Frontiers in Ecology: Science and Society

Key messages

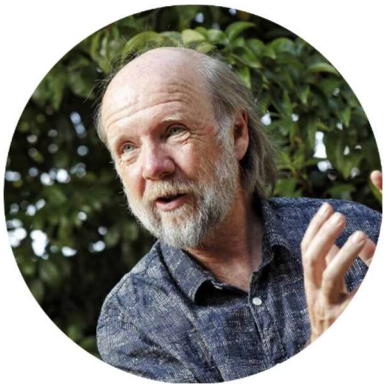
Videos available to registered participants from:
https://portalapp.symporg.eventsair.com/VirtualAttendeePortal/intecol-2022/intecol2022

KEYNOTE SPEAKERS

Peter **CHESSON**  *Biography*	**The challenge of climate change in community ecology, past, present and future**	"The highly variable and changing world is a challenge for the development of community ecology theory, but this challenge can be addressed with the new concept of the aedt, the asymptotic environmentally determined trajectory, which replaces the stable equilibrium concept in changing environments. Coupled with the idea of experienced environments as populations and communities move on landscapes, new theory, with a more realistic and practical view of the changing world, is rising to the challenge of climate change in community ecology."
"There is so much we can understand about the biology of extinct animals by looking at their bones. By understanding the biological signals recorded in the bones of modern animals we can better understand what those signals mean for the extinct species"	**Palaeoecological insights from fossil bone microstructure**	Anusuya **CHINSAMY-TURAN**  *Biography*
Sandra **DIAZ**  *Biography*	**The ecological and social shaping of functional diversity**	"Nature is mostly human nature, because of our extensive and long-term reconfiguration (as well as reduction of total number of species) Despite superficial variety, essential phenospace appears to follow strong trade-offs and constraints, which should facilitate monitoring and modelling."

"Animals that disturb the soil while foraging or creating habitat have generally positive effects on soil and ecological processes. Managing environments to protect and support these animals can result in dramatic and cost-effective restoration outcomes"	**Harnessing the activity of soil disturbing animals to restore degraded drylands**	**David ELDRIDGE**  *Biography*
Christian KÖRNER  *Biography*	**The global alpine biome and its common drivers**	"This presentation illustrated the overarching role of plant stature and topography for the actual life conditions above the climatic treeline. Together with a suite of physiological adaptations, alpine biota are traditionally robust against environmental change and any projections of their future fate would best account for the mosaics of life conditions near the ground rather than atmospheric conditions obtained from weather stations. When vulnerability in mountains comes into play, it is human life in and around mountainous regions and the associated infrastructure that are at risk under climatic change"
"The integration among theories is a first step towards a more logically consistent ecological theory. The concept of level of organizations may hinder integration to the extent that it makes us blind about processes that cut through levels. Genes, individuals and species seem to obey the same probability law"	**Integrating theories in ecology**	Pablo **MARQUET**  *Biography*

EJ **MILNER-GULLAND**  *Biography*	**What does becoming "nature positive" mean, and how can it realistically be achieved?**	"We need to practice what we preach in our own institutions and our own lives. We keep on filling the data, modelling and conceptual gaps but… can we coalesce behind a vision (e.g. natupositive.org) and support each other's contributions, though a pluralistic approach? So many opportunities for collaboration, synergy, catalysis exist… keep up the optimism!"
"This is fascinating and wide open field of research with many unknowns: How different pollutants combine to impact on individuals and populations; how exposure at the one life stage may translate into impacts at another life stage; what are the impacts on trophic relationships; and the ultimate impacts on community composition"	**Sensory pollution in urban environments**	Kirsten **PARRIS**  *Biography*
Steward **PICKETT**  *Biography*	**How is Society Still a Frontier for Ecology? Three Kinds of Co-production at the Science-Society Interface**	"Science itself is in part a social process (Coproduction). There are opportunities to better connect science and society for useful knowledge. The Anthropocene – intersecting climate change and urban transformation of the world demand better science-society engagement. Coproduction of knowledge can help."

"Flowering phenology is advancing due to warming. If warming continues, plants may reach the temperature limit above which flowering opportunity is completely lost and extinction risk will increase. Evaluating the adaptation limits is very important for the risk assessment of biodiversity loss. The cross-scale approach that explores the mechanism of phenological changes from the gene expression dynamics will contribute to estimate the adaptation limit This approach will be useful for predicting future phenological change and assessing the vulnerability of temperate and tropical plant species to climate change."	**A cross-scale approach toward a mechanistic understanding of plant phenology**	Akiko **SATAKE**  *Biography*
Marten **SCHEFFER**  *Biography*	**The lake as a microcosm. Using ecological thinking to understand humanity**	"To contribute to a sustainable future ecologists might consider focusing on assisted transitions to future ecosystem states, and on contributing to the study of human societies in interdisciplinary cooperations using the tools developed in ecology."
"Lakes are like pulsing hearts for freshwater diversity, but they are under threat. Freshwater represents a tiny part of habitats on the globe, yet it shelters half of the fish diversity. The combination of ecological apartheid globally and lack of inclusiveness of our science poses the most serious threat to biodiversity and future livelihood, more serious than climate change or any other environmental change on its own."	**Islands of endemism – lakes as cradle and refugia for freshwater species diversity**	Ole **SEEHAUSEN**  *Biography*

Ecology is a science with many important applications, yet ecology is firmly rooted in the fundamental study of nature at levels that vary from individuals within populations, through communities to whole ecosystems. Some of the topics for which we seek contributions in this Theme include Evolutionary Ecology, Biogeography or Macroecology… and more!

S1.1 Ecological mechanisms across scales.

Ecologists and evolutionary biologists are investigating biodiversity patterns across scales with many tools. Experimental and observational studies tied to mathematical and computer simulation models have revealed many clues about how ecological and evolutionary mechanisms interact across scales to generate biodiversity patterns. These diverse sets of approaches across different temporal, spatial and taxonomical scales also suggest that integrating theories and models across scales is key to better understanding how biodiversity patterns originated and how they will change into the future.

S1.2 Palaeolimnology placed in an evolutionary context

This session brought together paleolimnologists, ecologists and evolutionary biologists to explore how we can study the interplay of ecology and evolutionary processes at ecosystem scale based on sediment cores

S1.3 Trait based community ecology helps us see better

This session highlighted how traits can illuminate the mechanisms underpinning community patterns and dynamics, in a wide variety of systems and at multiple ecological scales. A strong thread was the ability to link observational data with ecological theory, enabling progress in understanding the processes shaping ecosystems globally

S1.4 Sensory ecology in changing environments

In changing environments: spanning aquatic and terrestrial organisms, this session highlighted the response of the sensory systems to environmental conditions and aimed to understand sensory

demands in order to protect whole ecosystems. While sensory modalities are flexible to a certain extent, recent rapid climate change together with other anthropogenic activities can detrimentally alter the animals' abilities to receive and to process signals and can eventually lead to a loss in biodiversity.

S1.5 Blue and green biodiversity: ecological patterns, processes and responses to global change in terrestrial and aquatic systems

After flourishing as two largely separate fields, aquatic and terrestrial ecologists are now more than ever working together to understand, predict and conserve biodiversity dynamics in blue and green ecosystems simultaneously using theoretical frameworks and studies spanning from local to global scales.

S1.6 Eco-evolutionary dynamics in multilayer networks: from lakes to oceans

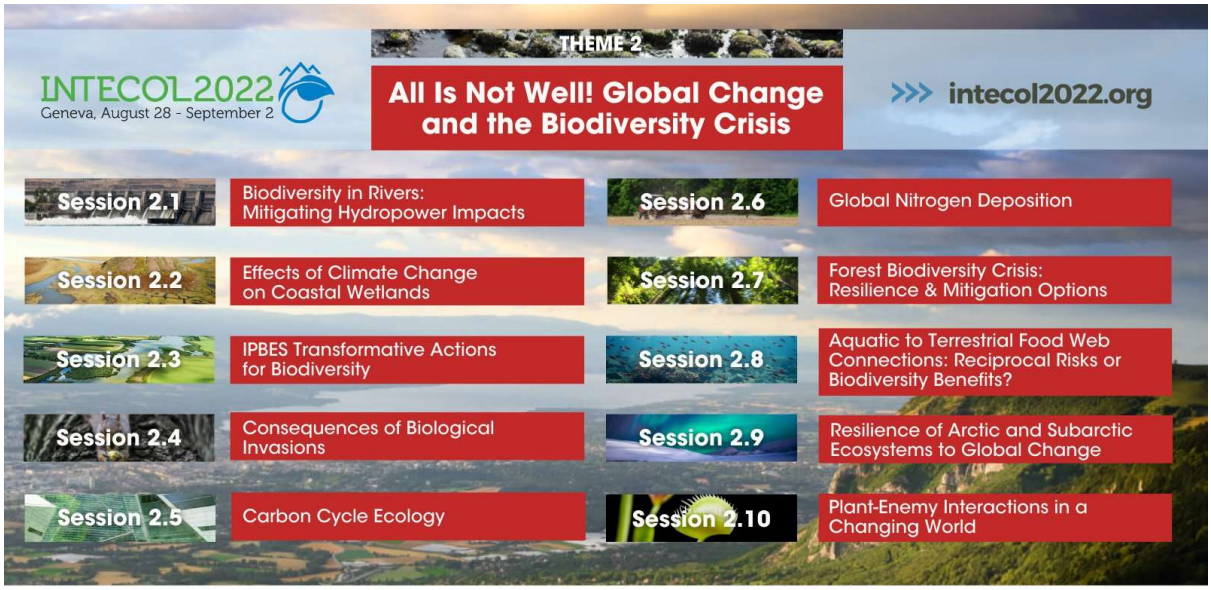
This session evaluated how species interactions, across different types of interactions as well as spatial and temporal scales, combine to influence eco-evolutionary dynamics

S1.7 Inter- and intraspecific variation in animal migration

In this session we explored the differences (and their causes) in migratory behaviour within and between animal populations

S1.8 Ecosystem responses to extremes

Ecology of extremes attracted a lot of attention as a window into the future. Current extreme climate resembles the average future climatic conditions and allows for predictions of the future response of ecosystems.



Much of what is studied in ecology is motivated by the urgency to understand how global change processes are affecting the functioning of terrestrial, freshwater and coastal or marine ecosystems and are altering global biogeochemical cycles. This Theme also covers contributions on the causes and consequences of the present biodiversity crisis which is linked to drivers as diverse as toxicants, eutrophication, invasive species, climate change or habitat loss.

S2.1 Biodiversity in rivers: mitigating hydropower impacts

The session focused on the global understanding and handling of the impacts of dams for river biodiversity. It offered an overview of the environmental issues due to dams (e.g hydropeaking, thermopeaking, reservoir sediment management, fish passage…), and highlighted the wide diversity of approaches used to cope with this issue (i.e. including laboratory or in situ experimental designs, modelling approaches, or in situ impact assessment) for both fish and invertebrates, at various spatial scales. The session stimulated fruitful discussions among attendees, and the number of questions at the end of each talks testifies for the interest that each presentation aroused. Contributors emphasized that research to mitigate impacts of dams 1) should go on given the large number of dams that are under construction or in project around the world; 2) should be coordinated and planned at a national scale to guarantee an efficient implementation of mitigation measures; 3) should further explore local, small-scale processes such as, e.g. local hydraulics preferences for invertebrates or the fine behavior of fish under rapid flow changes, to possibly further extrapolate to other sites.

S2.2 Effects of Climate Change on Coastal Wetlands

A stimulating discussion of likely effects of climate change on coastal wetlands was held at the meeting. Focus centered on the consequences of rising sea levels and the threats thereby posed for the persistence of coastal wetlands. Contributors emphasized both direct effects such as from inundation, but also indirect effects from salinity increases and species composition change, on both preservation and restoration efforts.

S2.3 IPBES transformative actions for biodiversity

We stretched our legs between Chili and China to discover transformative solutions as those advocated by the IPBES framework on Marine protected areas and urban green infrastructures.

S2.4 Consequences of biological invasions

This session will focus on patterns, processes and consequences of biological invasions and their impact on native biota

S2.5 Carbon cycle ecology

Presentations at the session ranged from in-situ observations and manipulation experiments across multiple biomes to idealized modelling experiments. Presenters cautioned against assumptions of increase in carbon stocks with elevated CO2 and climate change, highlighting how nutrients, water availability and disturbances act as strong controls of C turnover at multiple time scales.

S2.6 Global nitrogen deposition

Global N pollution leads to detrimental changes of the abiotic or biotic conditions for vegetation. The interactions with drought may lead to loss of sustainability in forests and to a negative carbon balance. For carbon sequestration, the oxidized form is more effective than reduced form.

S2.7 Forest biodiversity crisis: resilience & mitigation options

While the dramatic extinction rate of forest species is undoubtedly an important conservation concern, there is a potentially equally dramatic degradation of forest ecosystem properties and functioning. In this session we aimed at gathering presentations that illustrate ways to prevent, reduce and/or mitigate forest biodiversity losses oriented towards adaptive management.

S2.8 Aquatic to terrestrial food web connections: reciprocal risks or biodiversity benefits?

This session highlighted the nutritional benefits of aquatic to terrestrial subsidies of emergent aquatic insects, but also covered some of their potential risks. Emergent aquatic insects contain far more omega-3 long chain polyunsaturated fatty acids than terrestrial insects and subsidies of emergent insects provide terrestrial consumers in riparian zones like spiders with these important compounds. Factors such as land use, in-stream predation pressure, and riparian vegetation drive the biodiversity and density of aquatic insect communities which can in turn affect both the quantity and quality of emergent aquatic insect subsidies. Emergent aquatic insects can also serve as conduits of pollutants from aquatic to terrestrial ecosystems and early studies are underway to mitigate the transfer of pollutants without harming aquatic insects themselves

S2.9 Resilience of arctic and subarctic ecosystems to global change

This session explored several pathways through which the resilience of northern ecosystems is eroded and the implications of potential ecological transitions. It was a wonderful session where people shared results and opinions in a very constructive way.

S2.10 Plant-enemy interactions in a changing world

A major scientific challenge is to predict how communities and ecosystem functioning will respond to global environmental change. Global change can not only directly affect plant communities, but it can also indirectly alter species interactions. Understanding how interactions between plants and their enemies are affected is critical, as changes in rates of herbivory or pathogen attack can have far-reaching consequences for biodiversity and ecosystem functioning and altered plant-enemy

interactions may profoundly affect, and even reverse, ecosystem responses to global change. In this session we brought together researchers on this topic to explore global change effects on plant-enemy interactions from a variety of angles, and to take a step towards an integrative understanding of how global change will alter plant and enemy communities and their interactions with each other.

Ecologists are leading efforts to conserve intact and resilient ecosystems as well as the biodiversity they support and that supports them. Where ecosystems have been degraded or lost, efforts are aimed at their restoration. Contributions to this Theme will include studies on rewilding, ecological infrastructure as a basis for effective conservation planning or the conservation of "forgotten" groups like the fungi.

S3.1 Rewilding and restoration of degraded ecosystems

Rewilding and restoration are different yet complementary approaches to 'bending the curve' on biodiversity loss and ecosystem services degradation. Exploiting synergies, focusing on enhancing ecosystem functioning and ecological complexity at large scales, is necessary to create socio-ecological systems that will be resilient under rapid and ongoing global environmental change

S3.2 Monitoring change during rewilding

The session covered key aspects of monitoring abiotic, biotic and socio-ecological change during rewilding. The need for developing a clearer focus when monitoring rewilding landscapes was recurrently highlighted by academics and practitioners alike. In addition, case studies illustrated best practices, with successful strategies and techniques, e.g. in a national park, during beaver re-introduction, using environmental DNA and capturing complex socio-ecological benefits.

S3.3: Ecological infrastructure and area-based conservation

Impressive innovations are being presented to define and predict Ecological Infrastructures at all scales, in all kinds of ecosystems and in different regions of the World. This should help the CBD to reach its new target of 30% of conservation areas by 2030, but we still need to demonstrate that this is an efficient measure to protect biodiversity on the field.

S3.4: Insect decline

Most of presentations emphasized that insect decline in the tropics and temperate areas depends on a variety of factors (habitat loss, climate change and pollution including pesticides) but may greatly vary depending on taxa, habitats, biomes and developmental stages. Interpretations of trends in time series are further complicated by short time series and moving baseline years. These various challenges are not necessarily an impediment but represent an opportunity in ecological research, which reflects the diversity of insect communities. Current monitoring programs should be maintained and expanded at all costs, especially in the tropics. Entomologists should also inform more efficiently the public and be more politically engaged.

S3.5 Ponds and pondscapes: adaptation and mitigation to climate change

Implementation of Nature-based Solutions allows us to address several important societal challenges. This was demonstrated in this session focused on pondscapes: the creation, restoration and management of ponds and pondscapes efficiently promote the biodiversity and offer several Nature Contributions to People. Especially it helps us in our efforts on adaptation and mitigation to climate change.

S3.6 Predicting biodiversity to inform conservation decisions: from genes to ecosystems

This session aimed at exploring tools and approaches for predicting biodiversity change and how such projections can be translated into conservation measures

S3.7 How urban green space is good for people

The “green infrastructure” session enabled the participants to share different topics: methodological, identifying the most suitable plant species to be used in an urban context; technical, by showing the possibility of using recycled materials (bio-char, excavation waste, sludges) as versatile substrates; sociological, emphasizing the importance of participatory approaches and ways of using green spaces; design-oriented, assessing the relevance of many projects carried out I the recent past. It is worth highlighting the participation in the debate by designers and architects, who are responding to the emerging need of integrating ecological niches into their projects, treating the “species other than humans” as stakeholders and by collaborating with nature scientists. Many ideas to improve our quality of life!

Life on land, life under water are two of the UN Sustainable Development Goals. Ecological science is badly needed for a sustainable future. In this Theme we invite contributions on studies that broadly connect biodiversity and its governance with sustainability. Topics could include sustainable finance, Nature Based Solutions, agroecology and others.

S4.1. land use and biodiversity

The diverse presentations in the session on land use and biodiversity showed the multiple ways land use interacts with biodiversity and its conservation, thereby highlighting its critical role in biodiversity loss but also in biodiversity conservation. While various land use management practices were shown to benefit both biodiversity and human wellbeing, other presentations highlighted the trade-offs between them.

S4.3 Multilevel governance and the biodiversity crisis

With three presentations from Romania, France and Brazil, the importance of being able to report on biodiversity and ecosystems services was emphasized at various governance levels with innovative indictors frameworks.

S4.4 Circular bioeconomy for sustainable agriculture

This session discussed sustainable food production systems (soil, nutrients, mixed crops etc.) and implications of cropping systems for biodiversity and conservation

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S4.6 Planetary boundaries and biodiversity tipping points

This session explored how we can set actionable targets for biodiversity in order not to exceed to far this planetary boundary.

We ecologists study nature, but our ideas, opinions and actions are firmly rooted in society. Our work cannot and should not be seen separately from processes in society that aspire to change the ways we live and work together. Gender inequality, white supremacy and privilege and the legacy of colonialism to name just some important ones. Through this Theme we acknowledge the critical importance of a truly inclusive approach in ecology.

S5.1 Ecology in Africa: present and future prospects

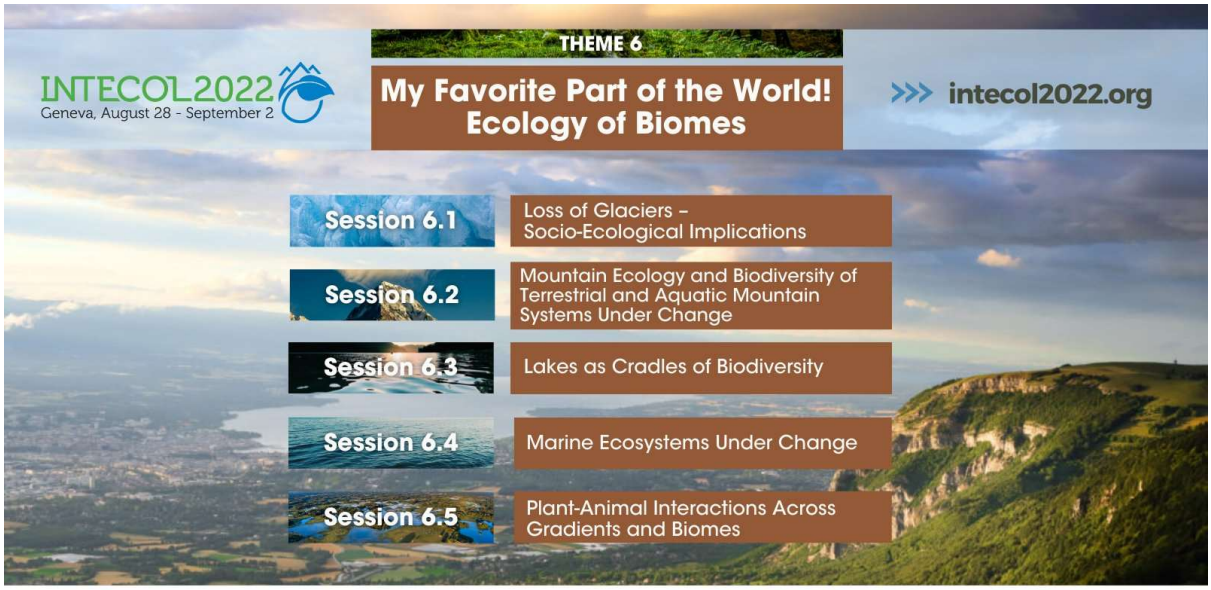
Africa does not lack researchers/scientists, the challenge is lack of, or limited funding from governments to research institutions/institutions of higher learning (Universities) limiting curriculum implementation, research and teaching this results in low publications and participation in international platforms of early career researchers and staff from the public institutions.

S5.2 Traditional and indigenous ecosystem knowledge

Indigenous science and local/Traditional knowledge systems need to be celebrated and promoted; Indigenous ways of being, ways of knowing and ways of doing embedded in conservation; Indigenous women empowered and gender roles in conservation supported; the visibility of Indigenous research increased. Integral is the global trend for many Indigenous Peoples and cultures to recognize the living beingness, legal personhood and rights of Nature. Non-Indigenous scientists/ecologists should listen and support Indigenous led research and solutions to global/local issues.

S5.3 Decolonizing science and fieldwork by dismantling white supremacy

This session examined the history of science in colonised places and propose ways to include indigenous knowledge and diversify research teams.



Ecologists are all different and love to study widely ranging topics. Some of us study mountains, others the urban environment, the cryosphere or coral reefs. In this Theme we invite ecologists to share their passion for a specific biome with the rest of INTECOL.

S6.1 Loss of glaciers – socio-ecological implications

Scientists presented environmental processes underlying the impact of glacier extinction on socio-ecological systems. Presentations explored a range of direct and indirect interactions among climate, hydrology, land use, biodiversity, ecosystem services, cultural values, and political drivers, and how these interactions contribute to management of glacier and downstream environments. We discussed strategies to anticipate and mitigate the erosion of socio-ecological systems following glacier extinction

S6.2 Mountain ecology and biodiversity of terrestrial and aquatic mountain systems under change

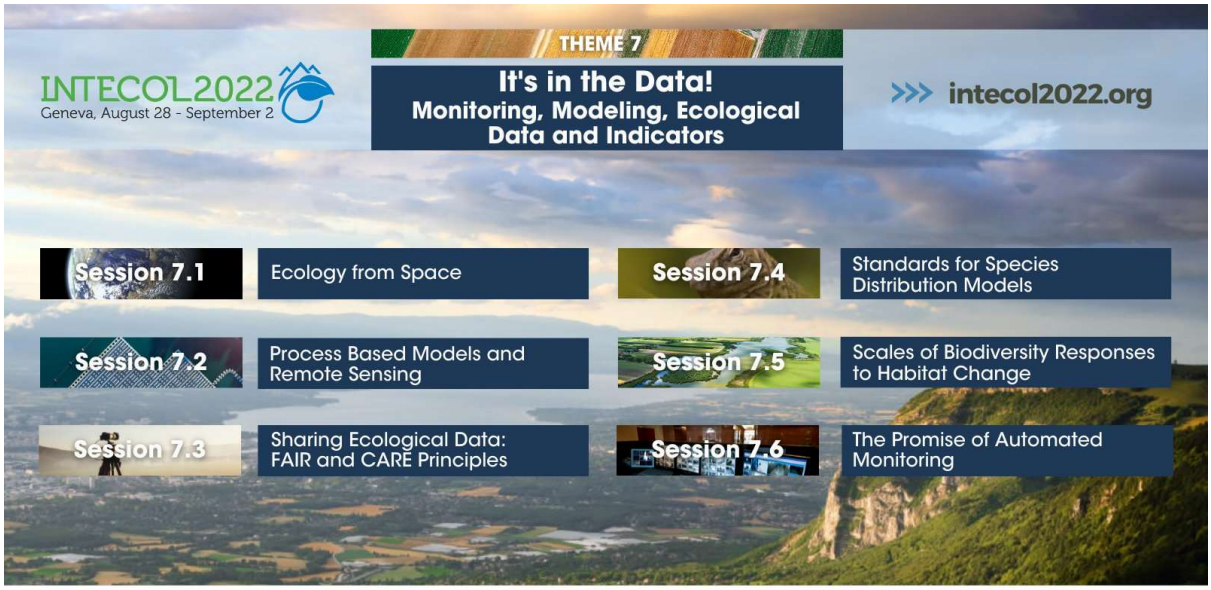
Together, remote sensing, eDNA and molecular methodologies, long-established field measurements, and data-based models are increasingly revealing the extraordinary richness and complexity of life in terrestrial and aquatic mountain ecosystems. Extensive long-term monitoring efforts combining these approaches are essential for detecting spatio-temporal patterns in species, trait, and genetic diversity and for disentangling the signature of long-term processes of natural evolution from recent responses to the combined effects of climate change and other anthropogenic drivers

S6.3 Lakes as cradles of biodiversity

The session aimed at documenting critical states of ocean life, including coastal systems

S6.4 Marine Ecosystems under change

Increasing climate change-related threats to and signs of marine ecosystems degradation are presented with focuses spanning from proving magnitude of impacts to identifying future research and societal needs to counteract their impact and adapt the ocean exploitation in a sustainable way.



Science is data driven. In this Theme we aim to explore developments in the acquisition of ecological data, in the usage of these data, for instance in ecological models or indicators, as well as in the way we store and share data. Thus, contribution to this Theme may show how a monitoring approach was integral to answering ecological questions, including remote sensing and more recent developments like citizen science, and how best to interpret, use, model and share the data?

S7.1 Ecology from space

This symposium invited experts in both biodiversity monitoring and satellite remote sensing to discuss ways to better capitalise on this technology to find operational solutions for biodiversity conservation, implications for policy and practice Speakers were able to debate the implications for conservation policy and practice. The presentations showed the variety of sensors available and their ability to develop original methods to use and combine information resulted in many ecological applications leading opportunities to predict the consequences of changes in drivers at different scales within a context of global change

S7.2 Process-based models and remote sensing

Experts have discussed how remote sensing data can be exploited best to be used in process-based simulation models to support management and conservation in different systems from tropical rain forests to the Southern Ocean. As one potential outcome we have discussed to publish a special issue on the contributions of the sessions S7.2 process-based models and remote sensing and S2.7 Forest biodiversity crisis: resilience & mitigation options

S7.4 Standards for species distribution models

Innovative conceptual approaches and practical tools aimed at providing standard frameworks for species distribution modelers were presented. By enabling the modelling of large number of species with best-available practices and reporting forms, these approaches and tools will facilitate the delivery of scalable and reproducible outputs for biodiversity assessments. Output data from these assessments will be valuable for guiding conservation and land management actions.

S7.5 Scales of biodiversity responses to habitat change

Invited speakers showed tools and provided advice for measuring land use change for monitoring and conservation purposes. We have heard time and time again that habitat loss is a major driver of biodiversity loss. The take home message was that models and experiments show we need large, connected habitats

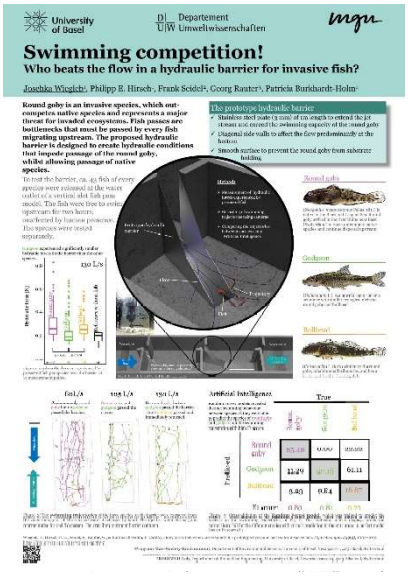
S7.6 The promise of automated monitoring and related workshop

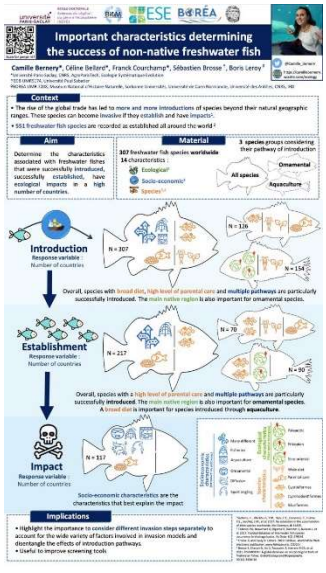
Several harware and software innovations are enabling a broader and more capillary collection of data: from organism presence and interactions to phenotypic traits, as well as data on trade and potential threats. The wider adoption of high-tech approaches in ecology and evolution can help tackle challenges at all scales, and a closer collaboration between the biology and data science communities can foster this.

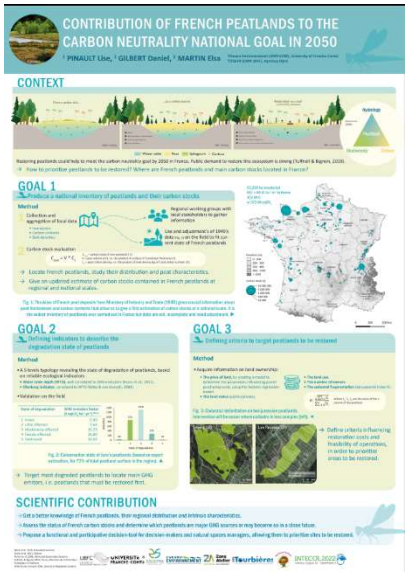
POSTER SESSION

Congratulations to Joschka Wiegleb, Camille Bernery, and Lise Pinault for winning the poster flash talks contest !

All posters are still visible for registered participants [on the web platform]







GEN BARS: Geneva Environment Networking Bars

Two hybrid networking sessions – Geneva Environment Networking Bars – open to Geneva communities are proposed in the margins of INTECOL 2022. These sessions are facilitated by the Geneva Environment Network (GEN) and the University of Geneva.

A total investment in nature of USD 8.1 trillion is required between now and 2050 – while annual investment should reach USD 536 billion annually by 2050 – to successfully tackle the interlinked climate, biodiversity, and land degradation crises, according to the State of Finance for Nature report released in May 2021. [Mode details here]

Full video of the session: https://youtu.be/uWy441wXXbU

In the face of the triple planetary crisis of pollution, climate change and biodiversity loss, this session focused on the opportunities to tackle the intertwined environmental challenges we face today. [Mode details here]

Full video of the session: https://www.youtube.com/watch?v=bo9iWgA2UQs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ACKNOWLEDGEMENTS
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FACULTÉ DES SCIENCES
REPUBLIQUE ET CANTON DE GENEVE
FNS SNF
FONDS NATIONAL SUISSE
SCHWEIZERISCHER NATIONALFONDS
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