints. Working with whole body samples is somewhat limiting since more abundant tissues are over-represented, so some gene expression information might get lost. To overcome this, we performed transcriptome analysis of specific tissues: nervous tissue, nephridia, digestive tissue, tegument, posterior segment tissue and circulatory system tissue and to provide context, we analyzed the associated histological alterations. The greatest differential expression after one month was noted in digestive and tegument tissues. GO term analysis of the tegument revealed possible modifications in the epidermal glandular cells that could improve water-retaining properties and gas exchange. The digestive tissue was characterized by polysaccharide catabolism activity, which probably originates from glycogen in the chloragogen cells. Glycogen could be used as an energy source during aestivation. Indeed, glycogen granules were more numerous in control than in aestivation earthworms. Biotic stressors seemed to be more important to nervous tissue and nephridia according to RNA-seq, while abiotic stress was reflected in gene expression of digestive tissue, posterior segment tissue and circulatory tissue. Lastly, genes for circadian rhythms were found upregulated in all tissues.

Cryptic diversity contributes to explaining variance in the functional traits of oribatid mites

Andrey Zaitsev[1]

[1]Severtsov Institute of Ecology and Evolution of the RAS, Moscow, Russia, [2]Senckenberg Museum of Natural History Görlitz, Görlitz, Germany

The challenge of soil fauna functioning assessment in the case of changing physical-geographical conditions in both space and time is highly appealing. It is not known, however, if genetic variance of soil fauna populations of widely spread species may explain their contrasting functional performance in different parts of distribution ranges. Earlier studies on the model species *Nothrus palustris* C.L. Koch, 1839 (Acari, Oribatida) revealed, however, that in the conditions of extreme continental climate lifecycle of this litter-dwelling mite shortens from two to one year. This may mean also the acceleration of ecophysiological processes in its populations and consequently higher rates of trophic and non-trophic activity also expressed in the traits of soil animals in focus. We aimed to find genetic markers of the spatial variance of the following model functional traits for the analysis of their spatial variance within Northern Palearctic: respiration (measured by infrared gas analysis), reproduction and mortality rates, individual lifecycle span (all three assessed in the laboratory experimental conditions), feeding preferences (assessed in a cafeteria experiment), nutrient assimilation from different food sources (assessed in the post-hoc experiments based on the stable isotope analyses), as well as excretion rates (assessed mathematically and verified by the near-infrared spectrometry (NIRS) method) of the two widely spread Oribatida species - *Hypochthonius rufulus* C.L. Koch, 1835 and *N. palustris*. Measurements were done in laboratory microcosms with controlled and standardized conditions of light and moisture at three temperature levels offering four standardized feeding substrates of different origin and nutritional values. Further coordinated analysis of functional trait variance associated with cryptic diversity of the model species allowed estimating the importance of cryptic diversity in explaining soil mesofauna functioning. This research was supported by the Russian Science Foundation (Grant No: 23-14-00201).

ICA_1 Wednesday 28 August, 09:30-09:45

Drivers of indigenous and introduced Collembola diversity in the Antarctic

Charlene Janion-Scheepers[1,2] Melissa Houghton[3], Helena Baird[4], Rebecca Hallas[5], Laura Phillips[5], Steven L. Chown[5]

[1]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa, [2]Securing Antarctica's Environmental Future, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa [3]Department of Natural Resources and Environment Tasmania, Hobart, Australia, [4]School of Biological Sciences, Monash University, Melbourne, Australia, [5]Securing Antarctica's Environmental Future, School of Biological Sciences, Monash University, Melbourne, Australia

The effects of environmental change drivers, such as the introduction of non-native species or climate change, on soil biodiversity is not yet fully understood. Climate change is expected to exacerbate the impact of invasive species globally, and the Antarctic Region is no exception. Indeed, this region is undergoing rapid climate change and a rise in invasive species. Given its relatively low species diversity in the Antarctic, Collembola make up an important component of the diversity here and play a key role in nutrient cycling. Consequently, the introduction of new species could significantly affect ecosystem functioning. To date, 158 species are known from this region, of which 36 are introduced. The diversity of Collembola are mainly influenced by the area and temperature range of the islands. In addition, invasive species exhibit greater phenotypic plasticity compared to their indigenous counterparts, as seen in traits such as thermal tolerance and desiccation resistance. Here we summarise these and other traits that can be used to predict new potential species invasions. Improved intraregional biosecurity measures are needed to mitigate further human-mediated introductions to the Antarctic.

Cyphoderini (Collembola: Entomobryidae: Paronellinae) species of the Free State Province, South Africa, with notes on their associated hosts

Hannelene Badenhorst[1], Charlene Janion-Scheepers[2], Ruan Booysen[1], Sopark Jantarit[3], Charles Richard Haddad[1]

[1]University of the Free State, Bloemfontein, South Africa, [2]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa, [3]Prince of Songkla University, Hat Yai, Thailand

Globally, several invertebrate species have adapted to living in the nests of termites and ants. Many of these co-inhabitants have developed relationships with their hosts and complete at least one part of their life cycle in their host's nest. These organisms are defined as termitophiles or myrmecophiles, referring to their associated host as being termites or ants. The tribe Cyphoderini consists of springtail species that are mostly collected from the nests of ants and termites but are also collected from edaphic and subterranean habitats. Even though ants and termites are relatively well studied in South Africa, there is very little known about the cyphoderids that live in association with them. This study aimed to survey the Cyphoderini species in the Free State Province and note possible host associations with ant and/or termite species. Cyphoderids were collected from 33 locations in the Free State Province. In total, 180 specimens were successfully barcoded and represent 35 newly generated Barcode Index Numbers (BINs). Randomized Axelerated Maximum Likelihood (RAxML) and Bayesian inference (BI) analyses were performed based on the COI region sequences and two phylograms were constructed. Eight clades were consistent in both phylograms. Only three clades (C, F & H) were well resolved, with bootstrap (BS) values ≥75 and posterior probability (PP) support ≥95%. *Cyphoderus* sp.1 has the largest distribution of all the collected species and was collected from 13 localities, mainly in association with the termite *Trinervitermes trinervoides*. Most other cyphoderids were collected in association with the common ant and termite species in the region/province. A *Megacyphoderus* species was collected from an *Odontotermes cf. transvaalensis* nest and represents the first record of the genus in the country.

Collembola associate with hermit crabs *Coenobita clypeatus* (Crustacea: Paguroidea: Coenobitidae)

José G. Palacios Vargas[1], Angela Arango[1], Margarita Ojeda[1], Gabriela Castaño-Meneses[2]

[1]Fac. Ciencias, UNAM, Ciudad de Mexico, Mexico, [2]UMDI, Ciencias, UNAM, Juriquilla, Mexico

Springtails or Collembola are mainly known as soil and litter inhabitants. Nevertheless, only a few families as Actaletidae, and Isotogastruridae, and some genera of Isotomidae, Neanuridae and Hypogastruridae are restricted to live on the seashores, which are found in marine littoral environments. Among them there is one family known to be associated with hermit crabs: Coenaletidae. Bellinger created Coenaletidae, with only two members of this monogeneric family: *Coenaletes vangoethemi* Jacquemart, 1980 from New Guinea, and *C. caribaeus* Bellinger, 1985 from Guadeloupe, in the Caribbean. They have been found only associated with hermit crabs of the genus *Coenobita* (Crustacea: Decapoda). *C. caribaeus* is also present in the Mexican Caribbean Sea and has springtails which are often found between the crab and the shell of the Gastropod mollusc *Cittarium pica*. The purpose of this contribution is to present our recent findings of the arthropods associated with hermit crabs. Several species of crabs were studied, living in different species of sea snails. For the Collembola we have done a morphological study using the electron scanning microscope to show the details of different structures, such as the feet complex, mandible and antennal spines of males. Some observations on the behaviour of *C. caribaeus* and its host are included.

From seashore to freshwater? The origin of *Archisotoma* (Collembola: Isotomidae) from Lake Biwa

Reina Takaesu[1], Taizo Nakamori[1]

[1]Yokohama National University, Yokohama-City, Japan

Lake Biwa is the third oldest lake in the world. It is a freshwater lake that has never been flooded by seawater, although it provides habitat for more than ten species of marine flora and fauna. Collembola (springtails) are wingless terrestrial arthropods with body lengths of 1–5 mm that are found in a variety of terrestrial environments including seashores, and some species are halotolerant. Twenty-nine *Archisotoma* (Collembola: Isotomidae) species are distributed worldwide in marine littoral habitats, two of which are found in Japan. In this study, we examined the origin of *Archisotoma* specimens inhabiting the shores of Lake Biwa by investigating *Archisotoma* species in Lake Biwa and in nearby coastal and brackish waters using the mitochondrial cytochrome c oxidase subunit I (COI) and large subunit ribosomal RNA (16S rRNA) genes. The results showed that the *Archisotoma* population from Lake Biwa formed a distinct clade that was separate from *Archisotoma utinomii*, which is found in coastal habitats. These findings suggest that *Archisotoma* specimens from Lake Biwa represent an undescribed species that has adapted to a freshwater environment.

Collembola of Réunion: Diversity and distribution

Dean A. Erasmus[1], Charlene Janion-Scheepers[1], Claudine Ah-Peng[2]

[1]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa, [2]Université de La Réunion, UMR PVBMT, Saint-Pierre, France

Collembola, or springtails, play many crucial roles in the soil food web, such as microbial population control and dispersal, detritus comminution, and as prey for various soil predators. Furthermore, their relative abundance and diversity makes them a significant component in soil transformation. The position as a link between micro- and macro-scale communities means springtail communities may also indicate broader properties related to soil health. Although trophic levels are often conserved at higher taxonomic levels (usually family), species or communities may respond differently to disturbance. Thus, species identities are important for monitoring the effects of climate change and habitat transformation, especially in tropical regions. Réunion, part of the Mascarene archipelago, is a volcanic island in the Indian Ocean with an area of 2,512 km² and peak elevation of 3,070 m. The island is made up of two volcanoes, Piton des Neiges and Piton de la Fournaise, the latter being active still. It experiences a humid tropical climate, but, due to a large elevational heterogeneity, contains various microclimates. Although numerous Collembola species have been described from Réunion and surveys have been undertaken, there is no recent checklist. The most extensive work has been on marine littoral species. Here we present a checklist of Collembola of Réunion. Since April 2023, over 150 samples have been collected using various methods, including direct aspiration, beating, sifting, Tullgren-Berlese funnel extraction, and D-vac. Samples were collected from coastal, subalpine, and cloud forests; as well as wetlands, caves, plantations, and various agricultural types. In addition to morphological identification, DNA barcoding was also conducted. During this period we found 45 Collembola morphospecies, bringing the total number of species known from Réunion to at least 56 species. Moreover, this number is expected to increase with additional sampling and molecular analysis.

High species diversity of Saproxylic Neanurinae in Japan

Hiro Kasai[1]

[1]Faculty of Agriculture, Kindai University, Nara, Japan

The subfamily Neanurinae are large group of Collembola comprising more than 800 species reported worldwide. However, the species diversity of this subfamily is likely underestimated, because few studies have focused on dead wood, which is the main resource used by this subfamily. In recent years, the discovery of several new species in dead wood has indicated that there are many more new species. Therefore, further research is required to address this gap. In this study, specimens were collected from fallen branches (small dead wood) using Berlese-Tullgren funnels at various locations in Japan. Subsequently, the specimens were mounted on slides in either Hoyer's or Marc André 2 medium and examined under a light microscope. If necessary, the specimens were cleared with 10% potassium hydroxide or Nesbitt's fluid before mounting. Collembolan specimens were collected from 82 sites and 50 species were obtained from 12 genera. The specimens collected from the 64 sites were unknown species (first report or undescribed species). Of the 50 species identified, 36 were unknown and nine new species were described. Examination of the previously disregarded deadwood revealed numerous unknown Neanurinae species, demonstrating an unanticipated level of diversity.

Soil Collembola in urban areas: results from a large sampling effort in four French cities

Jérôme Cortet[1], Arthur Brunaud[1], Matthias Brand[1], Nicolas Hénon[1], Alice Ardichvili[2], Sandra Barantal[1], Sébastien Barot[2], Yvette Barraud-Roussel[3], Marie Belin[2], Patrice Cannavo[3], David Carmignac[2], Robin Dagois[4], Christophe Ducommun[3], Louise Eydoux[1], Emmanuel Gendreau[2], Jacques Gignoux[2], René Guénon[3], Yvan Kraepiel[2], Jean-Christophe Lata[2], Annick Lucas[1], Yoan Marcangeli[2], Pierre-Alain Maron[5], Ambre Mautuit[1], Séverine Planchais[2], Alain Rakoto[6], Lionel Ranjard[5], Christophe Schwartz[6], Laure Vidal-Beaudet[3], Alan Vergnes[1]

[1]CEFE, Univ. Paul-Valéry Montpellier 3, Univ. Montpellier, EPHE, CNRS, IRD, Montpellier, France, [2]Sorbonne Université, Université Paris-Cité, UPEC, CNRS, INRAE, IRD, UMR 7618, Institute of Ecology and Environmental Sciences – Paris, iEES Paris, Paris, France, France, [3]Institut Agro, EPHOR, Angers, France, [4]Plante & Cité, Angers , France, [5]Agroécologie, INRAE, Univ Bourgogne Franche Comte, Inst Agro, Agroecol, Dijon, France, [6]LSE, Université de Lorraine, INRAE, LSE, Nancy, France

Knowledge of soil biodiversity in highly anthropised contexts has progressed considerably in recent years, against a backdrop of strong growth in SUITMAs (Soil of Urban Industrial Traffic and Mining Areas) worldwide. However, the diversity of soils and uses in urban systems has not yet made it possible to rank the factors that influence this biodiversity. Within the project BISES, funded by the French government, we were able to sample soil organisms in four French cities, representing 200 sites (around 50 per city). The different sites were chosen to be representative of the productive uses (community gardens, urban agriculture) or non-productive uses (urban parks, road features such as roundabouts or linear vegetated roads) present in urban systems. The four cities chosen (Paris, Nancy, Nantes, and Montpellier) are representative of the different climatic zones in France. The results presented here will focus on the communities of springtails. To our knowledge, they represent the most extensive work performed in urban areas until now. Around 130 species were identified and the communities were analysed in terms of soil physico-chemical factors and land uses. Collembola species and traits assemblages are mainly distinguished between food production sites and leisure plus traffic sites as expected. This dichotomy is at least partly explained by soil physico-chemical properties such as phosphorus, which was strongly associated with food production land uses across all cities, but also by organic carbon and nitrogen to a lesser extent; but not by metal pollution, which was unexpected.

Influence of mulch on Collembola seasonal fluctuations and community composition in South African apple orchards

Abdul Ghaseeb Jacobs[1], Juliette Chassain[1], Charlene Janion-Scheepers[1]

[1]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa

Collembola, one of the most abundant soil microarthropods, have been shown to be vital in understanding soil health and the effects of land-use on soil biodiversity. However, compared to above-ground biodiversity, Collembola remain understudied in agroecosystems, and more particularly in orchards. Additionally, information on their taxonomy and ecology remains limited in South Africa. This study investigated the differences in Collembola assemblages between apple orchards with and without organic mulch inputs, over three seasons in the Ceres region, Western Cape, South Africa. Soil samples were taken at a depth of 0-10 cm from the berm and work row within the orchards, and extracted using Tullgren funnels. Collembola were sorted to morphospecies, and genera or species were identified using available keys. A total of 33 Collembola species from 11 families and all four orders were identified. Mulched orchards significantly maintained Collembola abundance and species richness from winter to summer compared to unmulched orchards. Additionally, mulched orchards showed a significant difference in community composition between the berm and work row which was not apparent in the unmulched orchards. Overall, this suggests that organic mulch not only plays an important role in buffering Collembola assemblages during seasonal fluctuations, but also affects Collembola community composition. This is, to our knowledge, the first detailed study of Collembola diversity in apple orchards in Africa, thus providing important baseline knowledge for future work on soil health in commercial orchards and other agroecosystems.

About the knowledge of African fauna of Microcoryphia (=Archaeognatha)

Miquel Gaju-Ricart[1], Rafael Molero-Baltanás[1], Carmen Bach de Roca[2]

[1]University of Córdoba, Córdoba, Spain, [2]13th Mestral St., Matadepera (Barcelona), Spain

The Order Microcoryphia has been scarcely studied in Africa. Only 19 of the 64 known genera of Microcoryphia, are present on the continent and nearby islands. In relation to the two families of the order, the Meinertellidae are widespread over the continent, while Machilidae have not been found further south than the tropical zone (D. R. Congo - Seychelles Islands). Most species are known only by their original description. There are exclusive genera such as *Afromachilis* (D.R. Congo), *Corethromachilis*, *Dromadimachilis* and *Pseudomachilanus* (Seychelles) and *Metagraphitarsus* (Bioko). Some genera of Meinertellidae have a surprising distribution, for instance, *Machilinus* s.s., with a circummediterranean distribution, is represented by a single species in South Africa and *Machiloides*, with numerous species in South Africa, also includes a single species in the Pyrenees (Spain).

Effect of ecological factors on genetic lineages of *Parisotoma notabilis* s.l. (Collembola) under laboratory conditions

Anastasia Striuchkova[1], Maria Glagoleva[1], Sofia Lazareva[1], Mikhail Potapov[1], Nataliya Kuznetsova[1]

[1]Moscow State Pedagogical University, Moscow, Russian Federation

It was revealed that the genetic lineages of a common springtail species *Parisotoma notabilis s.l.* (L1, L2 and L4-Hebert) differ by habitat preferences. Particularly, the lineages replace each other along the urbanization gradient: L2 (natural forests) - L4-Hebert (forest parks) - L1 (urban green spaces). We clarified the causes for this differentiation in laboratory experiments using temperature and heavy metals as ecological factors. The results have shown that individuals of lineage L1 from disturbed habitats survive better at high temperatures (28-30˚C) in comparison with individuals from forests. The heavy metals supplement to food (Cu or Pb 5 mg/g) leads to the death of individuals from natural forests but does not significantly affect individuals from the urban lawn. The maturation of eggs in individuals from the urban lawn takes fewer days compared to individuals from natural forests (on average 10 vs 14 days) under favourable conditions (17-19˚C, plenty of food and 100% humidity). In general, individuals from disturbed habitats (line L1) exhibit r-strategy traits compared to individuals from natural forests. Differences in the biological and ecological characteristics of the lineages from natural and anthropogenic habitats concern the problems of ecotypes and ecological speciation. This study was supported by Grant No. 22-24-00984 of the Russian Science Foundation.

Posters

POSTER_1

Fauna of litter and soil diptera larvae in forests of Karkarala Native Park (Central Kazakhstan)

Veronika Abukenova[1], Nadezhda Slavchenko[1]

[1] Karaganda Buketov University, Karaganda, Kazakhstan

In Karkarala forest oasis we looked at the population structure of soil invertebrates as a pointer of various forest types. Within every biotope 16 litter samples of 0.0625 m² were collected from May to October and soil animals were analyzed. After Coleoptera (adult and larva**e**), Diptera larvae constituted the most abundant group of soil invertebrates. Based on the forest type, their number ranged from 9.5 to 35.7 specimens/m². There were fourteen families noted. The highest abundance of Diptera larvae was found in species belonging to the family Bibionidae, ranging from 0.9 sp/m² in mountain birch forest to 18.0 sp/m² in herb and birch pine forest. *Nephrotoma lunulicornis* (Schummel, 1833) *Tipula hortulana* Linnaeus, 1758 *Tipula vernalis* Meigen, 1804 *Tipula paludosa* Meigen, 1830 *Tipula scripta* Meigen, 1830, the European-Siberian species of the family Tipulidae are also widely distributed in biotopes. Of all the Diptera, the Therevidae family has the greatest prevalence of larvae (26% of total). The thread-horns flies predominate in fresh and wet pine forests. In birch and dry pine forests, short-horns flies play a larger role. The larvae of Diptera make up approximately 13% of the entire soil fauna in deciduous forests. Their proportion can reach as high as 47% of all soil invertebrates that have been documented in pine forests. The predatory Therevidae (38% of total abundance) and soil-forming Bibionidae (39% of total abundance) are crucial to the aboriginal pine forest.

POSTER_2

How accessible is collembolan taxonomic and handling expertise for their use as global change bioindicators?

Sarah Bird[1], Jeff Battigelli[2], Nancy Shackelford[1]

[1]University of Victoria, Victoria, Canada, [2]Northern Alberta Institute of Technology, Edmonton, Canada

The goal of my work is to understand how accessible springtails are as an indicator taxa for ecological change caused by major global change drivers based on 1) their known ecology at different taxonomic resolutions and 2) the availability of expertise and training (as expert knowledge and written documentation) for springtail collecting, handling, and identification.
The second question is the focus of this poster and will be investigated through interviews with taxonomic experts. A snowball sampling approach will be used, wherein all potential participants who are contacted directly will be asked to share the invitation with anyone they believe will be interested in participating. Interview responses will be analyzed using qualitative and quantitative methods, and open-ended responses will be analyzed thematically. The goal of the interviews is to identify what information is available (for methods in collecting and identifying springtails), if it can be accessed, and how complete it is. It is unlikely that quantitatively assessing completeness is achievable, but expert perceptions on completeness will be collected. I will look for themes of strengths, weaknesses, gaps, and opportunities in current global Collembola expertise and where resources should be allocated to develop future capacity. In a changing world, accessible indicators of ecosystem change ensure affordable and effective regular monitoring. Given their abundance and cosmopolitan distribution, Collembola have the potential to be valuable indicators of ecological change. This interview-based research will help identify whether the expertise on Collembola taxonomy is available and sufficiently accessible to enable their use as a bioindicator.

POSTER_3

Flower strips in arable fields enhance soil fauna communities

S. Acconcia[1], O. Aguado Martín[2], L. Miranda[3], A.L. Gayán Quijano[3], J. Peris[3], M.J.I. Briones[1]

[1]University of Vigo, Vigo, Spain, [2]Andrena iniciativas y estudios medioambientales SL, Valladolid, Spain, [3]Syngenta Crop Protection, Basel, Switzerland

The LivinGro® project aims to implement sustainable practices to create optimal conditions for enhancing above- and below-ground biodiversity. One of the planned activities is to examine the potential positive effects of establishing flower strips to promote soil macrofauna (earthworms) and mesofauna (microarthropods) in conventionally cultivated crops. Here, we investigated the effects of these two treatments at six farms located in different climatic regions: olives in Rioseco and Pozaldez (Valladolid, NW Spain with continental climate); olives in Alfamen and peaches in Almonacid (Zaragoza, NE Spain with Mediterranean climate); peaches in Yechar and plums in El Ciruelo (Murcia, SE Spain with Mediterranean climate). At each farm, each arable row was planted with a mixture of flowers (sustainable treatment) or left bare (conventional treatment). Three random soil samples were collected at each treatment in January, June and October 2023. Earthworms were hand-sorted in the field from soil quadrats (50 x 50 x 20 cm) and identified to species level. Microarthropods were extracted from intact soil cores (10 x 5 cm deep) and identified to family level. Results showed that the greatest earthworm abundance was recorded in Murcia and Valladolid (16 and 11 ind.m^{-2}, respectively), and the lowest one in Zaragoza (0.6 ind.m^{-2}), but the most diverse communities were found in Valladolid. Flowering cover crops significantly promoted earthworm biomass (6 g.m^{-2}) and diversity in Murcia. Microarthropod communities were particularly abundant and diverse in Valladolid (4633 ind.m^{-2}), especially in the vegetated plots. Similarly, the vegetational cover had a significant impact especially in soils of Murcia, leading to more abundant (4697 ind.m^{-2}) and diverse microarthropod communities. These results indicate that flower strips could alleviate the effects of extreme climatic conditions on soil communities, e.g. such as in the dry soils of Murcia, and highlights the shelter role of permanent plant cover in enhancing farmland soil biodiversity.

POSTER_4

Some new insights on culturing soil mesofauna species having wide distribution ranges

Philipp Byzov[1,2], Nina Pronina[1,2], Andrey Zaitsev[1,3]

[1]A.N. Severtsov Institute of Ecology and Evolution RAS, Moscow, Russian Federation, [2]Lomonosov Moscow State University, Moscow, Russia, [3]Senckenberg Museum of Natural History Görlitz, Görlitz, Germany

Soil mesofauna represents an important part of detrital food webs and fulfils many ecosystem functions. In light of global change and different anthropogenic disturbances, it is vital to broaden the range of test animals used in experiments, ecotoxicity tests and bioassays. However, only a very limited number of soil species are cultured. One of the problems here is that there is a high probability of having cryptic species within widespread morphologically described ones. Also, individuals from different parts of the range might be pre-adaptated to different climate and soil type and be functionally incomparable. To test the potential effect of cryptic diversity and local ecological preadaptation of widespread mesofauna species on the success of culturing, we selected two species of Oribatida (*Hypochthonius rufulus* C.L. Koch, 1835, *Nothrus palustris* C. L. Koch, 1839), two species of Collembola (*Parisotoma notabilis* (Schäffer, 1896), *Lepidocyrtus lanuginosus* (Gmelin, 1788)) and two species of Enchytraeidae (*Cognettia sphagnetorum* (Weidowski, 1878), *Buchholzia appendiculata* (Buchholz, 1863)). All of them potentially demonstrate high cryptic diversity within their broad ranges. Specimens were collected in 19 regions in different parts of Russia and put into culture with a specially treated substrate from their habitats at constant conditions (+20°C and 90% air humidity). We observed highly contrasting survival rates of the populations originating from different regions and soil types. This means, that when introducing new soil fauna species into the culture, much coordination is needed to ensure its sustainability at a given culturing regime. Ideally, uniform culture needs to be distributed around the world instead of using local populations for establishing new cultures for global studies. We further expect that cultures originating from different local populations might be incomparable in terms of food preferences, respiration rates, isotopic signatures, and sensitivity to toxins. The experiment was supported by Russian Science Foundation, grant No. 23-14-00201.

POSTER_5

Soil electrochemical remediation effect on life history of *Clavisotoma filifera* (Isotomidae) and *Brachystomella gabrielae* (Brachystomellidae)

Daniela Pérez-Velázquez[1,2], Gabriela Castaño-Meneses[1], José Guadalupe Palacios-Vargas[3], Atilano Contreras-Ramos[4]

[1]Ecología de Artrópodos en Ambientes Extremos, Unidad Multidisciplinaria de Docencia e Investigación, Facultad de Ciencias, Universidad Nacional Autónoma de México, Juriquilla Querétaro, Mexico, [2]Posgrado en Ciencias Biológicas, Ciudad Universitaria, Coyoacán, México, [3]Ecología y Sistemática de Microartrópodos, Facultad de Ciencias, UNAM, Ciudad Universitaria, Coyoacán, México, [4]Instituto de Biología, UNAM, Departamento de Zoología, Coyoacán, México

An experiment was done to evaluate the effect of soil electrochemical treatment on life histories in *Clavisotoma filifera* (Isotomidae) and *Brachystomella gabrielae* (Brachystomellidae) after electrochemical treatment and evaluated the effect of this treatment on life histories in both species. Ten individuals recently hatched from laboratory cultures of each species were placed in circular plastic containers with 500 gr of soil hydrated with 250 ml of CaSO4 0.01M solution for treatment and 250 ml of distilled water for control, in both cases wait for 18 hours to continue the experiment. The electrochemical treatment consisted of an electric field of 5A and 2 volts applied for 15 minutes. Specimens were recovered and placed isolated in a 35 ml jar with culture medium, and observed for 30 days, with the number of moults, oviposited eggs, and hatched individuals respectively recorded. Observations of behaviour and morphology using the software AxioVision 4.8.2SP2 to take videos and photographs were done. We found differences between organisms under treatment and control. In both species hatching time decreased, and fecundity increased in the treatment plot compared with control plots. In *C. filifera*, eggs under treatment were bigger than the control plots, but no differences were found in *B. gabrielae*. The frequency of moults was also reduced in both species under electrochemical treatment. The treatment affected the characteristics of life history in both species, promoting type "r" strategies in both species after treatment.

POSTER_6

Effect of habitat complexity on the coexistence of lapidicolous arthropods in Calvillo, Aguascalientes, Mexico

Israel de Jesús Rodríguez-Elizalde[1], **Gabriela Castaño-Meneses**[1], Enrique Cantoral-Uriza[1], Ismael Hinojosa-Díaz[2]

[1]Unidad Multidisciplinaria de Docencia e Investigación Juriquilla, Facultad de Ciencias, Universidad Nacional Autónoma de México, Juriquilla , Mexico, [2]Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, Alcaldía Coyoacán, Mexico

Coexistence is defined as the presence of two or more organisms at the same time and space. Rocks as microhabitats are important in areas with low structural complexity since they function as small-scale moisture reservoirs and are the refuge of a great diversity of organisms. This research aims to evaluate the diversity of lapidicolous arthropods in two environments with contrasting degrees of complexity, with the hypothesis that in a less complex site there will be a greater number of arthropods coexisting under rocks. The study was carried out at two sites in "La Cañada del Diablo", Calvillo, Aguascalientes, Mexico: a crassicaule scrubland and an oak forest. Arthropod collections were carried out during the warm-dry, warm-humid, and cold-dry seasons. The sampling consisted in collecting the arthropods sheltered under 30 rocks per season and preserving them in alcohol for later taxonomic identification. Diversity of order 0, 1, and 2 was determined, and rarefaction curves were performed based on species richness. A total of 692 specimens belonging to 138 morphospecies, 20 orders, and at least 53 families of arthropods were collected. The taxonomic groups with the greatest richness and abundance were Araneae, Hymenoptera (Formicidae), Acari, Coleoptera and Hemiptera. In crassicaule scrub, a higher percentage of rock occupancy and coexisting arthropods was observed than in oak forest. The highest abundance values were observed in crassicaule scrub, especially in the warm humid season, however, the greatest diversity was observed in oak forest, especially in the warm-dry season. The evidence suggests that in a low-complex environment there are a greater number of arthropods coexisting under rocks, but diversity is greater in a complex environment.

POSTER_7

Assessing tillage and fertilizer management in European long-term experiments by soil fauna communities

Lorenzo D'Avino[1], Guénola Pérès[2], Elena Tondini[1], Marc Roucaute[2], Maria Viketoft[3], Cristina Aponte[4], Carlo Jacomini[5], Anita Maienza[6], Rajasekaran Murugan[7], Thierry Morvan[2], Johann Zaller[8], Raphael Wittwer[9], Marcel van der Heijden[9], Marjetka Suhadolc[10], Anton Govednik[10], Rok Mihelič[10], Tess F.J. van de Voorde[11], Maria-Franca Dekkers[11], Derk van Balen[11], Gerard Korthals[11], Gaia Bigiotti[1], Francesco Vitali[1], Giovanni L'Abate[1], Jack Faber[12], Stefano Mocali[1]

[1]Crea Research Centre For Agriculture And Environment, Italy, [2]UMR SAS, Institut Agro, INRAE, Rennes, France, [3]Swedish University of Agricultural Sciences, Uppsala, Sweden, [4]Spanish National Research Council, Forestry institute, Spain, [5]Italian Environmental Protection and Research Institute, Rome, Italy, [6]National Research Council, Institute of Bioeconomy, Sesto Fiorentino (FI), Italy, [7]University of Natural Resources and Life Sciences, Institute of Soil Research, Vienna, Austria, [8]University of Natural Resources and Life Sciences, Institute of Zoology, Vienna, Austria, [9]Agroscope, Zürich, Switzerland, [10]University of Ljubljana, Biotechnical Faculty, Ljubljana, Slovenija, [11]Wageningen University & Research, Wageningen Plant Research, Wageningen, the Netherlands, [12]Wageningen University & Research, Wageningen Environmental Research, the Netherlands

Soil fauna actively contributes to the maintenance of various soil functions and ecosystem services, and agricultural management practices have a varying degree of influence on soil biodiversity. Therefore, several groups of organisms should be considered simultaneously for a comprehensive assessment. The evaluation of the effect of farming practices on soil fauna is commonly carried out using several types of indices: (i) abundance indices, indicating the quantity of animals; (ii) taxonomical indices, evaluating taxa diversity; and (iii) functional indices, measuring the roles of taxa in ecosystems. This work will compare the three categories of indices mentioned, within the EJP-MINOTAUR project. The aim is to determine which type of indices are most sensitive in detecting differences in soil fauna communities when organic or mineral fertilization practices and standard, reduced or no tillage management are applied.

The impacts of farming practices on soil fauna abundance and diversity were evaluated in nine European Long Term Agricultural Experiments (LTEs) across a gradient of pedoclimatic conditions, employing different tillage systems and fertilization practices. Nematodes, microarthropods, and earthworms were selected as representative of micro-, meso-, and macrofauna biodiversity, respectively. Generalized linear mixed models was applied setting (i) tillage and fertilization and (ii) LTE sites as fixed and random effect, respectively. Comparison of treatments was complicated by crossing effects that necessarily reduce the number of direct relations. Both no tillage and reduced tillage showed a greater micro- and mesofauna

abundance than in standard tillage. Likewise, the QBS-ar ecological index concerning mesofauna was significantly higher in no tillage than in standard tillage. Our results suggest that the development and application of appropriate ecological indices will facilitate a more accurate and comprehensive evaluation of soil fauna biodiversity, and even contribute to the formulation of targeted conservation and to foster sustainable management strategies aimed at promoting long-term soil health.

POSTER_8

Collembola communities' response to compost and bioinoculation in Italian vineyards and aromatic crops

Romane Leclerc-Kaufeler[1], Ninon Delcourt[1], Luigi Paolo D'Acqui D'Acqui[2], Sara Di Lornardo, Jérôme Cortet[1]

[1]CEFE, Univ Montpellier, Cnrs, Ephe, Ird, Univ Paul Valéry , Montpellier, France, [2]IRET-CNR - Istituto di Ricerca sugli Ecosistemi Terrestri, Italy

In the current context of global change, Mediterranean agrosystems face major challenges, such as extreme climatic events and depletion of water resources. These challenges are exacerbated by the intensive agricultural practices prevalent in the region, involving the massive use of pesticides and chemical fertilizers. Given this critical situation, it is necessary to preserve productive agricultural land by promoting the implementation of alternative agricultural practices. In this context, the European ReCROP project aims to identify innovative and environmentally friendly farming practices that can be implemented sustainably in the Mediterranean region. It assesses the impact of these practices on agrosystems health, as well as on the productivity of key Mediterranean crops. An essential component of this project is the study of soil biodiversity, recognized for its role in soil functions and as an indicator of its quality. The aim is to assess the effects of alternative practices to conventional agriculture on the taxonomic and functional diversity of soil mesofauna, by monitoring Collembola in particular. Vines and aromatic plants, two key Mediterranean crops, were subjected to alternative agricultural practices such as compost application and microbial bio-inoculation in Tuscany, Italy, and the Collembola communities of these crops were sampled to assess the effect of these two practices. First results show a positive effect of compost application on Collembola abundance in aromatic crops, while these effects depended on the ecomorphological class of Collembola in vineyards. Effects on functional traits are also expected with these hypotheses: (i) compost will promote larger body size in springtails, as well as (ii) lower pigmentation. This research will help identify beneficial practices for soil biodiversity of Mediterranean crops.

POSTER_9

Characterization of soil mesofauna communities from former contaminated mining sites in the South of France

Ninon Delcourt[1], Hector Duarte-Martínez[1], Jérôme Cortet[1]

[1]CEFE, Univ Montpellier, Cnrs, Ephe, Ird, Univ Paul Valéry, Montpellier, France

Metal mining activities represent an important source of air, soil and water pollution Trace elements (Cd, Pb, Zn) resulting from these activities are commonly occurring contaminants in past industrialized countries, since abandoned sites remain a persistent local source of contamination. Although several studies have shown that metal trace elements have a negative impact on soil functioning by assessing microbial diversity and activity, fewer in situ studies have assessed the effects of these pollutants on soil fauna despite their recognised role in regulating water and nutrient cycle, soil organic matter and carbon sequestration. This study investigated the effects of different levels of metal trace elements contamination on mesofauna communities in a former mining site in south of France (Saint Laurent le Minier, Gard, France). Collembola and oribatid mites communities from soils under different levels of Pb, Cd, Zn, Al and Fe were explored. Two levels of contamination were tested to assess (i) how do Pb, Cd, Zn, Al and Fe contaminations influence the structure and abundance of mesofauna communities in soils and (ii) how does this response evolve depending on contamination levels? The results show that total abundance of microarthropods was affected by the level of heavy metal contamination, with a lower abundance of organisms in soils containing the highest level of metals. Moreover, soils with different levels of metal contamination supported significantly different community compositions of oribatid mites, while the community structure of collembola seemed not affected. This study contributes to a better understanding of the factors explaining microarthropod distribution and invites discussion on using mesofauna organisms as bioindicators of contaminated soils.

POSTER_10

Coupling between plants and nematode community in a glacier foreland in the high Arctic

Marek Renco[2], Karel Janko[3], Miloslav Devetter[1]

[1]Biology Centre CAS, Ceske Budejovice, Czech Republic, [2]Institute of Parasitology, SAS, Kosice, Slovakia, [3]Institute of Animal Physiology and Genetics, CAS, Libechov, Czech Republic

It is well known that the diversity and community structure of soil nematodes are influenced by a range of abiotic and biotic factors, including plant species. Although research of soil nematodes has long tradition, our knowledge of Arctic soil nematodes is sparse and data are from small areas of the polar region, however nematodes are most abundant group there. In this study, we investigated the diversity and community structure of nematode communities in the rhizosphere of six Arctic plant species in Petuniabukta, Central Svalbard. The six species included cushion-forming plant species *Silene acaulis*, *Saxifraga oppositifolia* and *Dryas octopetala*, and mat-forming arctic dwarf-shrubs *Salix polaris*, *Cassiope tetragona* and grass *Carex rupestris*. We found that plant species was the most important predictor of nematode community composition in the root zone of the Arctic tundra, even though bacterivores were the dominant nematodes in our study. They are followed by fungivores and occasionally by plant parasites as in the patches of *D. octopetala* and *C. rupestris*. Closed canopies of *S. acaulis* form the most favourable microhabitats for nematode communities, showing the highest total abundance, diversity and number of species as well as the highest nematode biomass, with structured and undisturbed soil food web. Similarly, the analysis showed that the conditions under patches of *D. octopetala* and *C. rupestris* are more favourable for nematode communities than those created by *S. polaris* and *C. tetragona* themselves. These results show that plant species and their form strongly influence the development of soil fauna under harsh conditions of the high arctic tundra.

POSTER_11

Findings of the soil inhabiting entomopathogenic nematode *Steinernema carpocapsae* (Steinernematidae, Nematoda) in Russia

Boris Efeykin[1], Elena Ivanova[1], Sergei Spiridonov[1]

[1]Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia, Moscow, Leninskiy prospekt, 33, Russian Federation

Steinernema carpocapsae is one of the first described species of EPNs - entomopathogenic nematodes (Weiser, 1955), which are effectively used as biological control agents against insect pests. Unlike *Steinernema feltiae*, another steinernematid species actively used in biological control, *S. carpocapsae* is rarely found in nature. For example, this species has never been reported in some European countries, which is an obstacle to the use of such a 'non-autochthonous' organism in local agriculture. Under these circumstances, the discovery of *S. carpocapsae* opens the legal possibility for the widespread use of the products based on this biological agent, and provides new strains for the development of local formulations.Several hundred of 500 ml soil samples were collected throughout Russia in 2002-2023 and baited with *Galleria mellonella* caterpillars to isolate EPNs. The steinernematid fauna of Russia is characterised by low species diversity, with *Steinernema feltiae* as the most common species in cultivated soils, and *S. kraussei* and *S. poinari* in soils under forest canopy. Two decades of surveys resulted in only three records of *S. carpocapsae*: the tourist village of Shakhmatovo (Klin District, Moscow Region), the village of Semlevo (Viazma District, Smolensk Region) and the resort town of Kislovodsk (Stavropol Krai) in the North Caucasus. Samples positive for *S. carpocapsae* were always on sandy soils, but were collected in completely different habitats: the roadside ditch in Shakhmatovo, the cultivated wheat field in Semlevo, and river sediment covered with grass near the stream in Kislovodsk. Nucleotide sequence analysis of the ITS rDNA and CoxI mtDNA of these three isolates confirmed their primary morphological identification of these as *S. carpocapsae* and revealed some phyletic relationships with con-specific isolates from southern Europe. The work was supported financially by RSF, grant № 19-74-20147.

POSTER_12

Whole-genome survey and phylogenetic relationships within Mermithidae

Boris Efeykin[1], Sergei Spiridonov[1]

[1]Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia, Moscow, Leninskiy prospekt, 33, Russian Federation

The family of Mermithidae (Braun, 1883) is one of the least studied groups of Nematoda. Our research was aimed at clarifying the phylogenetic relationships within this family. To build the trees we used DNA from mermithids that we found on the territory of Vietnam, republic of Adygea and Moscow and sequences from NCBI database. DNA from the frozen nematodes samples was isolated using the QiAmp Micro Kit (Qiagen) according to a standard protocol. NGS-sequencing was performed on Illumina Novaseq6000 system with a 150 bp read length. We obtained different phylogenetic trees based on 18s rRNA, 28s rRNA, CoxI and 12 mitochondrial genes (Multigenic analysis) and 4 full genomes from worms of *Hexamermis*, Agamermis and Ovomermis genera. As a result, we have shown that genera of *Hexamermis* and *Ovomermis* are extremely close and combined into one clade with *Agamermis* genus. Moreover, genera of soil mermithids and genera of water mermithids separate in two different clades. At the same time, level of support for the entire family is extremely low. In addition to the main part, we compared sequences of genes in mitochondrial genomes from *Hexamermis* and *Ovomermis* obtained by us with mitochondrial genomes from NCBI. Against the background of high variability of mtDNA of nematodes, genomes of *Hexamermis* and *Ovomermis* show high level of similarity. This fact confirms the proximity of these genera once again. Also, 4 circular mitochondrial genomes of different mermithids were annotated. Mitogenomes contains all 36 of the typical metazoan genes: 22 tRNA genes, 2 rRNA genes and 12 protein-encoding genes. Gene atp8 is lacking. The work was supported financially by RSF № 19-74-20147.

POSTER_13

Changes in soil biota structures in different land use types and intensity in Romania

Cristina Fiera[1], M. Manu[1], I. Vicol[1], M. Mitoi[1], C.-T. Sahlean[1], D.E. Vadana[1], and the SOB4ES consortium

[1]Institute of Biology Bucharest, Romanian Academy, Romania

Soil organisms are key players in many ecosystems by ensuring a number of functions such as decomposition and nutrient mineralization. As these ecosystem services are threatened by land-use changes, an improved knowledge about the relationship between soil properties and soil biota over relevant spatial scales and in different land-use types is needed. The sampling campaign took place in the framework of European project: SOB4ES (https://sob4es.eu). We compared soil biota structures sampled in October-November 2023 in 51 differently managed sites of Romania: 9 forests, 9 grasslands, 9 wetlands, 9 agricultural lands, 9 urban areas and 6 orchards. In each investigated site, three 2 m x 2 m plots have been sampled approximately 15 m apart. Microarthropods (Collembola and Acari) and enchytraeids were sampled using a soil corer (5 cm diameter, 10 cm depth), 3 samples/site being collected. For each plot, earthworms have been sampled to a depth of 20 cm using the frame 25 x 25 cm. Microbes and nematodes have been collected from a combined 4 samples around the earthworm pits to a depth of 10 cm using an auger. Additional soil samples for physico-chemical analysis have been taken. Location, land-use type and abiotic soil properties explained significant proportions of variation in the abundance of soil biota if each predictor group was analyzed separately. Collembola and Mesostigmata mites were generally more abundant in forest and urban sites compared with the others land use types. Overall, our study demonstrates that abundance and diversity patterns of soil biota relate to soil properties. Larger spatial scales are essential for a better understanding of unifying principles in soil biology.

POSTER_14

Context dependency of fauna effect on plant growth, carbon and nutrient dynamics

Jan Frouz[1]

[1]Charles University, Praha, Czech Republic, [2]Biology centre, České Budějovice, Czech Republic

Ongoing global change and anthropogenic pressure create very dynamic changes of ecosystems driven by changes in environmental conditions, and driven alternation of vegetation cover or land use and or biological invasion, which force ecosystem to shift form one stage to another. Soil fauna is changing during this ecosystem changes as well. At the same time soil fauna often contribute to ecosystem changes during this process. Fauna may have an immediate effect on these processes, i.e. fauna effect will be visible in real time, at the moment fauna is present in the system and disappear when fauna is not present, but fauna may also cause soil modification which creates legacy that may take some time to appear but persist even when fauna is removed from the system. Here I summarize several case studies showing how fauna effect on plant growth, carbon and nutrient dynamics change during this ecosystem transitions alongside ecosystem restoration gradient using manipulation experiment where fauna was experimentally removed or added to soil in different stages of transition. Earthworms colonization in post mining sites in Europe, have negative effect on soil C storage in naive soil, promote soil C storage in intermediate stages and this effect disappear in mature soil. At the same gradient earthworms promote plant growth, the immediate effect was strongest in naïve soil, while in intermediate stages legacy effect was more important. During shift from tillage to no tillage soil show that fauna modify nutrient dynamics differently in tillage and no tillage soils. This suggests that immediate effect of fauna in the highest early after fauna is introduced in "naïve" soil which just started transition, legacy effect is the strongest during transition itself, after transition the immediate effect can become stronger but the effect itself is often have altered in comparison with situation before transition.

POSTER_15

On some species of African *Ctenolepisma* (Zygentoma: Lepismatidae) preserved in the Museum für Naturkunde (Berlin)

Rafael Molero-Baltanás[1], **Miquel Gaju-Ricart**[1], Carmen Bach de Roca[2]

[1]University of Córdoba, Córdoba, Spain, [2]13th Mestral St., Matadepera (Barcelona), Spain

Specimens of insects belonging to the genus *Ctenolepisma* (order Zygentoma, family Lepismatidae) preserved in the entomological collection of the Museum of Natural History (Museum für Naturkunde) in Berlin (Germany) have been studied for continuing with the revision of this genus. The species *Ctenolepisma erythraeum* sp. nov. is described based on specimens collected in Eritrea and labelled probably by Escherich as a new species, but never described until now. The description of two species from Madagascar established by Escherich (1910), *Ctenolepisma howa* and *Ctenolepisma madasgariense*, is updated based on type material belonging to both species, concluding that the first one belongs to the genus *Sceletolepisma* (formerly considered as a subgenus of *Ctenolepisma*), so the current name for this species is *Sceletolepisma howa*. Some characters of both species are corrected with respect to their original description and some new characters are provided. In some cases scanning electronic microscopy was used, despite the poor condition of specimens preserved for more than a century.

POSTER_16

Description of a new species of *Catamachilis* (Insecta: Microcoryphia) from Spain

Miquel Gaju-Ricart[1], Rafael Molero-Baltanás[1], Francisco José Remache-Ortiz[1], Carmen Bach de Roca[2]

[1]University of Córdoba, Córdoba, Spain, [2]13th Mestral St., Matadepera (Barcelona), Spain

Catamachilis ancorata Stach, 1930 was described on the basis of samples from two populations in Spain which are more than 120 km apart: Flix (Tarragona) and Pobla de Segur (Lérida). The first one was established as the type locality of the species. In 1990, a study of genomic variability through protein electrophoresis was conducted (Fanciulli et al., 1990) where specimens of the two populations were compared and the results showed 45% of divergence. Now, we present a morphometric study to distinguish specimens of both populations analyzing anatomical differences: the most significant differences were the length of the coxite V and the length/width ratio of the penis opening in males, while in females main differences were the number of rings of the gonapophysis IX and the length of the segment 3 of the maxillary palp. These findings allow us to describe the population of Pobla de Segur as a new species: *Catamachilis ilerdensis* n. sp.

POSTER_17

Relationship between colonization pattern in new patches and traits of collembolan species

Motohiro Hasegawa[1], Kazuki Hirose, Kenshiro Tatsumi

[1]Doshisha University, Kyotanabe, Japan

Collembolan community structure has been known to change after ecosystem disturbances. Changes in community structure are said to be accompanied by changes in trait structure, including body length and Edaphic Adaptation Score (EAS). Some taxa are seen in the early stages of succession after disturbance. In this study, we used experimental methods to verify whether such a trait structure is also confirmed in forest Collembola communities. Here, soil animals were killed by freezing the undestructed fallen leaf layer, which was then buried back into the original forest floor. After leaving it for three days or more, it was collected to extract the Collembola community. We used a method of comparing Collembola communities obtained from frozen samples. In 2019, in a natural cypress forest in Kyoto Prefecture, a frozen insect-killed fallen leaf layer was placed on-site, and three, 10, and 30 days later, the fallen leaf layer was collected, springtails were extracted, and the establishment process of early-establishing species was observed. We compared the community weighted mean of body length and EAS for the Collembola in the frozen monoliths of the organic layer and the control monoliths. There was no clear tendency in the CWMs of body length. However, CWMs of EAS tended to be lower in frozen monoliths on the 3rd and 10th day after installation. It was suggested that the species with higher EAS were less likely to colonize new patches. A comparison of changes in the structure of the Collembola community using a principal response curve showed that the community structure of the Collembola community in the frozen monoliths tended to gradually approach that of the control as time passed after installation. From the above, it was found that for Collembola, the EAS generally serves as an indicator for new patch colonization.

POSTER_18

Effects of wild boar disturbance on forest soil mesofauna in evergreen forests

Motohiro Hasegawa[1], Shuto Ohara, Ayu Toyota, Takashi F Haraguchi, Shigeho Sato

[1]Doshisha University, Kyotanabe, Japan

Recently damage to agriculture and forestry industries has been increasing due to the increase in the number of wild boars in Japan. In addition to many reports of damage to crops, wild boars also dig up tree seedlings and the forest floor. Such disturbance of the forest floor occurs when boars search for food such as underground rhizomes and roots of plants, or soil organisms, etc. In this study, we investigated the impact of wild boar disturbance on soil animal community structure by establishing areas where wild boar disturbance had been removed and comparing the soil animal community structure with areas where wild boar disturbance was ongoing. A 90 m line transect was placed within evergreen forest in Kochi, Japan. 10 stainless steel mesh cages (40 cm x 35 cm) were placed every 10 m to exclude wild boars. A 2 m × 2 m control area was set up within 2 m of each cage. One soil core (25 cm^2 x 5 cm deep) was collected from the wild boar exclusion area and the control area before the net cage was installed (end of June 2017) and two years after the installation (August 2019). The samples were extracted using a Tullgren apparatus at 35°C for 3 days. Two years after installation, the density of Collembola, Oribatida, Gamasida and Prostigmata were significantly higher in the wild boar exclusion areas. In addition, collembolan species richness was significantly higher in the exclusion plots, and redundancy analysis revealed a significant difference in species composition between the exclusion plots and the control plots for Collembola, but the difference was not significant for Oribatida. These results suggest that disturbance of the forest floor by wild boars brings about quantitative and qualitative changes in soil mesofaunal communities.

POSTER_19

Mycorrhizal type effect on soil food-webs accessed using compound-specific isotope analysis of amino acids

Amelie Hauer[1], Ajuan Zhang[1], Andrei Zuev[1], Anton Potapov[1,2,3], Melanie Pollierer[3]

[1]Soil Food Webs, Senckenberg Museum of Natural Histroy Görlitz, Görlitz, Germany, [2]German Centre for Integrative Biodiversity Research (iDiv) - Halle-Jena-Leipzig, Leipzig, Germany, [3]Animal Ecology, University of Göttingen, Göttingen, Germany

Soil food-webs are crucial for nutrient cycling and ecosystem functioning in forests. They involve complex interactions between soil invertebrates, fungi and microbes, and are based on multiple resources. Understanding these interactions is vital, yet soil food-webs remain challenging to assess due to their complexity and concealment. Forest ecosystems dominated by distinct mycorrhizae differ in their biogeochemical parameters on the global scale. One of the most important differences is in the carbon allocation and sequestration with much larger carbon stocks in ectomycorrhizal (EMF) than in arbuscular mycorrhizal fungi (AMF) dominated systems. However, soil functioning in these two forest types depends on the local soil context, and the drivers and ecosystem effects of soil invertebrate communities in these systems are poorly explored. Compound-specific isotope analysis of amino acids (CSIA-AA) is a novel tool to explore complex food-web dynamics. The combined use of $\delta^{13}C$ and $\delta^{15}N$ of essential amino acids helps to disentangle trophic relationships since it provides comprehensive information on basal resource consumption, and the trophic position of consumers. Here we present preliminary results of our study, where we have analyzed nine groups of soil invertebrates using CSIA-AA. The study aims at describing the use of plant, bacterial and fungal energy channels by different groups of consumers in soil and to elucidate structural differences in soil food webs among different mycorrhizal type dominated forests. As the first empirical quantification of root, bacterial and fungal energy channels in soil food webs across size classes, the study further marks the first application of CSIA-AA to a diverse array of consumers in soil food-webs.

POSTER_20

Reliability of earthworm data from citizen science: Lessons from a French national monitoring protocol

Kevin Hoeffner[1], Benjamin Bergerot[1], Kevin R. Butt[2], Céline Pelosi[3], Guénola Pérès[4], Maria J. I. Briones[5], Thibaud Decaëns[6], Sylvain Gérard[7], Sarah Guillocheau[1], Mickaël Hedde[7], René C. Le Bayon[8], Bart Muys[9], Helen R. P. Phillips[10], Daniel Cluzeau[1]

[1]University Of Rennes, Rennes, France, [2]University of Central Lancashire, Preston, United Kingdom, [3]INRAE, UMR EMMAH, Avignon, France, [4]Institut Agro Rennes-Angers, UMR SAS, Rennes, France, [5]Universidad de Vigo, Vigo, Spain, [6]CEFE, Montpellier, France, [7]INRAE, UMR Eco&Sols, Montpellier, France, [8]University of Neuchâtel, Neuchâtel, France, [9]KU Leuven, Leuven, Belgium, [10]University of Helsinki / Netherlands Institute of Ecology, Finland / Netherlands

Despite the crucial role of earthworms in soil ecosystems, monitoring their biodiversity comprehensively is challenging due to the spatio-temporal resolution required to accurately reflect the dynamic changes in these communities across diverse environments. Citizen science provides a promising approach to fill these gaps, engaging a broader audience in monitoring efforts and enhancing our understanding of earthworm ecology. However, a significant challenge remains: earthworms are difficult to identify to the species level by non-experts in the field, necessitating the use of morphotypes as taxonomic proxies. This study evaluates the reliability of earthworm classification into four morphotypes within the '500 ENI' (Non-intended Effects) Monitoring Network in France, which relies on annual sampling in agricultural lands conducted by non-specialist participants, followed by identity verification by expert taxonomists. We analyzed over 48,000 individual earthworms collected from 950 plots, calculating two indices: the misclassification rate (MR) and the undetected rate (UR), to assess the reliability of morphotype classification. The results indicated an average MR of 28% and an average UR of 32%, varying according to morphotypes, with lower rates for endogeics compared to epigeics, anecics with a red anterior, and with a black anterior. Our findings underscore the significant impact of sampler experience and earthworm community composition on the reliability of classifying individuals into morphotypes by citizens. To improve classification accuracy, we recommend the provision of additional training and resources, particularly for communities exhibiting low abundance, adult proportion, and morphotype diversity. Additionally, our results highlight the critical need for enhanced support and guidance for participants with limited experience, as evidenced by the quantity of plots sampled and individuals identified since joining the network. Overall, citizen science offers invaluable insights into the intricate dynamics of soil communities, advancing our understanding and conservation of the soil ecosystem.

POSTER_21

Soil microarthropod communities from urban meadows of Riga city, Latvia, characterized by QBS-ar index

Edite Jucevica[1], Ineta Salmane[1], Ugis Kagainis[1], Ruta Sniedze-Kretalova[2]

[1]University of Latvia, Institute of Biology, Riga, Latvia, [2]Latvian Fund for Nature, Riga, Latvia

Urban green infrastructure performs various important functions and urban meadows are an essential part of it. A grassland management program has recently been launched to restore natural meadows in the city of Riga where soil arthropod communities are planned to be used as a co-characteristic unit for further assessments during the program. QBS (Biological Quality of Soil) index was used to characterize the soil microarthropod communities, thus avoiding identifying their species in a considerably faster and easier manner. Eleven urban meadows were selected in the city of Riga and grouped according to their degree of degradation. Soil microarthropods were collected at the end of October 2023. In each sample plot, ten soil cores (5 cm diameter, 15 cm depth) were taken along the 30 m transect. Soil animals were extracted from soil samples using a Berlese-Tullgren extractor. Ecomorphological (EMI) and QBS indices were determined for each sample. EMI scores range from 1 to 20 for each group, and QBS is the sum of EMI points in the sample. QBS values correlated with environmental conditions among different urban meadows by Spearman and Kendall tests. In PCA analysis, the most severely degraded plots among those of the central part of the city with intensive traffic roads nearby, significantly corresponded to lower QBS. Factors e.g. relative soil moisture, vegetation height and naked soil cover described the variation of QBS and plant species for the most part of variation data for the first two axes (20.6-55.9%). We believe that further surveys at the sampling sites will improve the analysis, and the QBS evaluation method is expected to give a more precise assessment of how successful the urban meadow restoration program was.

POSTER_22

Assessing the ecotoxicity of gold mine tailings utilising earthworm (*Eisenia andrei*) cocoons

Mark Maboeta[1], Herman Eijsackers[1], Jurie Wahl[1]

[1]North-West University, Private Bag X6001, Potchefstroom 2521, South Africa

South Africa is one of the top ten gold-producing countries in the world (100 MT, 2023). For every tonne of gold produced, 200,000 tonnes of waste are generated. This comes at a considerable ecological cost as heavy metals have been reported to occur in gold mine tailings. This study aimed to assess the ecotoxicity of gold mine tailings (from two mines) on *Eisenia andrei* cocoons' hatching and juvenile growth. Ten cocoons (per replicate) were exposed to 250g of mine tailings, a reference field-collected soil and control. Endpoints measured included the cocoons' hatching success (after 23 days) and the hatchlings' survival rate (17 days later). Earthworm growth and mortality were assessed for nine weeks. The assessment of the hatching success of the cocoons exposed to the different substrates revealed that hatching was statistically lower in tailings from both mines when compared to the control ($P < 0.05$). Further, the hatching success was statistically lower ($P < 0.05$) in Mine1 than Mine2. The number of surviving worms at the end of the exposure period indicated that the worms hatching in both mine tailings material had significantly lower survival rates ($P < 0.05$) compared to the control. None of the hatchlings in tailings material from Mine1 survived the first week after hatching, while Mine2 had a 60% and the control a 100% survival rate. Growth assessments indicated that worms hatched from Mine2 showed no weight gain during the experimental period. It was concluded from the results of this study that the ecotoxicity of gold mine tailings could be assessed using cocoon hatching and subsequent juvenile earthworm growth. Given the large amounts of mine tailings in southern Africa, it is important to further develop an efficient testing system for ecotoxicity assessment at hand.

POSTER_23

Conventional agricultural management negatively affects soil fauna abundance, soil physicochemical quality and multifunctionality

Emogine Mamabolo[1], René Gaigher[1], James Pryke[1]

[1]Department of Conservation Ecology and Entomology, Stellenbosch University, Stellenbosch, South Africa

Agricultural intensification is one of the major drivers of biodiversity decline and the loss of its functions in the soil. For soil health and sustainability planning, it is important to understand the effects associated with agricultural management on soil function and biodiversity. This study explored soil fauna, physicochemical properties, soil quality and multifunctionality and how they are affected by agroecosystem management in four different land uses i.e., conventional agriculture, livestock-integrated agriculture, conservation agriculture and natural grassland. Linear mixed-effects models (LMMs) were used to determine the response of multifunctionality, soil quality as well as soil fauna abundance and diversity to different land uses. A structural equation model (SEM) was used to evaluate the links between soil management (tillage), soil quality, soil biodiversity (Shannon diversity) and ecosystem multifunctionality. According to the results, the conventional land use favoured some nutrients, however soil of both the integrated and conservation land uses had physical and chemical properties indicative of good soil quality e.g. low compaction, low C:N ratio and stable aggregates. Soil fauna abundance was more responsive to land use and the soil environment compared to species diversity which did not show significant responses as expected. Tillage is known to negatively influence soil fauna, soil functions and physicochemical properties through intense soil structure disruption. Here, its detrimental effect is reflected by the lowest record of soil fauna, poor soil physicochemical quality and low multifunctionality observed within the conventional land uses managed under deep tillage, compared to other land uses which are under zero tillage. Overall, the study shows that the implementation of sustainable soil management practices which improves the physical and chemical status will not only be beneficial for productivity but also for the promotion of important soil fauna, better soil quality and ecosystem multifunctionality.

POSTER_24

Clitellum does lie: Morphological and phylogeographical study of the hypervariable earthworm species complex *Allolobophora molleri-moebii*

Alejandro Martínez Navarro[1], Natasha Tilikj[1], Irene De Sosa[2], Marta García Cobo[1], Alberto González Casarrubios[1], Sergio Jiménez Pinadero[1], Dolores Trigo[1], Daniel Marchán[1], Marta Novo[1]

[1]Universidad Complutense De Madrid, Madrid, Spain, [2]Museo Nacional de Ciencias Naturales - CSIC, Madrid, Spain

Life in soils has led to a morphological stasis in key edaphic organisms such as earthworms, giving rise to cryptic species with great genetic diversity. However, the opposite phenomenon also occurs in earthworms, resulting in the description of different species from a single genetic lineage. This would be the case of the *Allolobophora molleri-moebii* species complex. To solve this taxonomic problem, 35 populations of this complex from Portugal, Spain and Morocco were collected, representing a wide range of variation in one morphological trait (clitellum position). Clitellate individuals were identified and their internal and external characters were studied. The phylogenetic relationships of the sampled populations and other representatives of Lumbricidae, Criodrilidae and Hormogastridae were recovered by Bayesian inference and Maximum Likelihood analyses for a set of seven molecular markers (COI, ND1, 16S, 12S, 28S, H3 and H4). An ultrametric tree was generated with BEAST and haplotype networks were represented with Popart. Finally, a PCA was built for external morphological characters. The results show phylogenetic clades of recent divergence and inconsistent with morphological data for the *A. molleri-moebii* species complex, recovering together individuals of *A. molleri*, *A. moebii*, *A. fernandae* and *A. monchicana* in several clades. The PCA slightly differentiates A. monchicana, the only diploid species of the complex, from the remaining taxa, whose individuals form a "continuum" in terms of morphological characters. These results support the *A. molleri-moebii* species complex as a potential single species with an unusual phenotypic variability, possibly acquired through genomic duplication or epigenetic mechanisms. This, and the fact that their distribution area is included in a latitudinal gradient along the Iberian Peninsula, would highlight this complex as a great candidate for studying the interaction between genotype, phenotype and environment, and therefore, the adaptation of these animals to climate change.

POSTER_25

Time to sleep! A comparative study of the aestivation process in riparian and terrestrial earthworms

Alejandro Martínez Navarro[1], Natasha Tilikj[1], Alberto Piris[1], Dolores Trigo[1], Daniel F Marchán[1], Marta Novo[1]

[1]Universidad Complutense De Madrid, Madrid, Spain

Earthworms are key organisms for the functioning of terrestrial ecosystems and the maintenance of their biodiversity. Climate change poses a real threat to earthworms which some species are able to cope with through a form of dormancy known as aestivation. This strategy has been studied in species living in semiarid environments such as *Carpetania matritensis*, but very little is known about the aestivation process in riparian earthworms. *Allolobophora molleri* is a hygrophilous species, often found in temporary rivers or seasonally waterlogged meadows. The aim of this research is to study the aestivation process in riparian earthworms and to compare the abiotic factors inducing aestivation with those species of drier soils. For this purpose, laboratory experiments were performed exposing individuals of two populations of *A. molleri* to different levels of soil moisture and temperature. In parallel, the effect of soil moisture on the cosmopolitan earthworm species *Aporrectodea trapezoides* was also studied. The obtained results showed that the *A. molleri* do not survive the very low levels of soil moisture at which *A. trapezoides* and *C. matritensis* are able to aestivate, needing twice as much moisture to induce the process. In addition, a strong effect of temperature in aestivation has been reported for *A. molleri* but not previously observed in other species. Differences between the studied populations of *A. molleri* have been observed for different abiotic stressors. This work explores for the first time the aestivation process in earthworm species that are particularly vulnerable to climate change and establishes the drivers that trigger these survival mechanisms. Further studies will add RNA sequencing to analyse gene expression and transcriptomic changes to better understand the aestivation process in earthworms.

POSTER_26

Edaphic fauna as bioindicators of soil conditions surrounding the unique Lecina oak tree (Spain)

Ignacio Piedrafita[1], Alejandro Martínez Navarro[1], Mónica Gutiérrez López[1]

[1]Universidad Complutense De Madrid, Madrid, España

Singular, monumental and veteran trees are primary elements of the urban and forest landscape in Spain. They are intrinsically valuable and fundamental in terms of their ecological and economic value, cultural and social heritage and contribution to society through ecosystem services. In recent decades, public interest in such trees has increased due to different media and social networks, and this has impacted such trees and their surrounding soils. Thus, studies on the condition of soils surrounding unique trees can serve as a scientific-technical basis for the development of conservation measures. The Lecina holm oak, a singular tree in Aragon, was named European Tree of the Year in 2021 and this triggered a massive increase in the number of people visiting the tree. In this study, we evaluated soil conditions and soil quality around the Lecina tree, including physical and biological parameters (e.g., community of edaphic arthropods). Soil samples were taken in three delimited areas: at the edge of the tree canopy (dripline), and inside and outside the protective perimeter fence). Soil quality indices (QBS and Maldague), based on arthropods as edaphic bioindicators, were calculated. Indices were generally low and in some areas, they showed changes to the complexity and stability of the edaphic system. A map of soil quality was developed, which indicated that the most disturbed area was at the edge of the canopy of the tree closest to the access road, where the majority of visitors view the tree, and thus generate greater disturbance. This work demonstrates the utility of the edaphic fauna as bioindicators of human disturbances, which informs the development of corrective measures to be taken to conserve unique trees and their supporting soil.

POSTER_27

Effects of climate change on soil fauna: Experimental study in forest of Guadarrama (Spain)

Hugo Martínez[1], Marta Novo[1], Dolores Trigo[1], Enrique Andivia[1], Alejandro Martínez Navarro[1], Mónica Gutiérrez López[1]

[1]Universidad Complutense De Madrid, Madrid, España

One of the main environmental challenges that society must face today is climate change. Global temperatures are rising and local precipitation patterns are changing with increasing rainfall intensity and periods of drought. These changes will probably affect the structure and functioning of terrestrial ecosystems. Soils will be particularly affected by this phenomenon and many edaphic animal communities will be threatened although possibly not all organisms will be affected in the same way. Some organisms will be less affected than others and may even present adaptations to these changes. In this work, the effect of climate change on soil fauna communities in an experimental plot in Sierra de Guadarrama (Madrid, Spain) is investigated. The experimental area was divided into different plots that were subjected to different of treatments simulating climate change: temperature increase (OTC; open top chamber), rain exclusion (ROS; rain shelters), as well as the combination of both treatments and controls without any treatment. The experimental conditions were maintained for six months (May-November), and at the end of autumn, soil samples were taken under each experimental treatment to analyse physical-chemical properties and to extract the edaphic fauna. Measurements of air and soil temperature and humidity were also taken. The installation of the OTCs increased the average air temperature by approximately 1.6 ºC and decreased air humidity. Soil moisture was also variable among treatments. Three species of earthworms were found: *Orodrilus carpetanus*, *Aporrectodea rosea* and *Lumbricus* sp., both mature and juvenile individuals, and the characteristic groups of microarthropod (mainly mites and springtails). To date, no clear effect of climate treatments on the edaphic fauna has been observed, making it necessary to delve deeper into these results.

POSTER_28

Bioluminescence, morphology, and DNA barcode of an undescribed species of *Lobella* from Japan (Collembola: Neanuridae)

Atsuko Ohira[1], Taizo Nakamori[2]

[1]Tamarokuto Science Center, Nishitokyo-City, Japan, [2]Yokohama National University, Yokohama-City, Japan

Collembola are terrestrial arthropods containing luminous species. Luminous Collembola has been known for more than 100 years. To date, twelve species have been reported to be luminous. However, these include uncertain records and unidentified species. In the genus Lobella (Neanuridae), *Lobella sauteri* and *Lobella yambaru* have been reported to be luminous. Here, we report a previously undescribed luminous species of Lobella from Miyako Island, Okinawa Prefecture, Japan. The morphology was described, the genomic DNA sequence of the mitochondrial cytochrome c oxidase subunit 1 gene was partially determined as a DNA barcode, and bioluminescence was characterised. This species is similar to *L. sauteri* but can be distinguished by the shape of the chaetae and the DNA barcode. This species emits light from tubercles on the abdominal and thoracic terga in response to stimuli, similar to *L. sauteri* and *L. yambaru*. The bioluminescence spectra were similar among the three *Lobella* species, with a peak at approximately 540 nm.

POSTER_29

Phylogenetically older taxa have broader geographic distribution, are trophic generalists, and are more often parthenogenetic

Xue Pan[1], Bastian Heimburger[1], Jing-Zhong Lu[1], Ting-Wen Chen[1], Peter Hans Cordes[1], Zhijing Xie[2], Xin Sun[3], Dong Liu[4], Donghui Wu[4], Stefan Scheu[1], Ina Schaefer[1], Mark Maraun[1]

[1]University of Göttingen, Göttingen, Germany, [2]Northeast Normal University, Changchun, China, [3]Institute of Urban Environment, Xiamen, China, [4]Northeast Institute of Geography and Agroecology, Changchun, China

Understanding ecological and evolutionary mechanisms that drive global biodiversity patterns is important for comprehending and preserving biodiversity. Despite being critically important to the functioning of ecosystems, the mechanisms driving belowground biodiversity are little understood. Here, combining phylogeny and trait approaches, we investigated the radiation and traits diversity of oribatid mites from two mountain ranges (the Alps in Austria and Changbai Mountain in China) at similar latitude that underwent different orogenesis and are exposed to different climates. The results highlight that oribatid mites in Eurasia are of ancient origin with species on Changbai Mountain being phylogenetically older than species in the Alps. Species on Changbai Mountain evolved long before the mountain uplift indicating that the species evolved at other sites resembling the ones on Changbai Mountain today. Most of Changbai taxa are trophic generalists, reproduce via parthenogenesis and possess broad range sizes, supporting the view that generalistic traits promote survival and evolution in phylogenetically old soil animal taxa. Contrasting Changbai Mountain, many species in the Alps evolved after the mountain uplift indicating that orogenesis may also foster diversification of species. Collectively, these results highlight that combining species traits and phylogeny allow deeper insight into the evolutionary forces shaping mountain soil biodiversity.

POSTER_30

First data on morphology of the ontogenetic stages of *Megalothorax* (Neelidae)

Ksenia Panina[1], Anastasia Striuchkova[2], Mikhail Potapov[3]

[1]Moscow State Pedagogical University, Moscow, Russian Federation, [2]Moscow State Pedagogical University, Moscow, Russian Federation, [3]Moscow State Pedagogical University, Russian Federation

So far the knowledge on ontogenesis of species of the genus *Megalothorax* is rather scarce. The embryonic development of this species lasts about 16 days at 20°C, and the maximum number of moults is 30 in a specimen that lived for 197 days. Data on the morphology of different developmental stages of *Megalothorax* are absent. We initiated and presently keep a culture of *M. perspicillum* that successfully reproduces at 17-22°C. Eggs from the main laboratory culture were transferred to individual glass microtubes. On average, first instars hatch from eggs after 3-5 days. Due to regular observations on eggs it was possible to get the individuals which were several hours old. After they were fixed in alcohol and mounted on cavity slides with Gisin's liquid. For the half of the body, the first stage has 12 common chaetae on the thorax (vs. 22 in final stage) and 13 on the abdomen (vs. 18 in final stage). The most conservative chaetotaxy is a- and p-rows of Thorax II (changing as 4 to 6 and 3 to 6, respectively), a-row of Thorax III (4 to 6), and five abdominal rows from **γ** to **η** which are similar although not identical to final stage. P-row of Thorax III has only one chaeta (vs. 4 in the final stage), **α**- or **β**-rows of the abdomen are represented by the only chaeta (these two rows together consist of 5 chaetae in the final stage). The first stage has only 4 free wrc-chaetae (vs. 7 in the final stage) and lacks inner sensilla of sensory fields. The other sensilla on the body are well developed in the first stage although the abdominal sensilla s3 is much larger than sensilla s2 (vs. subequal in the final stage). Integumentary channels are developed. The study is supported by the Russian Science Foundation (project No. 24-24-00203).

POSTER_31

The genus *Megalothorax* (Neelidae) in the hothouses of Moscow

Mikhail Potapov[1], Ksenia Panina[1], Maria Antipova[2], Anastasia Striuchkova[1]

[1]Moscow State Pedagogical University, Moscow, Russian Federation, [2]The Severtsov Institute of Ecology and Evolution, Moscow, Russian Federation

To date, seven species of the genus *Megalothorax* have been recorded in Russia. Three of them (*M. minimus, M. willemi*, and *M. incertus*) are known from the Moscow Region, although the two first species are common, the latter appears to be very rare. Two large hothouse complexes in Moscow were studied in the winter of 2023-2024. Thirty and 21 samples of moss, soil, and mulch were taken in the two hothouses, respectively. Both regimes, tropical and subtropical, were studied, mostly out of flower pots. Surprisingly, half of all samples contained individuals of the genus *Megalothorax* and this genus was the most diverse among other genera of Collembola. Three species, *M. laevis*, M*. perspicillum* and *M. minimus*, were recorded. The first one was found mostly in hot greenhouses, where the high temperature is permanently kept that imitates the tropics. The record of this generalist species is probably explained by its intertropical range. *Megalothorax perspicillum* was found only in the subtropical greenhouse. This species prefers gardens and agricultural fields and it is distributed in subtropics and southern part of boreal zone. *Megalothorax minimus* was recorded in different parts of greenhouses, and was much more frequent. *Megalothorax minimus* is very widely distributed, and from our data it prefers disturbed situations, e.g. lawns of Moscow city, where it substitutes *M. willemi*. *Megalothorax laevis* was recorded for the first time in Russia. The three species of the genus *Megalothorax* reflects three ecological groups of Collembola inhabiting Moscow hothouses: strictly thermophilic, moderately thermophilic and ruderal. These groups have been revealed by us after identifying all species of Collembola of the hothouses under study (~ 30 species). The study is supported by the Russian Science Foundation (project No 24-24-00203).

POSTER_32

What are the main drivers of soil aggregate stability: Soil biota or abiotic parameters?

Guenola Peres[1], Morgane Roquier[1], Jack Faber[2], Anna Edlinger[2], Stefano Mocali[3], Mathieu Emily[4]

[1]Institut Agro Rennes-Angers, UMR SAS INRAE, Rennes , France, [2]Wageningen Environmental Research, Wageningen, the Netherlands, [3]Agricoltura e Ambiente (CREA-AA), Cascine del Riccio, Italy, [4]Institut Agro Rennes-Angers, UP Applied Mathematic, Rennes, France

Soil structural stability is a key indicator of soil health as it also reflects soil resistance to erosion caused by wind and rain. It is well known that aggregate stability depends on abiotic factors (organic matter, soil texture) as well as biotic factors especially microorganisms (fungi and bacteria) and soil macrofauna (earthworms). However, the effective contribution of soil organisms is still unclear and requires further research. In this context, one objective of MINAUTOR project (EJP-Soil European program) was to assess the contribution of soil biodiversity to soil structural stability. Data on aggregate stability, soil biodiversity (microorganisms, soil fauna) and abiotic parameters (soil parameters, agricultural practices, climatic parameters) were collected from different sources: i) MINOTAUR data from field campaigns carried out in nine European Long-Term Experimental sites, ii) data from previous research projects carried out in different agroecosystems in Europe. This led to the creation of a database covering large panel of contexts (land uses, soil types, climatic regions). The main challenges in the database construction include the heterogeneous nature of the data concerning the method of aggregate stability measurement, the sometimes lack of metadata regarding sampling methodology, agricultural practices, soil properties, and climate at study sites. Thus, preliminary findings from our analysis highlight (i) the need for data harmonization and (ii) the inclusion of a minimal set of metadata to examine factors influencing aggregate stability in agricultural systems. Following a rigorous data harmonization process, we analyze our data to determine which factors, biotic or abiotic, have the greatest effects on soil aggregate stability and quantify the importance of soil biodiversity as aggregate stability driver. The results will permit to clarify the relationships between soil biodiversity, function and ecosystem services (ecological production functions, EPF) and will support the promotion of strategies to enhance soil and soil biodiversity protection.

POSTER_33

Effect of urban amendment contaminated by plastics on nanoplastic accumulation in earthworm's body

Guenola Peres[1], M Davranche[2], A Juif[2,5], J Wang[3], M Baalousha[3], A Fautrel[4], D Renault[5], J Gigault[2,6]

[1]Institut Agro Rennes-Angers, UMR SAS, INRAE, Rennes , France, [2]University of Rennes, CNRS, UMR GEOSCIENCES-Rennes, Rennes, France, [3]Center for Environmental Nanoscience and Risk, Department of Environmental Health Sciences, Arnold School of Public Health Sciences, University of South Carolina, Columbia, United States, [4]INSERM University Rennes, Plateforme H2P2, UAR Biosit, Rennes, France, [5]University of Rennes, CNRS, UMR EcoBio, France, [6]International Research Laboratory, Laval University, Quebec, Canada

Plastic pollution is gaining more and more attention from the scientific community. While the vast majority of scientific efforts have focused on oceanic gyres, less attention has been given to continental systems (e.g., soil, water), most of them additionally focusing on microplastics while the effects of nanoplastics have been less explored. It is now urgent to improve our knowledge on the effects of plastics on soil functioning, and in retrospect to improve our knowledge of the effects of soil organisms on plastic distribution, alteration and degradation. In the agricultural context, several sources of plastics contribute to significant soil pollution. As part of the agricultural amendments, particular attention is given to amendments of urban origin. In this context, the aims of CINAPE and PLASTICENE projects were to assess the impact of urban amendments rich in plastics (micro and nanoplastics) on the earthworm and the redistribution of nanoplastics in earthworm's tegument. A microcosm approach was carried out during two months under controlled conditions to assess the effect of plastic-rich amendments on three earthworm species (*L. terrestris*, *A c. chlorotica*, *L. centralis*). After two months of exposition, earthworms were weighted, and then frozen. Nanoplastic accumulation was assessed in earthworm's body by considering three parts of the body: i) before the male pore, ii) the clitellum part, and iii) after the clitellum part. The nanoplastic evaluation was done by a step-by-step development of two innovative analytical methods: i) after freezing, earthworm were cut with microtome and slices were placed on thin blade which were analysed by LA ICP-MS, allowing the measurement of metal (lead, copper, cadmium, nickel, zinc, chrome) considered as proxy of nanoplastics, ii) results were then validated by a new PY-GCMS method quantifying the nanoplastics concentration. The relevancy of these two approaches was discussed and analysed.

POSTER_34

A look into the phylogeography and ecological preferences of *Allolobophora chlorotica* in the western Mediterranean

Alberto Piris[1], Alejandro Martínez Navarro[1], Natasha Tilikj[1], Mónica Gutiérrez López[1], Lise Dupont[2], Daniel F. Marchán[1], Marta Novo[1]

[1]Universidad Complutense de Madrid, Madrid, Spain, [2]Université Paris-Est Créteil, Créteil, France

Allolobophora chlorotica (Savigny, 1826) (Lumbricidae) is a widespread earthworm that occurs in a variety of habitats through Europe and Anatolia and has been introduced in many territories outside its native range. This species exhibits colour variability, with two very distinct morphs, a green morph, generally more linked to humid environments, and a pink morph, typical of drier soils. Previous studies have shown that *A. chlorotica* comprises several cryptic lineages, at least one of which is peregrine (L4) and others with more restricted distribution: the green morph would represent a single species with two lineages (L2, L3), while the status of the pink morph is not so clear, presenting at least three mitochondrial lineages that could represent distinct species (L1, L4 and L5). To assess the phylogeography, 120 individuals from western Mediterranean were barcoded through COI mitochondrial gene sequencing. Furthermore, 16S, ND1 and 28S were analysed from a subset of samples in order to infer their phylogenetic relationships and putative taxonomic status. The phylogenetic analyses showed a clear separation between lineage L5 and all other lineages, as well as the putative species status of *A. chlorotica postepheba*. L5 is mainly distributed in the Mediterranean region, but shows an unexpectedly high genetic diversity in eastern France (near Switzerland). The remaining lineages are widely distributed throughout the rest of Europe. In order to test the existence of preferences within lineages/putative species, Species Distribution Modelling was performed for the ones occurring in the Iberian Peninsula (L2, L5). These results provide relevant information on the distribution and ecological preferences of the different lineages of *A. chlorotica*, showing that different taxa may exist, but are yet to be described, which may be key to their conservation if they are restricted lineages/species or are found in habitats more susceptible to the consequences of the incipient climate change.

POSTER_35

Effects of tree canopy heterogeneity on the leaf litter arthropod community

César Víctor Lorences[1], María Esther Pérez Corona[1], Alberto Piris[1], Mónica Gutiérrez López[1]

[1]Universidad Complutense de Madrid, Madrid, Spain

Climate change constitutes one of the main environmental threats that affect ecosystems, modifying their functions, structure and diversity. Attenuating its effects is one of humanity's most important challenges. Reforestation is one of the most used ways to curb some of these effects, such as the desertification. However, planting tree monospecific stands is an ecologically weak alternative, since it leads to the creation of little diverse communities of poorly resilient ecosystems that will be more unsheltered to future environmental disturbances compared to mixed forests which show a more complex ecological structure and functions. In the present work, leaf litter arthropod communities in the forests of Sierra de Guadarrama (Madrid, Spain) were studied considering monospecific pine or oak forests and mixed forests of both species. Arthropods are essential for the functioning of nutrient cycles in ecosystems and are also used to assess soil quality. The effect of some environmental variables on its distribution was also studied. The arthropod community was very abundant and rich, mainly represented by Oribatida and Actinedida mites, Poduromorpha springtails and Thysanoptera. However, no significant differences in number or order richness were observed among the different forests, indicating that the canopy and leaf litter types do not condition arthropod communities. Some differences were found between the localities considered, with altitude having a significant effect on the arthropod communities, indicating that local differences are more important than the type of canopy. The soil quality indices were low, maybe due to the low presence of specific edaphic arthropods. In conclusion, we have not found that mixed forests constitute a setting to sustain arthropod communities of greater richness and abundance than monospecific forests. However, future studies based on indices more suitable for leaf litter communities and on soil microclimatic variables could help to better understand their distribution in the different forest formations.

POSTER_36

Silent invasion in Galapagos: Exotic earthworms and their link to environmental factors and tortoise corridors

Marta Novo[1], Jaime Ortiz[2], Alberto Piris[1], Diana Correia[3], Andre Soares[3], Francesca Nicoletti[3], Adam Zenco[3], Luis Cunha[3]

[1]Universidad Complutense de Madrid, Madrid, Spain, [2]Cornell University, Ithaca, United States of America, [3]Universidade de Coimbra, Coimbra, Portugal

The spread of invasive species is a global threat to native fauna and flora, particularly in island environments where such disturbances can precipitate biodiversity loss. The Galapagos Archipelago is a key site for evolutionary studies and its biodiversity is threatened by species introduced for agricultural, livestock and ornamental purposes. This study aimed at understanding the exotic earthworm colonization routes and patterns in Galapagos and the role of environmental factors, considering human disturbance but also with a focus on the migratory corridors of endemic giant tortoises (complex *Chelonoidis nigra*). These corridors are assumed to aid in the passive dispersal of earthworms by these tortoises, potentially improving the distribution of earthworms in disturbed and undisturbed habitats. Exotic earthworms are known to favour the establishment of invasive plants, such as *Rubus niveus* in Galapagos, which in turn may displace endemic vegetation (*Scalesia pedunculata*). We collected earthworms by hand-sorting soil monoliths in Santa Cruz Island. Sampling quadrats were distributed in areas showing different anthropogenic disturbance degrees from protected forests within the Galapagos National Park, dominated by the endemic tree S. pedunculata to highly managed agricultural or urban areas, passing through buffer areas. . Additional collections were made along tortoise migration routes to assess their role in earthworm dispersal. Environmental parameters were recorded, including plant species diversity, land use, conservation status, elevation, soil pH, organic content, nitrogen levels, and texture. DNA was extracted from the collected specimens and the mitochondrial marker cytochrome oxidase I (COI) was sequenced to aid species identification and study the phylogeography. The findings of this study elucidate the habitat preferences of these exotic earthworms, clarify their ecological interactions, and assess their invasion potential, which will be critical in the development of targeted management strategies to curb their spread.

POSTER_37

Digitizing biodiversity data of soil invertebrates: Citizen science initiative starting with spiders

Evgeniia Plakkhina[1], Sophia Sokolova[2], Artem Sozontov[2]

[1]Perm State University, Perm, Russian Federation, [2]Institute of Plant and Animal Ecology, Ekaterinburg, Russia

Almost every environmental study relies on raw data about occurrences of living organisms (who, where, when, etc.). Manual mining these data from literature has become ineffective due to the exponential growth in the number of scientific publications. Therefore, tools for fast and high-quality searching of this type of environmental data are necessary, its development and testing are the aim of our project. In this context, we compare two completely different approaches: Data Science and Citizen Science. Currently, we are focusing on the second approach, which involves recruiting volunteers to recognize and digitize occurrence data from scientific literature via a web application. We set a limit by taxa and a region well-known to our team: spiders across the Ural Mountains. Within this scope, we identified 450 publications containing information on approximately 60,000 occurrences and 200,000 individuals. The ultimate goal is to create an open-source tool for rapid and efficient data digitization, along with an open database and a user-friendly interface for data exploration. The intermediate steps we have completed are: 1) a database of publications, a library of PDF files, and a front-end for managing them; 2) a web application for digitizing information from literary sources and formatting the data into the DarwinCore standard; and 3) a road map for the Citizen Science project, which includes gamification elements and offline activities to motivate volunteers to contribute to the digitization effort. The remaining steps are: 1) to launch the Citizen Science project; 2) to evaluate the speed and accuracy of the workflow; and 3) to clean and publish the obtained dataset. The resulting dataset could be useful in biogeography, ecology, and conservation studies. There is also potential to expand the project to other regions and groups of living organisms. The work is supported by RSF #24-24-00460.

POSTER_38

Improvement of the data quality of iNaturalist earthworm (Crassiclitellata) observations

Maxim Shashkov[1], Sergey Ermolov, Dina Nesterkova, Anna Geraskina, Elena Golovanova, Tatyana Gordienko

[1]Institute of Mathematical Problems of Biology RAS – the Branch of Keldysh Institute of Applied Mathematics of Russian Academy of Sciences, Pushchino, Russian Federation

iNaturalist is the largest citizen science observation system based on user photos and provides an increasing flow of biodiversity data that eventually contributes to the open biodiversity data volume hosted by the Global Biodiversity Information Facility (GBIF) portal. Any issues within these data could distort the research result in which these data were used as input occurrences, particularly species distribution modelling and monitoring of invasive species spreading. The aim of this work is to develop a workflow for verifying earthworm observations available through the iNaturalist system. As of May 10, 2024, about half of the 90,714 Crassiclitellata observations in the iNaturalist system are of a single taxon - *Lumbrius terrestris* (43,383), not only due to the fact that it is a common species but since in most cases the neural network that analyzes photos automatically suggests this species for any earthworm observation. But only somewhat more than 5k observations of this species have confirmed identification, they have "Research Grade" status and can be exported into GBIF. But among those observations, there are apparent misidentifications, as most iNaturalist users are not familiar with earthworm species features and tend to accept the automatic identification suggested by the computer vision model. We have been looking through observation of the earthworms, beginning in the territory of Northern Eurasia, and revising identification. We consider an observation to be reliable if its identification is confirmed by two iNaturalist users who are known earthworm researchers. When we are sure at the species level, we add an additional observation field: "identified by (expert)", where we specify who particularly suggests and confirms identification. After reviewing several hundred observations, we found that in most cases, the quality of the photos does not allow confident identification, and we have to lower the identification to the genus or even family level.

POSTER_39

eDNA extraction from large soil samples for the large organisms: Metabarcoding of soil invertebrate diversity

Ivan Sotnikov[1], Evgeniy Gusev[1], Nikita Martynenko[1], Boris Efeykin[1], Alexei Tiunov[1]

[1]A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninsky Prospekt, 33, Russian Federation

eDNA metabarcoding is a modern method for investigating the taxonomic composition of communities. Soil is a species-rich environment and this molecular approach creates a numerous benefits for studying its biodiversity. Special procedures for purification during DNA extraction are needed because organic compounds from soil is known are a PCR inhibitors. Most existing DNA extraction kits are developed for small amount of soil (0.5-1g). Such volumes have been shown to be sufficient for assessing the taxonomic composition of microorganisms, but not larger invertebrates and rare taxa. The aim of our research was to develop a procedure for pretreating of large soil samples for future processing using classical DNA extraction kits. According to the suggested procedure at the first step 10 grams of soil were mixed with different buffer solution (PBS, Longmire or CTAB) in a ratio of 1:2. After sedimentation of large particles solution was filtered using filtration funnels (Vladisart, Russia) with 0.2 μm pore size nitrate-cellulose filters. The filters were cut in small pieces and placed in microcentrifuge tubes and used for DNA extraction with FastDNA Spin Kit for Soil (MP Biomedical, China).Library preparation and Illumina MiSeq Sequencing of samples with the primer pair target on fragment 18S gene were conducted in Novogene company. Samples treated with the Longmire buffer yielded more Metazoans reads compared to PBS and CTAB buffers. Nematoda were the most abundant ASV of Metazoa but other important soil invertebrates (arthropods, annelids) were rare. Despite significant differences in non-metazoans reads between different sample treatments the diversity of Apicomplexan ASV`s was similar. Additional use of COI primers to identify a greater diversity of soil fauna will allow not only an assessment of soil invertebrate diversity, but also an evaluation of their interactions with their parasites (for example Apicomplexa). This work was supported by the Russian Science Foundation, project №22-14-00363.

POSTER_40

The peculiarities of haplotype networks of different genetic lineages *Parisotoma notabilis* s. l. (Collembola)

Anastasia Striuchkova[1], Maria Antipova[2], Daria Semenova[1], Natalya Kuznetsova[1]

[1]Moscow State Pedagogical University, Moscow, Russian Federation, [2]Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia

Molecular genetic studies reveal hidden diversity in many common species of springtails (Collembola) including the parthenogenetic *Parisotoma notabilis* (Schäffer, 1896) sensu lato. We constructed haplotype networks for the most common in Eastern Europe lineages of this species (L1, L2 and L4-Hebert) based on the mitochondrial gene COI-5P in the PopArt program. A total of 108 sequences were used for the analysis: 68 for the lineage L1 from 14 locations, 20 for the lineage L2 from 6 locations and 20 for the lineage L4-Hebert from 8 locations. Fourteen haplotypes were discovered for the L1 lineage in Eastern Europe. The network of haplotypes of the lineage L1 looks “star-like”. One predominated haplotype is distributed throughout almost the entire studied territory (86% studied locations). The variability of the L2 lineage is higher: 16 haplotypes were obtained despite less study, compared to the lineage L1. 10 haplotypes were discovered for the L4-Hebert lineage. The networks of haplotypes of the lineage L2 and L4-Hebert look "web-like". Haplotypes are more locally distributed: only 1 haplotype is found in different locations in both the L2 and L4-Hebert lineage. Differences in the structure of haplotype networks for lineages L2, L4-Hebert and L1 may be associated with differences in the ecology of the lineages. For Eastern Europe, we showed that lineage L1 successfully occupies disturbed habitats. Based on field data, the predominated haplotype is probably the most ruderal, among all haplotypes of lineage L1. This study was supported by Grant No. 22-24-00984 of the Russian Science Foundation.

POSTER_41

Soil microarthropods to evaluate the effect of climate change on crops in field experiments

Estela González Sánchez[1], María Carballo Creagh[1], Alberto Juan Cantos Echeverría[1], Natasha Tilikj[1], Monica Gutiérrez López[1]

[1]Complutense University of Madrid, Madrid, Spain

Climate change is having a significant impact on the planet, greatly affecting biodiversity and soil quality. In this global change scenario, it is important to understand the anthropogenic effects of agricultural techniques used to cultivate soils to preserve and restore biodiversity and improve the role of soil biota in agroecosystems. This study evaluates the effect of climate change and human activities on cultivated soils using soil fauna and quality indices as indicators. The experiment comprises a wheat-legume rotation over three years. Edaphic microarthropod communities were analysed in crops subjected to different tillage practices (conventional tillage versus minimum tillage), and to various types of treatments that simulate climate change: temperature increase (OTC; open top chamber), rain exclusion (ROS; rain shelters), as well as the combination of both treatments and controls without any treatment. To date, we have not found a clear effect of the different climatic treatments on the abundance of microarthropods and soil quality indices. A slight but significant effect of the temperature increase treatment were observed on the abundance of total insects and other arthropods (excluding springtails and mites) for the conventionally tilled crops. A greater abundance of Poduromorpha springtails was found in crops subjected to conventional tillage, but other groups of microarthropods (like Hymenoptera, Arachnida or Symphyla) were more abundant in soils subjected to minimal tillage. The QBS indices showed low values (below the optimal threshold for soil quality of 100) in all cases indicating that the quality of the soil is limited, showing similar values in all types of cultivation and treatments. It is important to note that these results represent the first stages of an ongoing study, and it is possible that we found clearer effects of these treatments in future sampling.

POSTER_42

Effect of climate change on edaphic arthropods in crops with different management in laboratory experiments

Luis Fernández Martínez[1], Natasha Tilikj[1], Mónica Gutiérrez López[1]

[1]Complutense University of Madrid, Madrid, Spain

Climate change is leaving behind numerous effects on the planet, many of them affecting soils, causing desertification and degradation. This soil degradation can be evaluated through soil fauna, studying its biodiversity and quality. Edaphic arthropods are generally very sensitive to changes in the environment. This project is included in another larger project that evaluates the effect of climate change on crops. The specific objective of this work is to evaluate the effects of four different crop management legacies on soil resilience to warming and drought through edaphic arthropod communities. The experiment design consists of crops with 30 years of experimental management subjected to three tillage practices (standard tillage, minimum tillage and zero tillage) in a 4-crop rotation system (fallow-wheat-vetch-barley) versus a wheat monoculture. Soils from these crops were placed in pots in a greenhouse and subjected to controlled conditions of extreme temperature and humidity. The evolution of the arthropod communities has been analyzed in each of the experimental microcosms subjected to these conditions and the quality of the soils has been evaluated based on these communities. In general, legacies of intensive management (standard tillage and monoculture) reduce soil resilience to climate change compared to low disturbance legacies. Not all arthropods were affected by climatic treatments. For wheat monoculture legacy, Gamasida mites decreased drastically in treatments, especially in the combined ones (drought and warming). The springtails, especially Entomobryomorpha, decreased drastically in treatments effected by drought, not being affected by warming. For rotation crops, similar results were obtained, showing significant effects on Gamasida mites, Symphypleona springtails and total arthropods. Drought seems to be the main factor that could affect these communities in a scenario of climate change, although future studies are necessary.

POSTER_43

Small but mighty: Transcription of small heat shock proteins in earthworms exposed to anthropogenic stressors

Natasha Tilikj[1], Mercedes De La Fuente[2], Ana Belén Muñiz González[2], Patricia Caballero Carretero[2], Alejando Martínez Navarro[1], Jose Luis Martínez Guitarte[2], Marta Novo[1]

[1]Complutense University of Madrid, Madrid, Spain, [2]National University of Distance Education, Madrid, Spain

An investigation of the effects of anthropogenic stress on terrestrial ecosystems is urgently needed. Earthworms improve soil properties, so their adaptation to stress is crucial. *Eisenia fetida* is an epigeic earthworm, which has been recognized as a model soil organism for abiotic stress and toxicology assays. Small heat shock proteins (sHSPs) are the most diverse and ubiquitous chaperones, however their roles in stress mitigation are largely unknown. Annelida have monomeric sHSPs (one **α**-crystallin domain) and dimeric sHSPs (two tandemly repeated **α**-crystallin domains). Earthworms were exposed to heat stress (31 °C or 35 °C), desiccation stress (20% or 10% humidity) and chemical stress from Bisphenol-A or Endosulfan at normal 21 °C or elevated 26 °C temperature. The sampling times for heat and desiccation stress were 2 h, 7 h and 24 h, while chemical exposure lasted for 2 h or 7 h. The survival rate of the earthworms was 100 % for all treatments except for sublethal T 35 °C, which only survived for 2 h. In heat stress sHSPs were mostly significantly expressed at 24 h mark suggesting they have a role in thermotolerance. However, there was a noticeable difference in expression between sHSPs with monomeric and dimeric architecture – the dimeric ones were only significantly expressed at 24 h, while some monomeric sHSPs also had significant expression at 2 h and 7 h. Desiccation stress induced a similar expression profile to heat stress meaning that acquired tolerance to these stressors share similar mechanism. Synergistic effects of heat and chemical stress were mostly noticeable with endosulfan exposure. Monomeric sHSPs were generally upregulated in at both 2 h and 7 h, while dimeric sHSPs were more prominent at 7 h. Sequence and structural analysis could help identify the reasons behind the differences in expression between monomeric and dimeric sHSPs.

POSTER_44

Effect of soil contamination on the growth and activity of two species of earthworms

Eloy Canales García[1], **Natasha Tilikj**[1], Dolores Trigo[1]

[1]Complutense University of Madrid, Madrid, Spain

Earthworms are a vital component of the soil ecosystem, their activity results in soil aeration and organic matter recycling, which contributes to soil fertilization. In the current environmental landscape, it is of special interest to know the effect of anthropogenic pollutants such as tire dust (TD) and copper (Cu+2) on the activity of these animals. Two earthworm species from distinct categories were used. *Eisenia fetida* was selected because it is an epigeic model organism in contamination studies, while *Aporrectodea trapezoides* is an anecic species with a worldwide distribution that can therefore serve as a model. The effect of TD was evaluated at 20% and 40% concentrations on microcosms of 10 mature individuals of *A. trapezoides* consisting of soil from el Tomillar (80%) mixed with horse manure (20%). As for *E. fetida* 30 mature individuals were placed in microcosms composed of horse manure moistened to 80% containing either TD 40% or Cu 1g/L. Over three months, earthworm biomass measurements were taken as a direct indicator of the effect of the pollutant. The resulting vermicompost obtained from both species was used to plant cherry tomatoes (*Solanum lycopersicum*) and beans (*Phaseolus vulgaris*) seeds. Earthworm-treated medium favoured higher plant biomass, suggesting their capability to attenuate the effect of the pollutant. Subsequently, the oxidative stress of plants and earthworms was evaluated by lipid peroxidation, and it was observed that TD does not have a significant effect on the oxidative stress of the earthworms, in contrast to copper, which does. In the case of *E. fetida*, it was possible to generate individual cultures where recently hatched specimens were introduced and subsequently paired to analyze how their life cycle and reproduction developed in the presence and absence of the contaminants.

POSTER_45

Up the down staircase: Trophic links between belowground and aboveground food webs

Alexei Tiunov[1], Dmitry Vinogradov[1], Oksana Rozanova[1]

[1]A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russian Federation

Soil detrital food webs and aboveground grazing food webs make up an inextricable functional unity, although direct trophic links between aboveground and belowground communities are rarely considered in food web models. Functional connections between aboveground and soil biota are usually regarded through the prism of plant-mediated interactions, but they are much more diverse. Detrital food webs process most of the primary production, although, with huge losses, this energy is converted into a large biomass of soil animals. This biomass spills out of the soil as a constant upward stream of flying insects having soil-dwelling larvae, mass emergence of winged ants and termites, surfaced earthworms, and other ways. The flow of invertebrates inhabiting the aboveground space moves in the opposite direction, ending up on the soil surface and ultimately becoming victims of soil predators and detritivores. Unlike other forms of aboveground resources that fuel soil food webs, such as leaf litter, root exudates, frass, and honeydew, that are primarily processed by microorganisms, this gravity-driven "arthropod rain" is assimilated directly by animals, supporting especially high-order consumers. The role of soil animals in the feeding of aboveground predators, especially vertebrates, has been documented in numerous case studies, but only a handful of studies have examined the effect of predator pressure on soil communities. There is even less quantitative data on the role of aboveground subsidy in maintaining populations of soil predators and on the upward flux of organisms leaving the soil. This work was supported by the Russian Science Foundation, project No. 22-14-00363.

POSTER_46

Soil doesn't matter: Suspended food web in a tropical monsoon forest

Sergey Tsurikov[1], Oksana Rozanova[1], Alexei Tiunov[1]

[1]A.N. Severtsov Institute of Ecology and Evolution, Moscow, Russian Federation

Tropical forests are known as ecosystems with high biological diversity, also due to the wide variety of ecological niches which they provide. One of these niches, unique to tropical forests, is suspended litter – leaf and small branch litter trapped by rhizomorphs of marasmioid fungi (species of the *Marasmius* genus). The suspended litter forms a unique model case for studying the principles of detrital food web organization, because its inhabitants have no direct access to either the carbon released by plants through their roots or the stabilized organic matter of mineral soil. The aim of this work was to compare the composition and trophic niches of invertebrates from suspended and aboveground litter to determine differences in basal trophic resources. The study sites were located in the Dong Nai (Cat Tien) National Park, Vietnam (11.428786, 107.426769). Suspended litter was collected from a height of 1.5-2 meters above the soil level. Invertebrates were extracted into 70% ethanol using modified Tullgren funnels with filament lamps. Stable isotope analysis was used to determine the trophic structure of invertebrates. As a result, in total 9107 specimens of invertebrates from 88 different taxonomic groups were found in 1437 grams of dry mass of suspended litter. The list of major taxonomic groups in this substrate and in aboveground litter at the same site is similar. Stable isotope analysis showed that invertebrates of suspended litter are enriched in ^{13}C relative to suspended litter by an average of 5.4‰, ^{15}N by 2‰. Trophic structure of invertebrates of suspended and aboveground litter is also similar. Thus, although invertebrates of suspended litter are limited in the resources provided by the soil, these invertebrates rely mainly on saprotrophic microorganisms as a basal trophic source, i.e., just as invertebrates of aboveground litter. This work was supported by the Russian Science Foundation, project No. 22-14-00363.

POSTER_47

Assessing the impact of artificial urine on springtail communities on moss-concrete tiles in urban parks

Wouter van der Vegt[1], Jacintha Ellers[1], Nienke Schijfsma[1], Max Veegers[2], Joscha Beninde[1], Matty Berg[1]

[1]VU Amsterdam, Amsterdam, The Netherlands, [2]Delft University of Technology, Delft, The Netherlands

Urbanization is rapidly increasing due to which natural habitats are decreasing in size, threatening the habitats of the local biodiversity. To compensate for the loss of green areas, urban environments are attempting to become greener. One initiative is by incorporating moss growth on concrete. Mosses are important to mitigate e.g. the urban heat island effect, but they provide habitat for a variety of species such as springtails. Given the differences in 3D structures of mosses, differences in niches are created and could result in different springtail communities. Yet, there is limited knowledge on how moss-concrete tiles, acting as new habitats, are colonized by springtails. In addition, in and near urban green spaces both mosses and inhabitants are frequently exposed to urine by urban dwellers and their cats and dogs, which could impact the community composition. This study aims to assess the potential of moss-concrete tiles to facilitate springtail communities in urban green spaces and the effect of urine on the community. This was done by investigating which springtail species occur in i) monoculture mosses (*Brachythecium rutabulum*) or ii) a mixture of mosses (*Tortula moralis* and *Bryum capillare*), and iii) adding artificial urine on half of the samples. Tiles were placed in multiple parks in Amsterdam, and the community composition was assessed after four and eight weeks and compared with the species present retrieved from soil samples and tree samples when tiles were placed. Given that this is an ongoing field experiment at the time of writing, no results have yet been obtained. Results can help to indicate how community assembly rules function in urban environments where humans play crucial (in)direct roles.

POSTER_48

Plasticine model experiment indicates high predator pressure on surfaced earthworms

Dmitry D. Vinogradov[1], Ivan V. Sotnikov[1], Alexei V. Tiunov[1]

[1]A.N. Severtsov Institute of Ecology and Evolution of Russian Academy of Science, Moscow, Russian Federation

Aboveground communities strongly depend on the detrital subsidy, i.e. the release of energy and nutrients from the soil detrital food webs. Earthworms predated by aboveground animals are seemingly among the most important link connecting belowground and aboveground food webs. Here, we conducted an experiment with plasticine models in various ecosystems to estimate predator pressure on surfaced earthworms compared to aboveground prey (caterpillars). The method consists of deploying plasticine models of prey (worms and caterpillars) and identifying predators from marks left on the models. This approach became a standard tool in the aboveground trophic ecology, and it is accepted that the attack rate on plasticine models reflects natural predator pressure. The experiment was conducted in alpine tundra (Murmansk region, Russia), temperate forest (Moscow, Russia), and monsoon tropical forest (Dong Nai, Vietnam, dry and rainy season). We used 2208 earthworm models on the ground and 1668 caterpillar models on the plants, both in brown and green colours. The attack rate was highest in the tropical forest; earthworm models were attacked several times more often than caterpillar models. For all predators combined and for arthropods, the difference in attack rates between earthworms and caterpillars was significant in the tropical monsoon forest in both seasons (HSD, $p < 0.05$), but not in the temperate forest. In total, 26.8% of earthworm models were attacked by biting arthropods, 0.6% by stinging arthropods, 0.6% by birds, 3.1% by mammals, 0.2% by reptiles or amphibians, 5.1% by gastropods and 2.9% by unidentified animals. In both forests the most common types of attacks on earthworms were arthropod bites, and in tundra mammal bites prevail. Our results emphasize the intensity of the direct trophic links between belowground and aboveground food webs. This work was supported by the Russian Science Foundation, project No. 22-14-00363.

POSTER_49

Belowground effects of regenerative agriculture on soil fauna in South Africa's semi-desert Western Cape region

Gemma Walker[1], Gemma Nel[1], Charles Haddad[2], Charlene Janion-Scheepers[1]

[1]Soil Ecology and Entomology Research Group, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa [2]University of the Free State, Bloemfontein, South Africa

Soil degradation is increasing globally, threatening soil health, biodiversity, and food security. Most causes of degradation, such as aggressive tilling, agricultural intensification, soil compaction, and loss of organic matter, cause dramatic drops in soil biodiversity. To combat this, shifts to environmentally sustainable agriculture, with greater focus on soil health, are increasing. This study assessed the biodiversity of important soil macrofauna (ants, beetles, spiders) and mesofauna (springtails) in a cauliflower seed production system at three sites near Lutzville, South Africa. Here, a six-year regenerative agriculture trial was implemented to investigate the impacts of conventional agriculture, mulch and compost inputs, cover crops, and crop rotation on soil arthropod community structure. Species richness and abundance were determined from a total of 324 pitfall samples collected every two months between February 2021 and February 2022. For macrofauna, 2696 individuals were found, representing 36 families. The families Formicidae, Tenebrionidae, Staphylinidae, and Lycosidae were the most abundant. Collembola comprised 7498 individuals from four families and nine species. Overall, higher species richness was recorded for macrofauna whilst higher abundance was found for mesofauna. Mean species richness for all taxa showed significant site and temporal differences, with the degree of response being taxon specific. The Analysis of Similarity (ANOSIM) results further indicated significant correlations between arthropod communities and both site and sampling season ($p<0.001$). However, the relationships between communities and each treatment were weak. This is likely because sampling occurred during the first year of the trial and the sites were subjected to greater disturbance. This study serves as baseline data for this long-term agricultural trial that has had no previous arthropod diversity data. Sampling has continued through to February 2024 and we hope that these data will elucidate clearer trends as the trial management treatments have become more established.

POSTER_50

Extinction of earthworms from different natural sites in the Haifa-Carmel region in northern Israel

Ittai Warburg[1]

[1]Haifa, Haifa, Israel

Earthworms feed mainly on rotten material in the soil, though they serve in certain ecosystems as decomposers. During the winter of 2023-2024, ten different natural habitat sites in the Haifa-Carmel region were checked for surface activity, or for activity beneath stones, of earthworms or of millipedes. The locations of those natural habitats are the followings: Nahal Ahuza - slope facing NW (32.780°N; 34.989°E); Hill SE of Nahal Ahuza (32.779°N; 34.989°E); Ramat Eshkol neighbourhood (32.779°N; 34.988°E); Ahuza neighborhood – slope facing west (32.782°N; 34.987°E); Beit-Biram (32.778°N; 34.997°E); Ramat Almogi neighborhood (32.777°N; 35.000°E); Denya neighborhood (32.765°N; 35.014°E); Haifa University (32.764°N; 35.015°E); 200 meters ENE of Telalim campsite (32.763°N; 35.016°E); Carmel Park northern campsite (32.757°N; 35.021°E). No earthworms were found in this research, in any of those natural habitats. The following three millipede species were found in this research. From Nahal Ahuza: *Tetrarthrosoma syriacum* (Humbert & Saussure, 1869); *Polydesmida* sp. From hill SE of Nahal Ahuza: *Archispirostreptus syriacus* (?). All those millipedes were found in habitats of Mediterranean shrub. This fits previous findings, that millipedes favour habitats with trees, which include humid conditions. The finding of *A. syriacus*, in a different location than the other 2 millipede species in this research, shows that *A. syriacus* favours slightly different ecological conditions then those favoured by *T. syriacum* or *Polydesmida* sp. *E. phoeniceus*, which is known as a millipede species that eats earthworms, was reported from the Haifa-Carmel region during the year of 2016. Since then it seemed to have spread in that region. Since 2016, the earthworms' frequencies on ground surface during winter times became reduced gradually from winter to winter. This can explain why earthworms are at the winter of 2023-2024, almost extinct from the Haifa-Carmel region. Alternatively, this can be because of acidic rain, or because of other implications of climate change.

POSTER_51

Uplifts of the Roof of the World contribute to the "cryptic" diversity of springtails (Collembola: Isotomidae: Isotoma)

Yating Zhang[1], Daoyuan Yu[1]

[1]Soil Ecology Lab, College of Resources and Environmental Sciences, Nanjing Agricultural University, Nanjing, China

To reveal the long-term overlooked soil collembolan diversity in the Qinghai-Tibetan Plateau Himalayas (QTPH) areas, we conducted a systematic survey in these areas from 2018 to 2022. We found that species of the Holarctic genus *Isotoma* (Entomobryomorpha, Isotomidae) are frequent components of collembolan communities in the alpine habitats ranging from about 2400 to 5050 m.a.s.l. These species may be morphologically identified as *Isotoma spinicauda* Bonet, 1930, but the variations of colour patterns among them questioned their nature as a single species. However, since the taxonomy of Chinese *Isotoma* remains largely undeveloped, a systematic analysis is needed to reveal the true diversity of this group and the impact of QTPH on its diversification. To address this research gap, we sequenced two mitochondrial (COI and 16S) and three nuclear (18S, 28S D1–2 and 28S D7–10) markers of *Isotoma* from QTPH and adjacent areas, employed both single-locus (ABGD and ASAP) and multi-locus (PTP and mPTP) species delimitation analyses, reconstructed the phylogenetic relationships within this group, and estimated divergence times and ancestral ranges based on the phylogeny. Our results support 14 to 17 candidate species within this branch of *Isotoma*, varying either subtly or distinctly from each other in colour patterns. Because the validity of "colour pattern species" in Isotomidae is still controversial, we temporarily treat these lineages as "cryptic" species. The phylogenetic tree supports allopatric speciation within this group. The divergence-time estimation and ancestral area reconstruction suggest that the QTPH branch of *Isotoma* likely originated in the middle-late Miocene. The speciation events occurred during the late Miocene to early Pleistocene, corroborating the uplift of the eastern Tibetan Plateau margin and consequent climate changes. These results support that the orogenesis of QTPH has likely contributed significantly to the local speciation of alpine springtails.

POSTER_52

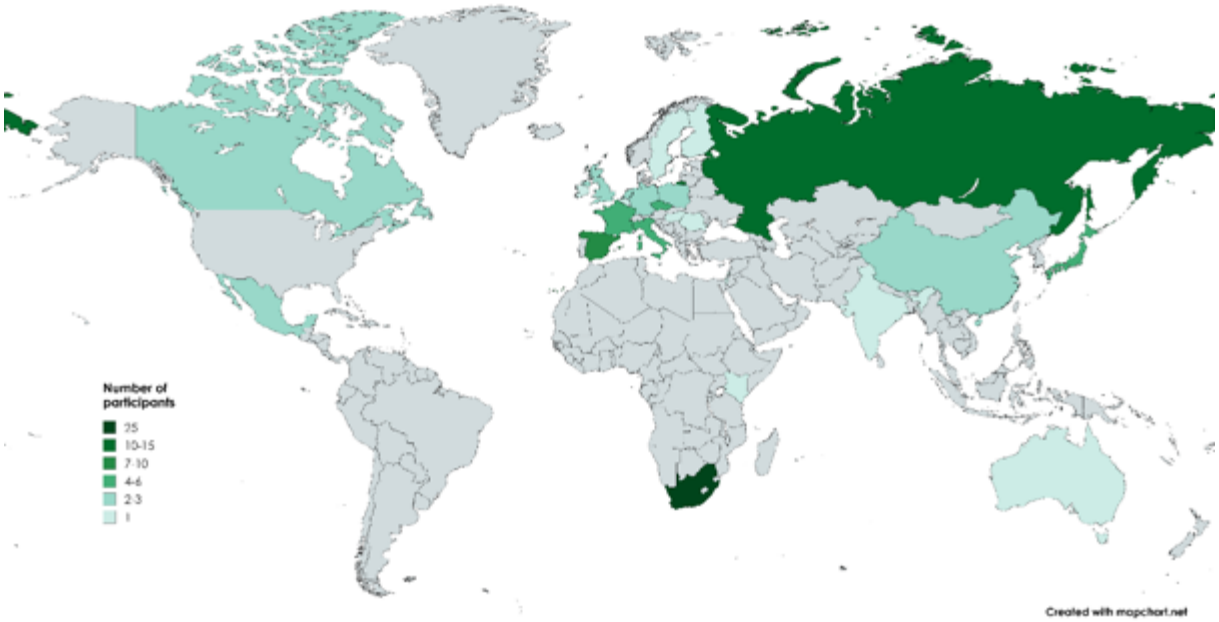
Earthworm population in anthropogenized deciduous forests in Kazakh upland

Veronika Abukenova[1], Sabyrzhan Zhumabayev[1]

[1]Karaganda Buketov University, University Str 28, Kazakhstan

Long-term studies of in birch-aspen forests of the Bayano-Karkarala uplands, including protected areas, were conducted. The standard soil-zoological method of hand-sorting was employed. The primary objective of our research program is to assess the characteristics of earthworm communities in over time. The study demonstrated that in all forest communities under minimal anthropogenic pressure, epigeic earthworms are the dominant species. In particular, *Dendrobaena octaedra* (Savigny, 1826), which prefers non-coarse litter and low soil acidity, as well as a flowing moisture regime, was identified. *Dendrodrilus rubidus* subsp. *tenuis* (Eisen, 1874) has a broad ecological range and was previously distributed from rock pine forests to meadow-marsh soils. In forests where soil horizons become thicker and moister, species diversity increases, and the percentage of endogeic species varies from 7% to 10% of the worms, depending on the type of forest. In deciduous forests, endogeic species are predominant in the context of long-term anthropogenic changes to the natural environment.

List of participants



Sara Acconcia
University of Vigo
Vigo, Spain
96.sarac@gmail.com

Hannelene Badenhorst
University of the Free State
Bloemfontein, South Africa
hannelenebadenhorst@gmail.com

Anne Bedos Deharveng
Muséum National d'Histoire Naturelle
Toulouse, France
bedosanne@yahoo.fr

Sarah Bird
University of Victoria
Victoria, Canada
sarahcbird@uvic.ca

Helene Blasbichler
Eurac Research
Bolzano, Italy
helene.blasbichler@eurac.edu

Maria J I Briones
University of Vigo
Vigo, Spain
mbriones@uvigo.gal

Philipp Byzov
A.N. Severtsov Institute of Ecology and Evolution,
Russian Academy of Sciences
Moscow, Russian Federation
byzovfilipp@gmail.com

Gabriela Castaño-Meneses
Unam
Querétaro, Mexico
gcastanom@ciencias.unam.mx

Partha Pratim Chakravorty
Raja Narendra Lal Khan Women's College
Midnapore, India
parthapratimchakravorty@yahoo.in

Juliette Chassain
University of Cape Town
Cape Town, South Africa
juliette.chassain@outlook.fr

Peter Convey
University of Johannesburg
Cambridge, United Kingdom
pcon@bas.ac.uk

Jérôme Cortet
Université Paul-Valéry Montpellier 3
Montpellier, France
jerome.cortet@univ-montp3.fr

Margarita Danilova
A.N. Severtsov Institute of Ecology and Evolution,
Russian Academy of Sciences
Moscow, Russian Federation
ritdanilov@hotmail.com

Benjamin De La Fontaine
Rhodes University
Makhanda, South Africa
ben.dlf@yandex.com

Pallieter De Smedt
Forest & Nature Lab, Ghent University
Gontrode, Belgium
Pallieter.DeSmedt@UGent.be

Louis Deharveng
MNHN-CNRS
Toulouse, France
dehar.louis@wanadoo.fr

Ninon Delcourt
Centre d'Ecologie Fonctionnelle et Evolutive
Montpellier, France
ninon.delcourt@univ-montp3.fr

Miloslav Devetter
Biology Centre, Czech Academy of Sciences
Ceske Budejovice, Czech Republic
devetter@upb.cas.cz

Camille D'Hervilly
Umeå University
Umeå, Sweden
camille.d-hervilly@umu.se

Anna Edlinger
Wageningen Environmental Research,
Wageningen University & Research
Wageningen, Netherlands
anna.edlinger@wur.nl

Boris Efeykin
A.N. Severtsov Institute of Ecology and Evolution,
Russian Academy of Sciences
Moscow, Russian Federation
bocha19@yandex.ru

Dean Erasmus
University of Cape Town
Cape Town, South Africa
03dean@gmail.com

Cristina Fiera
Institute of Biology Bucharest
Bucharest, Romania
cfiera2013@gmail.com

Norbert Flórián
Institute for Soil Sciences, Hun-Ren Centre for
Agricultural Research
Martonvásár, Hungary
florian.norbert@atk.hu

Bartolo Forestieri
Catholic University of Sacred Heart
Piacenza, Italy
bartolo.forestieri@unicatt.it

Tanya Fouché
University of South Africa
Roodepoort, South Africa
fouchtc@unisa.ac.za

Jan Frouz
Charles University, Environment Centre
Prague, Czech Republic
jan.frouz@natur.cuni.cz

Saori Fujii
Forestry and Forest Products Research Institute
Tsukuba, Japan
sfujiii@gmail.com

Miquel Gaju-Ricart
Dpt. of Zoology, University of Cordoba
Cordoba, Spain
ba1garim@uco.es

Pietro Gardini
Sapienza University of Rome
Rome, Italy
pietro.gardini@uniroma1.it

Konstantin Gongalsky
A.N. Severtsov Institute of Ecology and Evolution,
Russian Academy of Sciences
Moscow, Russian Federation
gongalsky@gmail.com

Polina Guseva
A.N. Severtsov Institute of Ecology and Evolution,
Russian Academy of Sciences
Moscow, Russian Federation
guseva.polina2001@gmail.com

Alasdair Harris
Illovo Sugar Africa
Umhlanga, South Africa
aharris@illovo.co.za

Motohiro Hasegawa
Doshisha University
Kyotanabe, Japan
mohasega@mail.doshisha.ac.jp

Ziyang He
The University of Melbourne
Melbourne, Australia
heziyang16@gmail.com

Kévin Hoeffner
University of Rennes
Rennes, France
kevin.hoeffner@univ-rennes.fr

Pablo Homet
University of Cadiz
Puerto Real (Cádiz), Spain
pablo.homet@uca.es

Elizabeth Hugo-Coetzee
National Museum
Bloemfontein, South Africa
Lhugo@nasmus.co.za

Abdul Ghaseeb Jacobs
University of Cape Town
Cape Town, South Africa
ghaseebjacobs@gmail.com

Charlene Janion-Scheepers
University of Cape Town
Cape Town, South Africa
charlene.janion-scheepers@uct.ac.za

Caro Kapp
Stellenbosch University
Stellenbosch, South Africa
ckapp@sun.ac.za

Hannah Karuri
University of Embu
Embu, Kenya
karuri.hannah@embuni.ac.ke

Hiro Kasai
Graduate School of Agriculture, Kindai University
Nara, Japan
shkhiro1@gmail.com

Julia Köninger
University of Vigo
Vigo, Spain
julia.koninger@uvigo.gal

Daniil Korobushkin
A.N. Severtsov Institute of Ecology and Evolution,
Russian Academy of Sciences
Moscow, Russian Federation
dkorobushkin@yandex.ru

Coşkun O. Küçükkaragöz
University of Cape Town
Cape Town, South Africa
onurubu@gmail.com

Robin Lacey
Stellenbosch University
Stellenbosch, South Africa
rslacey@sun.ac.za

Zoë Lindo
University of Western Ontario
London, Canada
zlindo@uwo.ca

Mark Maboeta
North-West University
Potchefstroom, South Africa
mark.maboeta@nwu.ac.za

Thandeka Mahlobo
University of the Free State
Bloemfontein, South Africa
thandekatee99@gmail.com

Emogine Mamabolo
Stellenbosch University
Matieland, South Africa
emogine.mamabolo@gmail.com

Alejandro Martinez
Universidad Complutense De Madrid
Madrid, Spain
alejma21@ucm.es

Nokuthula Mbanyana-Nhleko
Iziko Museums of South Africa
Cape Town, South Africa
nnhleko@iziko.org.za

James McCulloch
University of Cambridge
Copthorne, United Kingdom
jandpande@hotmail.co.uk

Caswell Munyai
University of Kwazulu-natal
Durban, South Africa
Munyaic2@ukzn.ac.za

Abusisiwe Ndaba
University of Cape Town
Cape Town, South Africa
ndbabu001@myuct.ac.za

Atsuko Ohira
Tamarokuto Science Center
Nishitokyo-shi, Tokyo, Japan
atsuko-ohira@outlook.jp

Jose G. Palacios Vargas
Fac. Ciencias, Unam
México, Mexico
troglolaphysa@hotmail.com

Guénola Pérès
Institut Agro Rennes-Angers
Rennes, France
guenola.peres@institut-agro.fr

Helen Phillips
University of Helsinki
Helsinki, Finland
helen.phillips@helsinki.fi

Alberto Piris Martín
Universidad Complutense de Madrid
Fuenlabrada, Spain
alpiris@ucm.es

Evgeniia Plakkhina
Perm State University
Пермь, Russian Federation
plakkhinaevg@gmail.com

Anton Potapov
Senckenberg Museum For Natural History, Society for Nature Research
Görlitz, Germany
potapov.msu@gmail.com

Nina Pronina
A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences
Moscow, Russian Federation
pronina.nina2018@yandex.ru

Elise Marie Quigley
University of Vigo
Vigo, Spain
elisemarie.quigley@uvigo.gal

Giles Ross
Nioo-knaw
Wageningen, Netherlands
G.ross@nioo.knaw.nl

Davina Saccaggi
Citrus Research International
Stellenbosch, South Africa
davinas@cri.co.za

Ruslan Saifutdinov
A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences
Moscow, Russian Federation
sairusair@gmail.com

Jiri Schlaghamersky
Masaryk University, Faculty of Science, Department of Botany and Zoology
Brno, Czech Republic
jiris@sci.muni.cz

Olaf Schmidt
University College Dublin
Dublin, Ireland
olaf.schmidt@ucd.ie

Julia Seeber
Eurac Research
Bozen, Italy
julia.seeber@eurac.edu

Sivuyisiwe Situngu
University of the Witwatersrad
Johannesburg, South Africa
sivu.situngu@wits.ac.za

Michael Steinwandter
Eurac Research - Institute for Alpine Environment
Bozen/Bolzano, Italy
michael.steinwandter@eurac.edu

Vladimír Šustr
Institute of Soil Biology and Biogeochemistry, Biology Centre Cas
České Budějovice, Czech Republic
sustr@upb.cas.cz

Reina Takaesu
Yokohama National University
Yokohama City, Japan
takaesu-reina-sr@ynu.jp

Sergey Tsurikov
A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences
Moscow, Russian Federation
smtsurikov@rambler.ru

Wouter van der Vegt
Vu Amsterdam
Zuidoostbeemster, Netherlands
wb.vandervegt@gmail.com

Mia Vermaak
Stellenbosch University
Cape Town, South Africa
miavermaak92@gmail.com

Marizanne Visagie
University of Cape Town
Cape Town, South Africa
marizanne234@gmail.com

Ittai Warburg
Haifa, Israel
Shlomit, Israel
Ittai.Warburg@gmail.com

Maxim Shashkov
Institute of Mathematical Problems of Biology RAS
Pushchino, Russian Federation
max.carabus@gmail.com

Ivan Sotnikov
A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences
Moscow, Russian Federation
vania.sotnikov@ya.ru

Anastasia Striuchkova
Moscow State Pedagogical University
Moscow, Russian Federation
astr2502@yandex.ru

Artur Szpalek
Warsw University of Life Sciences
Warsaw, Poland
Artur.szpalek01@gmail.com

Natasha Tilikj
Universidad Complutense De Madrid
Madrid, Spain
ntilikj@ucm.es

Kim van den Heever
Western Cape Department of Agriculture
Stellenbosch, South Africa
Kim.VanDenHeever@westerncape.gov.za

Emiel van Son
Citrus Research International
Stellenbosch, South Africa
emiel@cri.co.za

Dmitry Vinogradov
A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences
Moscow, Russian Federation
vdd98@list.ru

Gemma Walker
University of Cape Town
Cape Town, South Africa
wlkgem001@myuct.ac.za

Wanda Maria Weiner
Institute of Systematics and Evolution of Animals, Polish Academy of Sciences
Bolechowice, Polska
wanda.m.weiner@gmail.com

Daoyuan Yu
Nanjing Agricultural University
Nanjing, China
yudy@njau.edu.cn

Yating Zhang
NJAU
Nanjing, China
yatingzhang@njau.edu.cn

Andrey Zaitsev
Senckenberg Museum of Natural History
Görlitz, Germany
andrey.zaytsev@hotmail.com

Andrei Zuev
Senckenberg Museum of Natural History
Görlitz, Germany
agzuev.sevin@gmail.com