



Beijer Institute of Ecological Economics

Annual report 2023/2024

Beijer 
Institute
OF ECOLOGICAL ECONOMICS



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THE ROYAL SWEDISH ACADEMY OF SCIENCES

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Editor
Agneta Sundin


Design & production
Ruby Creative Sthlm

Cover illustration
Hannes Högberg "Al, a helping hand?"

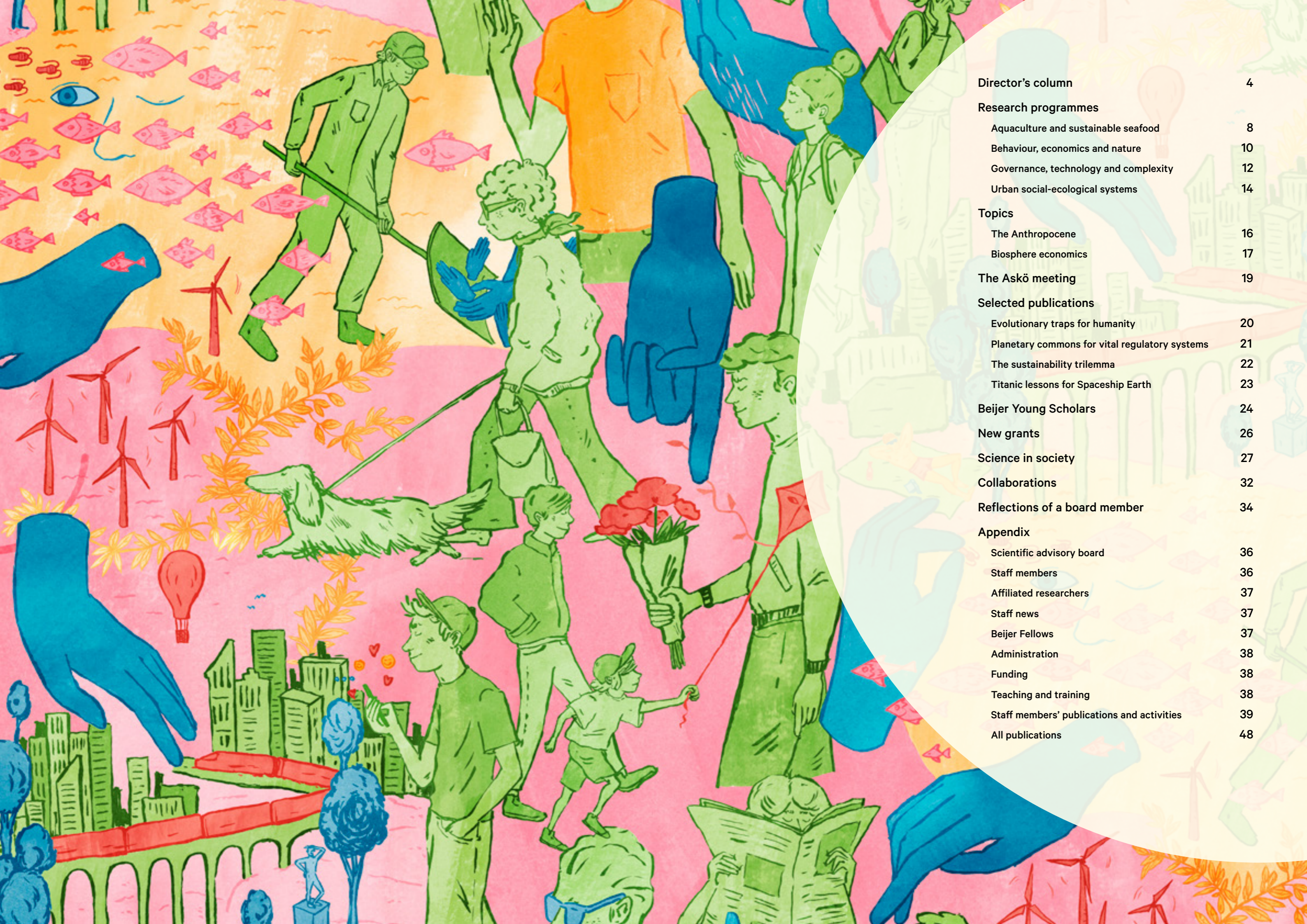
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Contact
P.O. Box 50005,
SE-104 05 Stockholm, Sweden
+46 8 673 95 00
beijer@beijer.kva.se
beijer.kva.se



The Beijer Institute of Ecological Economics is an international research institute under the auspices of the Royal Swedish Academy of Sciences. The major objectives of the Beijer Institute are to carry out research and stimulate scientific cooperation to promote a deeper understanding of the interplay between ecological systems and social and economic development.



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Director's column

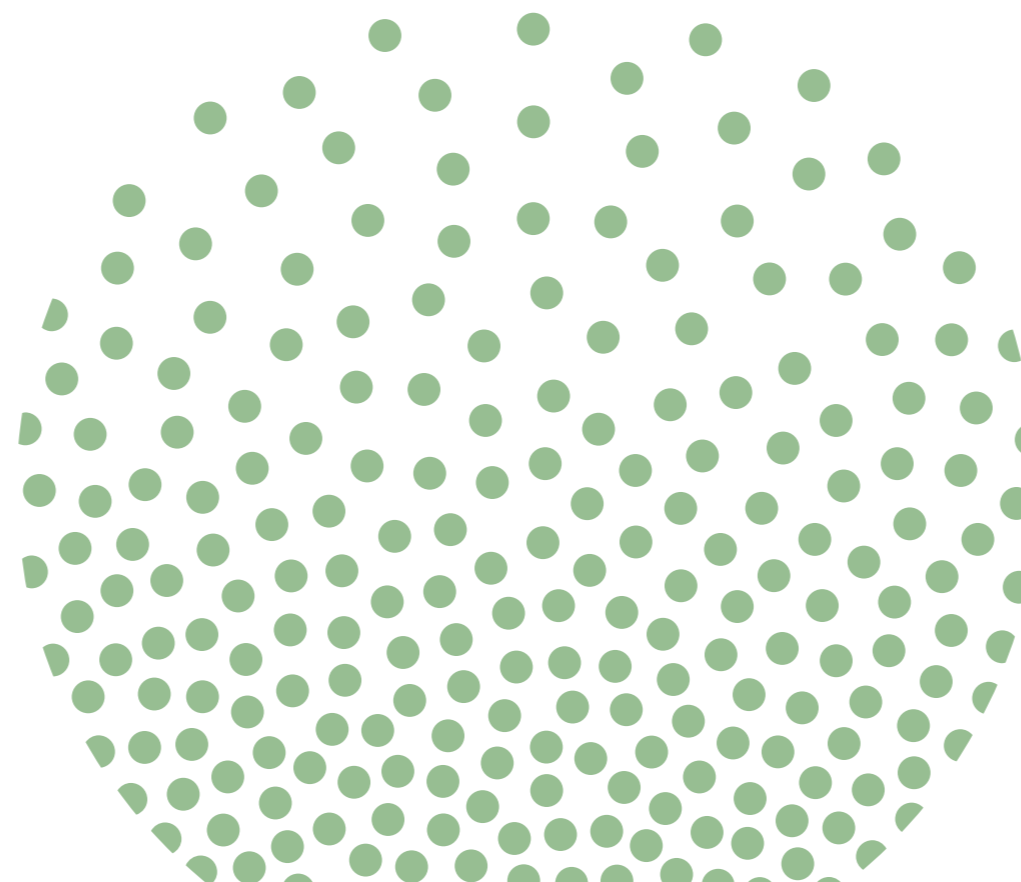
This year the Beijer Foundation turns fifty! Anders Wall and the foundation have supported the Beijer Institute of the Royal Swedish Academy of Sciences since its early days in the mid 1970s. In 1991, the Institute restarted with a focus on the interplay of ecological systems and social and economic development in relation to sustainability. I have been lucky to be with the Beijer Institute since then, in the first couple of years as deputy director and since 2007 as director.

What inspires someone to stay on for 17 years leading a research institute and to be involved for more than 30 years? It is because the Beijer Institute is simply a unique place of freedom of thought, creativity and collaboration across disciplines and cultures with great, humble, skilful and deeply engaged people. We perform curiosity-driven collaborative work through research programmes, workshops and projects with a worldwide

network of amazing scholars. The focus is on the significant problems, challenges and opportunities of an intertwined globalised world facing planetary boundaries. It is about our future on the unique living planet as embedded in the biosphere. Over the years, the academy has given us space to freely operate with a lot of trust in our efforts of creating new frontiers and breaking new ground. The fundamental support of the Beijer Foundation has provided freedom and opportunity for exploring, reflecting, learning and performing. This is unique and highly appreciated!

New research areas have emerged from the seeds planted at the Beijer Institute and spread across the world, and many new centres, institutes and departments have been created. Our interdisciplinary science has generated new systemic understandings and insights that nowadays are widely applied in society. It is indeed inspiring to witness the

“Our interdisciplinary science has generated new systemic understandings and insights that nowadays are widely applied in society.”



scientific findings providing guidance for engagement and action with practice, policy and business. There is exciting work in the art-science interface as well.

Our joint Stockholm platform of the Beijer Institute, the Stockholm Resilience Centre, the Global Economic Dynamics and the Biosphere Academy programme (GEDB) and the Anthropocene Laboratory, serves as a world-leading foundation in advancing science for sustainability. It is most inspiring to interact with a new generation of highly devoted, skilful and pleasant young people. It is highly rewarding to witness all the ongoing amazing research and the open-minded, trust-based and sharing work culture. My wish for the future of the Beijer Institute is to further develop its unique catalytic role in serving

as innovator and incubator of new scientific insights and transdisciplinary frontiers of great significance for guiding human actions towards a sustainable future. I am truly grateful and thankful for the privilege of being part of this journey.



Photo: Bram Belloni, Heineken Prize

Carl Folke
Director of the Beijer Institute
July, 2024



Research programmes

Work at the Beijer Institute strives to create research frontiers at the interface of ecology, economics and related disciplines, to promote a deeper understanding of the interplay between ecological systems and social and economic development in relation to sustainability.

Our research framework recognises that economies and societies are components embedded within the Earth's biosphere, the thin layer around our blue planet where life exists, resulting in biosphere dependence. Today, the globalised human world is shaping the functions of the biosphere at planetary level in truly intertwined systems of people and nature.

In dialogue with the Institute's scientific advisory board, we discuss, assess and modify our research programmes to better capture and understand this intertwined world. There are currently four research programmes at the Beijer Institute, all combining important theoretical insights with novel and grounded empirical research. The focus and progress of each are presented under this section.

Aquaculture and sustainable seafood

Programme director
Max Troell

The research programme *Aquaculture and sustainable seafood* has during the past year focused on how aquaculture can contribute to reducing climate impacts from foods, and the aquaculture sector's potential for adaptation to climate change. This research is timely considering that global aquaculture in 2023 reached a new record high and for the first time surpassed capture fisheries production. This growth is promising, indicating aquaculture's potential for future food provision, although many sustainability challenges still exist.

The global demand for seafood continues to increase and today's consumption of 185 million tons of fish and shellfish constitutes almost 20% of overall animal protein intake. Captured and cultured aquatic foods are expected to continue to play an important role for food security and nutrition for billions of people. However, climate change is already impairing the growth of aquaculture. The role of seafood in the mitigation and reduction of greenhouse gases, and for adaptation to changes caused by climate change, are being explored through an in-depth literature review and expert consultations, as part of an ongoing collaboration with Stanford University and WorldFish. This project, which is funded by the Gordon and Betty Moore Foundation, also includes a global review of seafood's role in national climate strategies.

Coral reef restoration in Madagascar

Madagascar is ranked 173rd out of 191 on the Human Development Index, and this island state is home to one of the most chronically undernourished populations in the world. It has experienced a severe decline of its coral reefs and associate fisheries. A project led by the Beijer Institute and Harvard University (and funded by the Belmont Forum) aims to restore coral reefs in Madagascar. These restoration efforts have involved building artificial reefs and seeding them with biota from healthy natural reefs. A biodiversity census tool called Autonomous Reef Monitoring Structures or "ARMS" have been instrumental for passively aggregating reef biodiversity, that then are used for "seeding" artificial reefs. These artificial reefs have been installed in a coastal lagoon system in the Bay of Ranobe – a multi-use protected area on the southwestern coast of Madagascar.

“The suggested deep-ocean seaweed dumping is clearly neither an ecological, economical nor ethical answer to climate change.”

These endeavours are described and analysed in a forthcoming article in *Frontiers in Public Health*¹.

As part of an attempt to assess the economic and nutritional importance of seafood in the area, almost 300 seaweed and sea cucumber farmers in six villages were interviewed. Preliminary results² indicate that even though these newly introduced livelihoods bring important economic benefits, their instalment only indirectly provides food security, and challenges the area's multi-use function.

Reviewing efforts to remove carbon dioxide with seaweed

To limit global warming, society drastically needs to reduce greenhouse gas emissions and remove atmospheric carbon dioxide. Many methods for carbon dioxide removal (CDR) have been suggested, including marine CDR strategies. One such strategy is ocean afforestation: a deliberate expansion of seaweed



¹ Golden, C., A. C. Hartmann, E. Gibbons, G. Todinanahary, M. Troell, G. Ampalaza, F. Behivoke, et al. In press. HIARA study protocol: impacts of artificial coral reef development on fisheries, human livelihoods, and health in southwestern Madagascar. *Frontiers in Public Health* 12:1366110

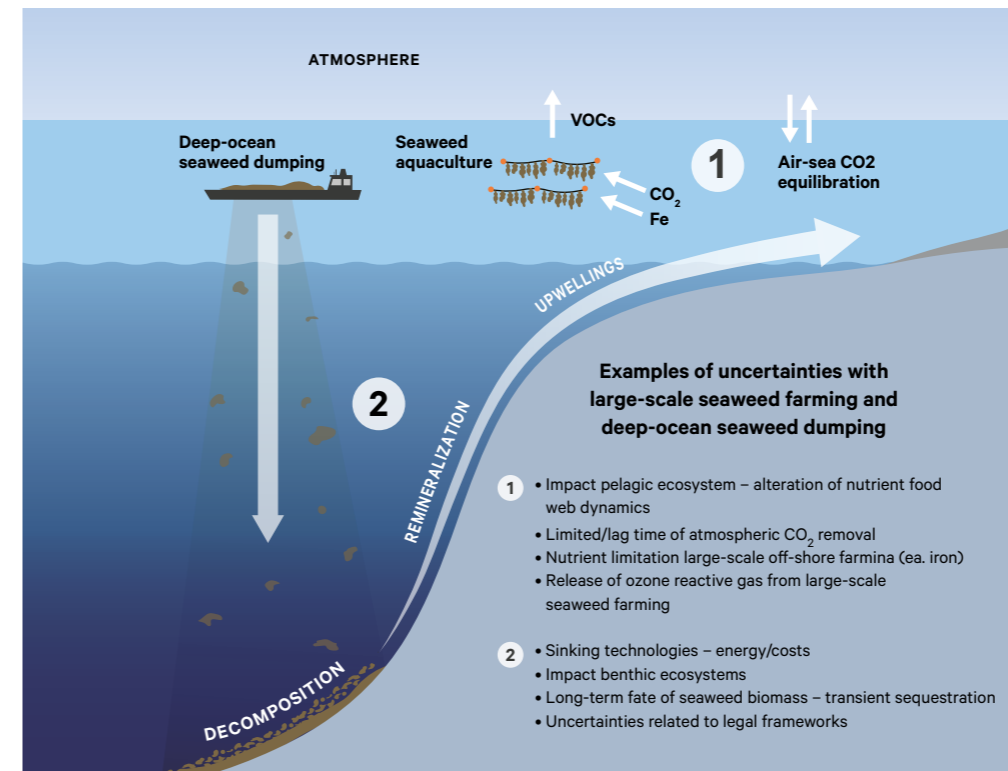
² Lavitra, T. et al. 2024. Local perceptions of the socioeconomic and environmental impacts of sea cucumber farming in southwestern Madagascar *BECHE-DE-MER information bulletin*, 4: 48-58.

³ Chopin, T. et al. 2024. Deep-ocean seaweed dumping for carbon sequestration: Questionable, risky, and not the best use of valuable biomass. *One Earth* 7(3): 359-364

⁴ Troell, M., C. Hurd, T. Chopin, B.A. Costa-Pierce, and M.J. Costello. 2024. Seaweeds for carbon dioxide removal (CDR)—Getting the science right. *PLOS Clim* 3(3): e0000377.

⁵ Partelow, P. et al. 2023. Aquaculture for sustainability transformation. *Current Opinion in Environmental Sustainability* 65: 101379:1-14.

⁶ Chary, K. et al. 2023. Transforming sustainable aquaculture by applying circularity principles. *Reviews in Aquaculture* 16 (2): 656-673.



aquaculture in the open ocean, and then sinking the cultivated biomass into the deep ocean. *The Aquaculture and sustainable seafood programme* has, through international collaborations (e.g. Australia, Canada, USA and Norway) and publications^{3,4}, contributed to an increased understanding about seaweed's role in protecting the climate. The suggested deep-ocean seaweed dumping is clearly neither an ecological, economical nor ethical answer to climate change. There is a need for robust, evidence-based assessments to avoid implementing efforts that distract from more rational and effective interventions.

Transforming to a sustainable aquaculture system

In order for farmed aquatic food to play a bigger part in the global food system, in a sustainable manner, it is necessary that the sector improves its contribution to human well-being and limits environmental impacts.

As part of an international research team, programme researchers performed and reviewed an expert-elicitation process and identified five engagement arenas that can advance a governance agenda for an aquaculture sustainability transformation: (1) setting sustainability transformation goals; (2) cross-sectoral linkages; (3) land-water-sea connectivity; (4) knowledge and innovation; and (5) value chains. This research is published in *Current Opinion in Environmental Sustainability*⁵.

Such capacity-building of governance is crucial for moving the sector beyond fragmented technical questions associated with intensification, expansion, and social or environmental impacts, and towards system-based approaches that address interconnected sustainability issues.

Another necessary element of aquaculture transformation is improving its role in building a circular economy. A paper⁶ led by Wageningen University analysed how fostering aquaculture can result in more efficient and equitable use of resources and generate less waste and emissions. The analysis was based on the five ecological principles developed by Muscat et al. in 2020 for guiding biomass use towards a circular economy. This is the first time these principles have been explored in aquaculture. Six priorities for making aquaculture more circular were proposed: (1) increase production and demand for the most essential species; (2) decrease food loss and waste at farm and post-harvest stages; (3) support nutrient recycling practices at multiple scales; (4) adapt aquafeed formulations; (5) inform consumers about the benefits of species with low trophic levels and other environmentally friendly aquatic foods; and (6) address urgent research gaps.

Source: Troell et al. 2024.



Seaweed farmers in the village of Sarodrano, South-West coast of Madagascar. Photo: Max Troell.

Behaviour, economics and nature (BEN)

Programme directors
John M. Anderies
Therese Lindahl

BEN continues to produce cutting-edge research that explores the intricate connections between biosphere dynamics and human behaviour. By linking individual motivators and actions to emergent large-scale behavioural patterns, institutions and sustainability outcomes, BEN research explores alternative pathways towards a sustainable future. BEN's efforts have resulted in several high-quality journal publications this year, along with successful applications, policy interactions and new collaborations.

Large-scale collective action for environmental protection

Three recently published BEN papers address the urgent need for large-scale collective action to tackle global environmental challenges. These papers share an additional common theme: acknowledging the criticality of taking human behavioural insights into account when exploring solutions to these challenges.

Programme director Therese Lindahl and colleagues draw inspiration from the Titanic disaster to explore latent aspects of human behaviour related to risk anticipation, coordination and collective action¹. They then suggest ways to enhance institutional solutions for environmental protection by better accounting for human behaviour. See page 23 for a more extensive summary of the paper.

Several BEN researchers explored psychological barriers to sustainability in another article². They dwelled into how different psychological processes at the individual level (such as hopelessness and denial) and collective level (such as misperceptions of others' opinions and polarisation) can affect recovery towards sustainability after negative disturbances. While such psychological processes can by nature be difficult to observe and assess, neglecting them is risky. The paper provides solutions for how decision-makers can better acknowledge these processes.

Based on insights about human behaviour, BEN programme director John M. (Marty) Anderies and Beijer Institute director Carl Folke propose an alternative approach to confront current global-scale challenges³. Instead of incremental adjustments to existing institutions, they emphasise the power of shared



“stories” as frames and guidelines for action. While some “stories” (like the idea of limitless growth) have been critical for shaping our current societies, stories highlighting the intertwined relations between human societies and the biosphere could better guide societies toward a flourishing future.

Maintaining hope for flourishing futures can be difficult. Yet, hope is an important prerequisite for change, as it is a vital motivator for individual and collective action. BEN researcher Caroline Schill is co-leading an initiative on hope in the Anthropocene at the recently established Anthropocene Laboratory at the Royal Swedish Academy of Sciences. Read more about the Anthropocene Laboratory on page 32.

Advancing understanding of human behaviour in the Anthropocene

Together with colleagues, BEN researchers are working on analysing data collected during fieldwork in Thailand, Colombia

¹ Lindahl, T., J. M. Anderies, A.-S. Crépin, K. Jónás, C. Schill, J. C. Cárdenas, C. Folke, G. J. Hofstede, M. A. Janssen, J.-D. Mathias, and S. Polasky. 2024. Titanic lessons for Spaceship Earth to account for human behavior in institutional design. *npj Climate Action* 3(1):1-9.

² Mathias, J.-D., J. M. Anderies, A.-S. Crépin, M. Dambrun, T. Lindahl, and J. Norberg. 2024. Emergence of social-psychological barriers to social-ecological resilience: from causes to solutions. *Ecology and Society* 29(2):6.

³ Anderies J. M. and C. Folke. 2024. Connecting human behaviour, meaning and nature. *Philosophical Transactions of the Royal Society of London* 379(1903):20220314.

⁴ Ran, Y., P. Van Rysselberge, B. Macura, U.M. Persson, A. A. Hatab, M. Jonell, T. Lindahl, and E. Róos. 2024. Effects of public policy interventions for environmentally sustainable food consumption: A systematic map of available evidence. *Environmental Evidence* 13:10.



© Kinga Psiuk 2023. New Normal project, Wainwright, Alaska. “The Earth is my home and home is where the heart is”-Lloyd K. Tagarook. His Eskimo name is Kula. He is a hunter from Wainwright who started hunting with his father when he was 4 years old.

and Alaska (USA) (presented in last year's report) to advance understanding of human behaviour in the Anthropocene. As part of these efforts, a virtual exhibition has been launched to showcase the results of a participatory photography study in Wainwright (also known as Ulġuniq in the local language Iñupiaq), a small city on the Arctic Ocean in Alaska (USA). In this study, participants shared their experiences and stories of ecological change through photographs. The study, led by BEN researcher Caroline Schill and Simon West (SRC), will inform and frame subsequent behavioural experiments to investigate how the community of Wainwright might respond to specific scenarios of ecological change.

The virtual exhibition is available here: newnormal.science/photovoice

Behaviour change through policy interventions

Several studies published in the past year focus on the promises and perils of different types of policy interventions to promote more sustainable behaviour. A systematic review⁴ synthesises knowledge about the effectiveness of different policy interventions for promoting more sustainable food consumption. A study in *Environmental Values*⁵ explores the challenges of using “willingness to pay” to inform policies based on cost-benefit analyses. The study's title, “I didn't count ‘willingness to pay’ as

⁵ Isacs, L., C. Håkansson, T. Lindahl, U. Gunnarsson-Östling, and P. Andersson. 2024. “I didn't count ‘willingness to pay’ as part of the value”: Monetary valuation through respondents' perspectives. *Environmental Values* 33(2):163-188.

⁶ Linder, N., P. Sörqvist, T. Lindahl, and R. Ljung. 2023. Managing waste behavior by manipulating the normative appeal of trash bins: Lessons from an urban field experiment. *Resources, Conservation & Recycling Advances* 19: 200186.

⁷ Alvstad, R., M. Jonell, and T. Lindahl. 2024. Synergies and trade-offs between crisis preparedness and environmental sustainability of school meals in Sweden. *Mistra Food Futures*, Report #22.

⁸ Hansson, H., P.-A. Hansson, G. Carlsson, C. Eriksson, L. Gordon, M. Hellström, M. Jonell, T. Lindahl, E. Róos, and U. Sonesson. 2024. Improved preparedness with respect to food can be achieved through sustainable and resilient food systems – examples from Sweden. *Mistra Food Futures*, policy brief.

part of the value”, highlights the potential discrepancy between a respondent's perspective and that of a policymaker. Another article⁶ investigated outcomes (both intended and unintended) of using normative messages to decrease littering.

Good news for science-policy interface

The research funding agency Mistra has decided to continue funding the research programme “A sustainable and resilient food system | Mistra Food Futures”. Read more at page 26. BEN programme director Therese Lindahl will also be involved in this second phase and lead work related to consumer attitudes, values and behaviour, as well as policy developments for sustainable food consumption. Some examples of policy-relevant outputs produced by BEN researchers within the Mistra Food Futures programme, include a scientific report⁷ on synergies and trade-offs between crisis preparedness and environmental sustainability of school meals in Sweden, and a policy brief⁸ on how improved food preparedness can be achieved through sustainable and resilient food systems.



© Apayauk 2023. New Normal project, Wainwright, Alaska. Erosion- seeing our ground falling apart due to erosion. You can see lots of coal. It used to be big, hard coal to burn; to keep the house warm. Now the coal we see is crumbly.

Governance, technology and complexity

Programme director
Victor Galaz

The *Governance, technology and complexity* research programme strives to combine important theoretical insights with novel and grounded empirical research. The emphasis is on how societal complexity interacts with complex systems of the biosphere and new technologies, and on governance issues associated with these interactions.

AI, democracy and climate action

The year of 2024 is often termed a “super-election year”, with about 4 billion voters in around 65 countries or regions going to the polls. The rapid advances in generative AI and its ability to produce synthetic text, images, sound and video has led to a rapidly growing interest in the risks involved with automated climate misinformation, and how it can potentially influence elections, but also shape people’s perceptions of and behaviours around climate and sustainability issues. Work led by programme researcher Dr Stefan Daume has shown that the connection between automation and the diffusion of climate misinformation is far from simple. An article published in *Current Opinion in Environmental Sustainability*¹ illustrates the need to nuance common perceptions that climate misinformation is diffused online through a growing number of “fake” and automated accounts (also known as “social bots”). While automation certainly is a central feature of today’s digital media, the evidence that such automation systematically amplifies climate misinformation, is scant.



“The rapid advances in generative AI and its ability to produce synthetic text, images, sound and video has led to a rapidly growing interest in the risks involved with automated climate misinformation”

Programme work on these issues, especially a synthesis² of the growing risks of climate misinformation created by advances in generative AI, has led to increased interest from external organisations, like the Energy and Climate Intelligence Unit (ECIU.net), the Swedish Parliament’s research service (Riksdagens Utredningstjänst) and the International Institute for Democracy and Electoral Assistance (IDEA). We were delighted to see our work referenced in the United Kingdom’s official response to the EU White Paper on AI regulation.

2024 also saw the publication of two special issues where the programme’s contribution has been central. One special issue about the impacts of increased uses of AI and digitalisation on sustainability was published by *Current Opinion in Environmental Sustainability*³. The second special issue was published in *Global Perspectives*⁴ based on the presentations at the conference Illusion of Control, hosted by the Beijer Institute at the Royal Swedish Academy of Sciences in May, 2023.

We are also delighted to have been able to welcome Dr Amare Teklay Hailu to the programme team. His combined expertise in economics, field experiments and programming has made a huge difference for our work already.

Digital farming in the spotlight

The expected growth in demand for food commodities globally due to an expanding population and continued pressure on agroecosystems, paired with technological advances, have led to a rapidly increased interest in “digital”, “data driven” or “precision” farming, with investments and turnover in these technologies skyrocketing.

¹ Daume, S., P. Bjersér, and V. Galaz. 2023. Mapping the automation of Twitter communications on climate change, sustainability, and environmental crises —a review of current research. *Current Opinion in Environmental Sustainability* 65: 101384.

² Galaz, V., H. Metzler, S. Daume, A. Olsson, B. Lindström, and A. Marklund. 2023. AI could create a perfect storm of climate misinformation. *arXiv preprint arXiv:2306.12807*.

³ Galaz, V., O. P. Dube, and W. Solecki. 2024. Editorial Overview: Open Issue 2023: Sustainability Science, Digitization, and Artificial Intelligence. *Current Opinion in Environmental Sustainability*, 68: 101452

⁴ Vasbinder, J., S. van der Leeuw, and V. Galaz. 2024. Special Collection: The Illusion of Control. *Global Perspectives*. (University of California Press).



NaturaTech LAC launch at the Inter-American Development Bank (IDB) in Washington D.C. May 2024. Panel: Moderator Regina Cervera (Future of Earth Lab), Jean-Michel Baudoin and Yves Lesenfans (IDB), Maria Paula Duque (Microsoft Latam), Victor Galaz, and Ursula Parillo (IUCN). Photo: NaturaTech LAC

While increased resource efficiency and growing agricultural output may have environmental benefits, such a focus on optimisation can also lead to loss of social-ecological resilience. As we noted already in 2021, if not implemented with safeguards in place, increased automation and digitalisation may very well lead to loss of local ecological knowledge, the expansion of mono-cultures and growing inequity. However, the lack of studies exploring the relationship between new technologies (including artificial intelligence) and social-ecological resilience hinders our understanding of the wider impacts of the expansion of digital farming.

As a way to help bridge this knowledge gap, we co-organised the International Conference on Digitalisation and Artificial Intelligence in Agricultural Management on 15–17 November 2023 in collaboration with the Royal Institute of Technology KTH (Stockholm). The conference brought together scholars from all over the world to explore both the risks and opportunities emerging from increased uses of data-driven analysis and automation, including uses of generative AI for farming advice.

From words to action

One of our main ambitions for the programme has also been to explore hands-on applications of AI for sustainability science. Thanks to a new grant from the philanthropic leg of Google, Google.org, the Beijer Institute is one of the key collaborators in a new project led by our affiliated professor Timon McPhearson at the Urban Systems Lab (New School, New York). The project ClimateIQ will develop urban climate risk models using deep-learning methods, aiming to present a prototype in September 2024 at the New York Climate Action Week. Dr Stefan Daume and programme director Victor Galaz are both heavily involved in the project, contributing with both strategic advice, as well as supporting new work on responsible uses of AI for urban resilience. Read more at page 26.

Since May 2024, programme director Victor Galaz is also a Senior Advisor to a new project called NaturaTech LAC, launched at the headquarters of the Inter-American Development Bank (IDB) in Washington D.C. on 29 May 2024. The project is funded by the IDB Lab, and aims to support and pilot

novel technologies for environmental conservation and community resilience in the Amazon biome and other ecosystems in Latin America and the Caribbean.

In addition, the programme organised a roundtable on 17 May 2024 at the Royal Swedish Academy of Sciences, in close collaboration with professor and Academy member Danica Kragic. The ambition of the roundtable was to build stronger collaborations across academia and business to help accelerate sustainability research using novel AI methods. As part of this endeavour, we are happy to announce a new partnership with Google DeepMind, that will help explore areas in the sustainability and climate sciences where increased uses of AI methods could lead to breakthroughs of major social importance. A key workshop for this collaboration is planned for November 2024.

Participants at roundtable at the Academy in May 2024 on novel AI methods for sustainability. Nicolas Moch, (SEBx), Pontus Strimling (Institute for Futures Studies), Mirna Vlašić Feketija (Croatian Embassy), Juan Rocha (SRC), Ingo Fetzer (SRC), Tobias Andermann (Uppsala University), Siri Sachs (SEB), Nanda Wijermans (SRC), Thomas Schön (Uppsala University), Anna Wählin (University of Gothenburg), Erik Zhivkopoulos (SRC), Victor Galaz, Danica Kragic (Royal Institute of Technology), Saba Hussein Gore (British Embassy), Emma Sundström (Institute for Futures Studies), Linda Leopold (H&M), Anastasia Varava (SEBx).



Urban social-ecological systems

Programme director
Johan Colding

The role of urban form in making cities more liveable, inclusive and climate resilient has attracted significant attention in recent years. The *Urban social-ecological systems* research programme contributes to the emerging discourse on urban resilience, specifically focusing on how elements such as urban form, institutions, new digital technologies and green urban infrastructure, can foster human well-being and contribute to the development of resilient cities. The programme recognises the importance of considering not only physical aspects but also social and institutional dimensions to create sustainable and resilient urban environments.



researchers found that there is a gap between their assumed climate-friendly and inclusive nature and the reality, which is overlooked by decision-makers.

Recent research shows that the ICT sector is far from climate-friendly when considering its embodied carbon impact, which mainly originates in the material and the energy sectors. As for direct energy consumption, ICTs and related electronic appliances consume a growing portion of global electric energy. Additionally, not all digital solutions are user-friendly, which can lead to social exclusion and the creation of “digital divides” that hinder individuals from using the services offered by digital technologies.

“Not all digital solutions are user-friendly, which can lead to social exclusion and the creation of ‘digital divides’”

Transformation towards a fossil-free future

During the past year, most work has been centred around climate change within the Fairtrans programme, jointly funded by the Swedish research councils Formas and Mistra. This programme, working towards a fair transformation to a fossil-free future, is developing economic and political frameworks for transformation in collaboration with key actors from the business sector, trade unions and various organisations within Swedish civil society. The aim is to produce roadmaps that keep Sweden within the remaining carbon budget of the Paris Agreement.

Researchers linked to the *Urban social-ecological systems* programme are involved in a Fairtrans project aiming to address gaps in the current Swedish fossil-fuel transformation that are important when it comes to decision-making. One key area with many knowledge gaps is digitalisation. Cities are becoming increasingly digitalised, with most functions today carried out through various Internet and Communication Technologies (ICTs). “Smart city” is a term used for an urban area that uses digital technology and data analytics to improve the efficiency, sustainability and quality of life for its residents. Smart cities can contribute to climate-proofing; however, the

Another research objective of this Fairtrans project is to more fully understand how people, companies, public authorities and researchers can facilitate greater collective action in the transformation towards a carbon-neutral society that Sweden needs to undertake in the coming years in order to meet the Paris Agreement on climate change. In a recent study, researchers including programme director Johan Colding (also professor at the University of Gävle, Sweden), explored how the concept of social sustainability is defined and used in various scientific discourses. Through a systematic literature review and content analysis, the researchers shed light on the multifaceted discussions around sustainability and its many definitions and uses. Based on the results, they developed a novel analytical framework of social sustainability, referred to as the SoSuCompass (Figure 1). The SoSuCompass is a tool for promoting a fuller understanding of the definition of social sustainability, and it is already becoming an appreciated tool among urban planners and decision-makers of local municipalities in Sweden. The scientific paper was published in the journal *Sustainable Development*¹.

In another study², led by Johan Colding, a research team applied Nobel laureate Amartya Sen’s capability approach to

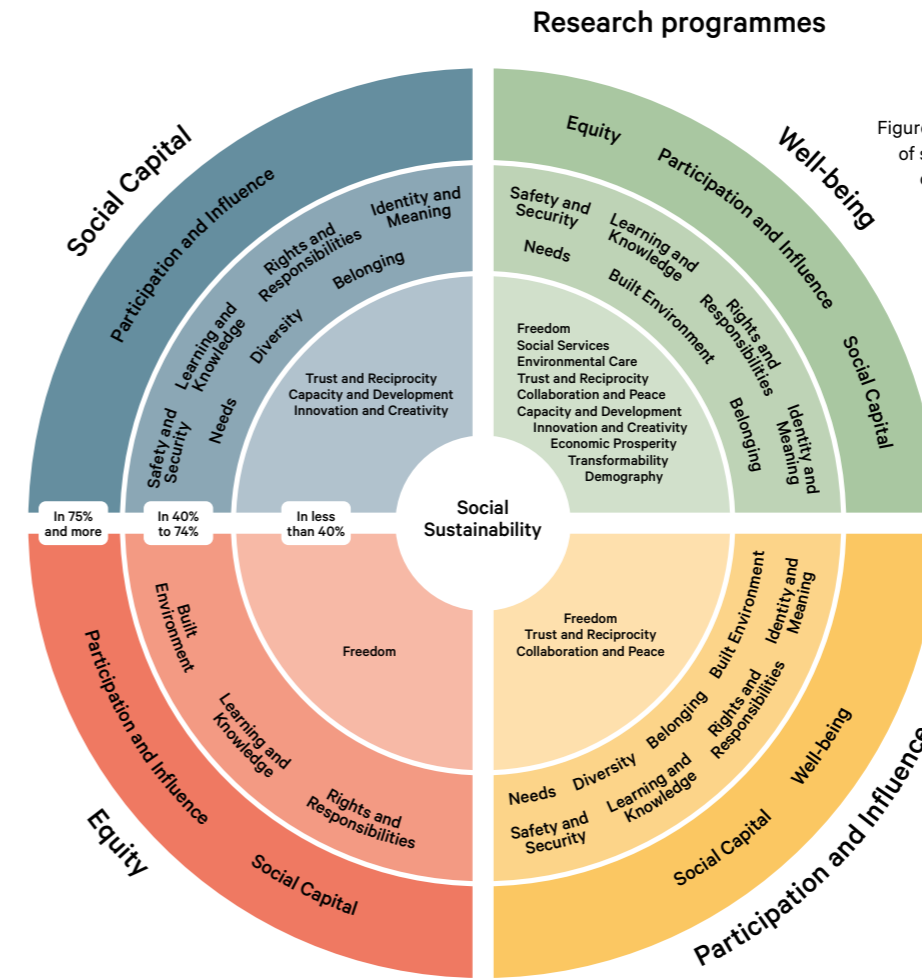


Figure 1. The SoSuCompass depicting a framework of social sustainability. It is based on four main categories (Social Capital, Well-being, Equity, and Participation and Influence) and their associated elements. The different meanings and interpretations are represented by three smaller circles within the large circle. The circular shape illustrates that the aspects are interrelated and should be viewed as an interconnected system. Source: Nilsson et al. 2024.

smart cities, for the first time. By focusing on human capabilities and examining scientific sources, the article theorises on how to make smart cities more inclusive, particularly for those facing challenges with new technology. It also highlights the importance of viewing a city as a system where different parts are interdependent. Therefore, failures in the digital grid can have significant social consequences, hindering climate change transformation in society. The article concludes with policy recommendations to enhance social inclusion and climate readiness in smart cities.

Community Climate Commons – arenas for collective climate action?

Another line of research within this Fairtrans project focuses on strengthening collective action through so-called Community Climate Commons (CCCs). This research is linked to the Urban Commons programme at the University of Gävle. CCCs represent a type of property right that brings together people and stakeholders that share an interest in collaborating on climate issues, and mobilising to create shared low-carbon assets. The research aims to build new insights into how such stakeholder groups collectively can enhance climate mitigation and adaptation solutions, for example through collectively managed solar panel parks, wind power plants and urban gardening projects. The project draws heavily on the research of Elinor

Ostrom, Fikret Berkes, Carl Folke and Johan Colding on local common property systems.

We are also proud to report that a paper on climate change mitigation conducted under the CCC umbrella, titled “Contribution of prioritized urban nature-based solutions allocation to carbon neutrality” (mentioned in last year’s Annual Report and published in the journal *Nature Climate Change*³) reached the top 5% of all research results worldwide in terms of media impact, according to Altmetric in October 2023.

Climate proofing cities

A team of researchers led by Åsa Gren and Johan Colding has investigated the effects of torrential rain and increased water flows in the Gothenburg area, using an InVEST calculation model from the Natural Capital Project and data from the UN’s climate panel IPCC. InVEST models help decision makers weigh the pros and cons of different management options and pinpoint areas where investing in natural resources can boost human development and conservation. The Natural Capital Project is a collaborating partner of the Beijer Institute, co-founded by Beijer Fellow Gretchen Daily, with Beijer director Carl Folke on the advisory board. The results, published in the journal *Land*⁴, clearly show that forests and green areas help absorb water and can therefore protect the Gothenburg metropolitan area against heavy rains.

¹ Nilsson, C., T. Levin, J. Colding, S. Sjöberg, and S. Barthel. 2024. Navigating complexity with the four pillars of social sustainability. *Sustainable Development*. <https://doi.org/10.1002/sd.2982>

² Colding, J., C. Nilsson, and S. Sjöberg. 2024. Smart Cities for All? Bridging Digital Divides for Socially Sustainable and Inclusive Cities. *Smart Cities* 7(3):1044-1059.

³ Pan, H., J. Page, R. Shi, C. Cong, Z. Cai, S. Barthel, P. Thollander, J. Colding, and Z. Kalantari. 2023. Contribution of prioritized urban nature-based solutions allocation to carbon neutrality. *Nature Climate Change*: 13(8):862-870.

⁴ Egegård, C.H., M. Lindborg, Å. Gren, L. Marcus, M.B. Pont, and J. Colding. 2024. Climate Proofing Cities by Navigating Nature-Based Solutions in a Multi-Scale, Social-Ecological Urban Planning Context: A Case Study of Flood Protection in the City of Gothenburg, Sweden. *Land* 13(2):143.

Some areas of research at the Beijer Institute are conducted outside the research programmes. This may occur for instance when the research is relevant for several research programmes or is in the form of early investigations into a new field that may develop into a research programme in the future. To highlight these and how they fit within our general research agenda, they have been collected under the section Topics.

The Anthropocene

In the Anthropocene – the age of humankind – the magnitude, speed, spread and connectivity of the human dimension is unseen in Earth's history. Humanity and our actions now constitute the major force in the evolution of life on Earth. All aspects of our lives – social conditions, health, culture, democracy, power, justice, inequity and security – are intertwined with the Earth system and embedded in the biosphere in a complex and dynamic interplay of local, regional and worldwide interactions and dependencies.

Bringing nature into decision-making

The significance of the biosphere for human well-being was the focus of the special issue “Bringing Nature into Decision-Making” published in *Philosophical Transactions of the Royal Society B*¹. The issue contains nine articles examining some of the challenges and the most promising solutions for bringing nature into decision-making at scale, and highlighting successful demonstrations and cases in a variety of sectors. The thematic scope ranges from the significance of green space in cities, to ecosystem services valuation and natural capital accounting, to frameworks for capturing the multiple values of nature. It includes a paper by BEN programme director John M. (Marty) Anderies and Beijer Institute director Carl Folke exploring collective shared stories – imagined orders – to enable us to revitalise meaningful and nurturing relationships with nature and the global biosphere in the Anthropocene.

Shocks and polycrisis in the Anthropocene is the focus of a pathbreaking article led by Peter Sogaard Jørgensen also published in *Philosophical Transactions of the Royal Society B*². The article is already recognized as a “Hot Paper” by the Web of Science, placing it in the top 0.1% of papers in its academic field. Read more on page 20. Another major Anthropocene article, published in *PNAS*³ and led by Beijer Fellow Johan Rockström, appeals for a shift towards stabilising the natural resources of the commons to secure a liveable planet. Read more on page 21.

Basic income can boost GDP and fight climate change

History shows that shocks and polycrisis tend to cause increased inequality. An analysis of 186 countries found that providing a basic income (regular, set payments to all adults in the world), could boost global GDP by about 130%. For every dollar

invested, approximately USD 4–7 could be generated in the form of positive economic impacts, according to a study led by Beijer Institute board member Rashid Sumaila and published in *Cell Reports Sustainability*. The researchers argue that there are several ways to finance basic income that also reduce environmental degradation, a major one being carbon taxes. For instance, in line with the global push to reduce emissions, governments could design taxes to target major polluters and degraders of biodiversity including the oil and gas industry. Another source of financing could come from redirecting environmentally harmful fishery subsidies, or government payments that incentivise overcapacity and lead to overfishing.



“Everyone affected by decisions related to water should have the opportunity to participate in the decision-making process”

Managing the water cycles

Two Anthropocene publications deal with management of the water cycles, but with very different takes.

Hydrological cycles are increasingly interconnected across larger spatial scales, sometimes even globally. This calls for rethinking how we study and govern water to enhance resilience and sustainability, according to research published in *Nature*

¹ Malhi, Y., G.C. Daily, I. Bateman, R. Bierbaum, S. Diaz, C. Folke, S. Polasky, and K. Willis (eds.). 2024. Bringing Nature into Decision-Making. *Philosophical Transactions of the Royal Society B* (1903).

² Sogaard Jørgensen, P., R.E.V. Jansen, D.I.A. Ortega, L. Wang Erlandsson, J. Donges, H. Österblom, P. Olsson, M. Nyström, S. Lade, T. Hahn, C. Folke, G.D. Peterson, and A.-S. Crepin. 2023. Evolution of the polycrisis: Anthropocene traps that challenge global sustainability. *Philosophical Transactions of the Royal Society Biological Sciences* 379: 20220261.

³ Rockström, R., L.J. Kotzé, S. Milutinović, F. Biermann, V. Brovkin, J. Donges, J. Ebbesson, D. French, J. Gupta, R.E. Kim, T.M. Lenton, D. Lenzi, N. Nakićenović, B. Neumann, F. Schuppert, R. Winkelmann, K. Bosselmann, C. Folke, W. Lucht, D. Schlosberg, K. Richardson, and W. Steffen. 2024. The Planetary Commons: A new paradigm for safeguarding Earth's regulating systems in the Anthropocene. *Proceedings of the National Academy of Sciences* 121(5): e230153112.



An artist generated image illustrating possible futures in policy and research due to human modifications of the atmospheric water cycle. © Fabio Comin & Patrick Keys.

*Water*⁴, led by Michele Lee-Moore of the Stockholm Resilience Centre and with Carl Folke on the author team. In meteorology, a “precipitation-shed” refers to the upwind ocean or land surface that supplies moisture to the atmosphere, which later falls as precipitation in downwind areas. To address current water challenges, the study puts forward a new term: “participation-shed”. It refers to the idea that everyone affected by decisions related to water should have the opportunity to participate in the decision-making process. Moreover, the study suggests improving coordination among existing governing organisations, strengthening resilience capacities and expanding their mandates.

The starting point of the second article is that although human activity is changing the way water flows between the Earth and the atmosphere in complex ways and with likely long-lasting consequences, these changes are hard to picture.

Land use change is altering where clouds form and how precipitation is distributed. Meanwhile, weather modification activities like cloud seeding are shifting how nations plan for water use in the face of climate change.

To better grasp how those kinds of activities could shape the world, a group of researchers, including Carl Folke, led by Patrick Keys (Colorado State University), enlisted water scientists from around the globe to write story-based scenarios about the possible futures humanity is facing. The results were published in the journal *Global Sustainability*⁵ as part of a creative pursuit to understand atmospheric water research with an eye towards the potential economic and policy issues that may be just beyond the horizon.

To create these narratives, the research team hosted a series of workshops with interdisciplinary water experts from a range

⁴ Moore, M.-L., L. Wang-Erlandsson, Ö. Bodin, J. Enqvist, F. Jaramillo, K. Jónás, C. Folke, P. Keys, S. J. Lade, M. Mancilla Garcia, R. Martin, N. Matthews, A. Pranindita, J. C. Rocha, and S. Vora. 2024. Moving from fit to fitness for governing water in the Anthropocene. *Nature Water* 2(6):511–520.

⁵ Keys, P., L. Wang-Erlandsson, M.-L. Moore, A. Pranindita, F. Stenzel, O. Varis, R. Warrior, B. Wong, P. d’Odorico, and C. Folke. 2024. The dry sky: Future scenarios for humanity's modification of the atmospheric water cycle. *Global Sustainability* 7: e11, 1–13.

of fields and backgrounds and walked them through a “futures thinking” approach. In the end, 10 story-based scenarios were developed and are included in the paper. The team also worked with the artist Fabio Comin to create the accompanying imagery.

Biosphere economics

The field of biosphere economics focuses on the intertwined dynamics between nature and society, at the interface between the biosphere and the economy. Much of our research relates in one way or another to biosphere economics. Here, we highlight a few activities where these aspects were particularly prominent during the year.



Social-ecological systems in the Arctic

The Beijer Institute is involved in two projects sharing a systemic focus: They both aim to develop methods to describe and investigate social-ecological connections in an Arctic context, to support decision-making in situations of great uncertainty. One project aims to examine climate change impacts on fish, shellfish and their fisheries in the Atlantic and Pacific Arctic Shelf seas, focusing on systemic interactions. It is led by Sturla Kvamsdal from Samfunns- og næringslivsforskning (at the Norwegian School of Economics) and financed by the Norwegian Research Council. The other project, led by former Beijer

Young Scholar Juan Rocha (SRC), focuses on tracking the main impacts of climate change on seascape and society in the Arctic, as well as on the economic activities they support.

Given these common objectives, Beijer Institute researcher Anne-Sophie Crépin has explored potential synergies between them, aiming to synthesise appropriate scientific methods that could be used, combined and further developed to this end. During project meetings in Alaska and Tromsø the initiative has been discussed and has received input from project members to help finalise it into a publishable manuscript. Crépin took the opportunity to present the work at the Third International Conference on the Ecosystem Approach to Management in Arctic Large Marine Ecosystems, in Tromsø, Norway, 15–18 April 2024.

Economics and regime shifts

During the past year, Beijer Institute researchers Chuan Zhong Li, Therese Lindahl and Anne-Sophie Crépin published an overview⁶ of the latest research at the interface between “regime shifts”, sudden and significant changes in a system, and economics. The Beijer Institute has been instrumental in initiating and shaping the research field to include such features in environmental economics models. In contrast to previous overviews of this kind, they also placed a strong focus on behavioural aspects, investigated through experimental approaches in several different contexts.

In other sections of the published article, the authors explored how economists have approached the idea of regime shifts through various models. These models differ based on a few key factors. First, the nature of the threshold: Is it a smooth



transition, or is it more abrupt? Second, where exactly the tipping point occurs, as well as how big the resulting change is once the threshold is crossed. Third, whether the shift is influenced by what is known as the Allée effect. This effect, seen in nature, occurs when a species struggles to reproduce if its population falls too low, simply because it is harder to find a mate.

The authors illustrate how economists also explored how different speeds of change within a system can interact and affect outcomes and how impatience among resource users influences the best strategies for managing those resources. Additionally, they examined various ways to model risk, considering factors like whether the risk unfolds over time, varies across different locations, or has delayed impacts. Based on this work, Crépin contributed to an updated version of a chapter on regime shifts and management for the *Encyclopedia of Energy, Natural Resource, and Environmental Economics*⁷.

Inequality and the biosphere

This project, initiated and led by members of the second group of Beijer Young Scholars, with advice from Carl Folke and Anne-Sophie Crépin, is financed by the research council Formas. The project published an article⁸ with Tong Wu and Juan C. Rocha as lead authors, where they explored the connections between prosperity, inequality and environmental challenges across various countries. Their findings reveal that no country has managed to achieve high prosperity, low inequality and minimal environmental damage all at once. This challenge of balancing these three goals is referred to as the “trilemma”. Read more about this article on page 22.

In a separate project Beijer Institute affiliated researcher Chuan-Zhong Li coedited a special issue on the related topic of CO₂ allocation and equity issues under China’s carbon neutrality targets, in the journal *China Economic Review*, together with Chu Wei and Jinlan Ni. The editorial⁹ for this special issue establishes its context and summarises the collection of 16 diverse papers presenting recent advancements, challenges, and thematic explorations linked to carbon dioxide emissions, highlighting the need for a holistic analysis of the allocation mechanisms and the critical balance between equity and efficiency in achieving China’s carbon neutrality targets.

Picture 1 and 2, workshop within the Inequality and the Biosphere project at Askö Marine laboratory and at the Academy, in May 2024. Photo: Dineke Verkleij.



⁶ Li, C.Z., Crépin, A.-S., and Lindahl, T. The economics of tipping points: Some recent modelling and experimental advances. *International Review of Environmental and Resource Economics*. In press.

⁷ Crépin, A.S. 2024. Regime shifts and management. In Lundgren, T., Bostian, M. and Managi S. (eds.) *Encyclopedia of Energy, Natural Resource, and Environmental Economics, Second Edition*. Elsevier Inc.

⁸ Wu, T., J.C. Rocha, K. Berry, T. Chaig-neau, M. Hamann, E. Lindqvist, J. Qiu, C. Schill, A. Shephon, A.-S. Crepin, and C. Folke. 2024. Triple bottom line or trilemma? Global tradeoffs between prosperity, inequality, and the environment. *World Development* 178:106595

⁹ Wei, C., J. Ni, and C.Z. Li. 2024. CO₂ allocation and equity issues under China’s carbon neutrality targets: Recent advances and a review. *China Economic Review* 83:102108.

Honouring Karl-Göran Mäler: Exploring Social-Ecological Regime Shifts

The 2023 Askö meeting was dedicated to the memory of the late Beijer director Karl-Göran Mäler, and was uniquely held “off location”, in central Stockholm. The meeting focused on the topic “The Frontier of Social-Ecological Regime Shifts”, a fitting area of research in which Karl-Göran made seminal contributions with his work on the economics of shallow lakes.¹

There is widespread evidence that change does not only unfold incrementally, but also occurs abruptly when certain tipping points are passed. This sometimes leads to persistent shifts in the social-ecological systems where the change took place.

Scientific literature on regime shifts generally focuses on identifying triggers, patterns, warning signals and other specific characteristics of regime shifts, to better understand them and design policies that can help address or navigate them. On the other hand, the literature on transformations towards sustainability also relates strongly to regime shifts, but focuses instead on factors that could actively help trigger a desirable societal regime shift (a transformation). Many of the

conversations during the workshop aimed at investigating how these two literatures could be reconciled, where they differed and how they could enrich each other.

To mark the occasion, we also decided to experiment with a slightly new way of organising the meeting. In addition to Beijer fellows, Beijer board members and external experts on the topic, participants from the Beijer Young Scholars’ networks (I-III) with the relevant expertise were invited. This mix of brilliant researchers across generations triggered very enthusiastic, innovative, high-level conversations, led by board member Reinette “Oonsie” Biggs.

Having smaller group discussions between plenaries provided small pauses throughout the day, which we complemented with short breaks for physical exercise to engage the body and keep the mind alert, and longer breaks for coffee and meals, where the more relaxed atmosphere serves as a fruitful incubator of innovative ideas.

Read more about the Askö meetings on page 39.



Florian Diekert (University of Augsburg), Alessandro Tavoni (University of Bologna), Elke Weber (Princeton University), Therese Lindahl and Caroline Schill (Beijer Institute).



Eli Fenichel (Yale University), Elsa Ordway (UCLA), Rashid Sumaila (University of British Columbia), and John M. Anderies (Arizona State University and Beijer Institute).

Board members, workshop participants and staff at the annual board dinner, September 2023.



¹ Mäler, K.G., A. Xepapadeas. And A. de Zeeuw. 2003. The economics of shallow lakes. *Environmental and Resource Economics* 26:603-624.

Evolutionary traps for humanity

Humankind risks getting stuck in evolutionary traps, ranging from global climate tipping points to misaligned artificial intelligence, chemical pollution and accelerating infectious diseases. Researchers have identified 14 of these, but they also point to ways out.

The evolution of humanity has been an extraordinary success story, but is showing more and more cracks. Multiple global crises, such as the Covid-19 pandemic, climate change, food insecurity, financial crises and conflicts have started to occur simultaneously, which scientists refer to as a “polycrisis”.

“Evolutionary traps are a well-known concept in the animal world. Just like many insects are attracted by light, an evolutionary reflex that can get them killed in the modern world, humankind is at risk of responding to new phenomena in harmful ways”, explains Peter Søgaard Jørgensen, a researcher at the Global Economic Dynamics and the Biosphere (GEDB) programme, the Stockholm Resilience Centre (SRC) and the Anthropocene Laboratory.

Evolution of the Anthropocene

Jørgensen is the lead author of a landmark study published as part of a larger assessment in the journal *Philosophical Transactions of the Royal Society B*, with the Beijer Institute’s Anne-Sophie Crépin and Carl Folke among the co-authors. The assessment gathers insights from a wide range of different scientific disciplines across the natural and social sciences to understand how the Anthropocene evolved and how global sustainability can continue to evolve in the future.

The study shows how humanity could get stuck in “evolutionary traps” – dead ends that occur from initially successful innovations. In a first scoping effort, they identify 14 of these traps, including the simplification of agriculture; economic growth that does not deliver benefits for humans or the environment; the instability of global cooperation; climate tipping points; and artificial intelligence.

The research team outlines a four-phase model of how these traps become institutionalised, namely: (1) initiation of a new trajectory; (2) global scaling of the trajectory; (3) masked signs of negative impacts in the global system; and (4) activation of trapping mechanisms and growing risks of negative impacts.

“It’s time for humans to become aware of the new reality and to collectively move to where we want to be as a species.”

The simplification of agricultural systems is an example of such a trap. Relying on a few highly productive crops such as wheat, rice, maize and soya has meant that the number of total calories produced globally has skyrocketed over the past century. But it has also meant that the food system has become very vulnerable to environmental change, such as weather extremes or new diseases.

Of the 14 evolutionary traps, 12 are in an advanced state, meaning that humankind is on the verge of getting stuck to a degree where it becomes very difficult to get out. What’s more, societies are continuing to move in the wrong direction in 10 of these 14. Alarmingly, these evolutionary traps tend to reinforce each other.

Humanity is not doomed

This does not mean that humanity is doomed to fail, argue the researchers. But we must start to actively transform our societies. So far, the Anthropocene has to a large extent been an unconscious by-product of other evolutionary processes.

“It’s time for humans to become aware of the new reality and to collectively move to where we want to be as a species. We have the capability to do that and are already seeing signs of such movements. Our creativity, and our power to innovate and collaborate equip us with the perfect tools to actively design our future”, explains Jørgensen.

Søgaard Jørgensen, P., R. E. V. Jansen, D. I. Avila Ortega, L. Wang-Erlandsson, J. F. Donges, H. Österblom, P. Olsson, M. Nyström, S. J. Lade, T. Hahn, C. Folke, G. D. Peterson and A.-S. Crépin. 2023. Evolution of the polycrisis: Anthropocene traps that challenge global sustainability. *Philosophical Transactions of the Royal Society B: Biological Sciences* 379(1893):20220261.

Planetary commons for vital regulatory systems

All the environmental systems that regulate the functioning and state of the planet should be considered global commons, namely all systems on Earth that humanity depends on. Currently, they only include parts of the planet outside of national borders, like the high seas or Antarctica. This calls for a new level of transnational cooperation, say leading experts in legal, social and Earth system sciences in an article in *Proceedings of the National Academy of Sciences*. They propose a new framework of planetary commons to guide governance of the planet.



and Earth system scientists make their case building on the well-known idea of the global commons. Global commons (or global public goods) like the high seas and deep seabed, outer space, Antarctica and the atmosphere, are shared by all states. They lie outside of jurisdictional boundaries and sovereign entitlements. All states and people have a collective interest in their being protected and governed effectively for the collective good, not least when it comes to resource extraction.

“From the Amazon rainforest to the Greenland ice masses, there are rising risks of triggering irreversible and unmanageable shifts in Earth system functioning.”

However, in their article, the team significantly expands this idea to design more effective legal responses to better govern biophysical systems that regulate the resilience and state of the Earth beyond and across national boundaries. Examples include natural carbon sinks and the major forest systems. “We believe the planetary commons have the potential to articulate and create effective stewardship obligations for nation states worldwide aimed at restoring and strengthening planetary resilience and promoting justice. However, since these commons are often located within sovereign territories, such stewardship obligations must also meet some clear justice criteria”, highlights social scientist Joyeeta Gupta, professor at the University of Amsterdam.

“The stability and wealth of nations and our civilisation depend on the stability of critical Earth system functions that operate beyond national borders. At the same time, human activities push harder and harder on the planetary boundaries of these pivotal systems. From the Amazon rainforest to the Greenland ice masses, there are rising risks of triggering irreversible and unmanageable shifts in Earth system functioning. As these shifts affect people across the globe, we argue that tipping elements should be considered as planetary commons the world is entrusted with, and consequently in need of collective governance,” explains Beijer Fellow Johan Rockström, director of the Potsdam Institute for Climate Impact Research (PIK) and Professor of Earth System Science at University of Potsdam.

The publication is the result of an almost two-year-long research process involving 22 leading international researchers, including Beijer Institute director Carl Folke. Legal, political

Louis Kotzé – law professor at the North-West University (South Africa) and the University of Lincoln (UK) and researcher at the Research Institute for Sustainability Helmholtz Centre Potsdam – concludes: “Our existing global environmental law and governance framework is unable to address the planetary crisis and keep us from crossing planetary boundaries. This is why we urgently need planetary commons as a new law and governance approach that can safeguard critical Earth system regulating functions more effectively.”

Rockström, R., L. J. Kotzé, S. Milutinović, F. Biermann, V. Brovkin, J. Donges, J. Ebbesson, D. French, J. Gupta, R. E. Kim, T. M. Lenton, D. Lenzi, N. Nakićenović, B. Neumann, F. Schuppert, R. Winkelmann, K. Bosselmann, C. Folke, W. Lucht, D. Schlosberg, K. Richardson, and W. Steffen. 2024. The Planetary Commons: A new paradigm for safeguarding Earth’s regulating systems in the Anthropocene. *Proceedings of the National Academy of Sciences* 121(5): e230153112.

The sustainability trilemma

In the quest for sustainable development, achieving prosperity, equality and a healthy environment is the ultimate goal. This trio, often called the “triple bottom line”, aims to provide high living standards that are both widely shared and environmentally sustainable. However, recent research suggests that this ideal may be more of a trilemma, as these goals frequently conflict with one another.

In a study initiated within the Beijer Institute project *Inequality and the Biosphere* (see page 18), a group of former Beijer Young Scholars analysed data from 140 countries between 1995 and 2017, to better understand the synergies and tradeoffs between prosperity, income equality and environmental impact. Led by Tong Wu (Stanford University) and Juan Rocha (the Stockholm Resilience Centre), the analysis shows that no country has successfully balanced all three dimensions. The authors claim “this strongly suggests that there is a sustainability trilemma at the global scale”.

The trilemma in action

The researchers, including Caroline Schill, Anne-Sophie Crépin and Carl Folke at the Beijer Institute, used three key indicators for their analysis: per-capita gross national income (GNI) to measure prosperity, the Gini coefficient for income distribution to assess inequality, and the ecological footprint to gauge environmental impact. They discovered that while some countries manage to achieve high prosperity and equality, or high equality and low environmental impact, none achieve all three simultaneously.

Instead, their analyses showed clear trade-offs, where improving one aspect can lead to setbacks in another: A country’s environmental impact tended to increase as its income inequality decreased. Similarly, as nations became more prosperous, their environmental impact also grew. Even countries with historically low inequality, such as Sweden and New Zealand, began to show increasing inequality as their economies continued to grow.

“A country’s environmental impact tended to increase as its income inequality decreased.”

Global patterns and country clusters

The study also identified patterns and clusters among countries. Some nations showed synergies, moving in positive directions on more than one front, while others faced trade-offs, where gains in one area led to losses in another. One cluster of primarily advanced Western economies had high prosperity, high inequality, and high environmental impact. A second cluster, comprised of countries from Africa, Latin America and Asia (broadly, the “Global South”) tended to have lower prosperity while the levels of inequality and environmental impact varied. A group of Latin American countries, however, stood out as being trapped in a state of high inequality.

Interestingly, the analysis revealed that inequality exacerbates the trilemma. Countries with high inequality find it harder to balance prosperity and environmental health, as wealth concentration often leads to higher overall consumption and environmental degradation. This underscores the importance of addressing income distribution as a crucial component of sustainable development.

Pathways to sustainable development

The study’s authors suggest that mitigating this sustainability trilemma requires a shift in priorities, especially for already prosperous nations. They recommend focusing on economic redistribution and environmental stewardship over relentless growth. This could involve policies that promote fairer wealth distribution and stricter environmental regulations to ensure that economic activities do not compromise the planet’s health.

The *Inequality and the Biosphere* project is financed by Formas, the Swedish government research council for sustainable development.

Wu, T., J. C. Rocha, K. Berry, T. Chaigneau, M. Hamann, E. Lindqvist, J. Qiu, C. Schill, A. Shephon, A.-S. Crépin, and C. Folke. 2024. Triple bottom line or trilemma? Global trade-offs between prosperity, inequality, and the environment. *World Development* 178:106595.



Titanic lessons for Spaceship Earth



In the journey towards a sustainable future, humanity finds itself at the helm of “Spaceship Earth”, a metaphor capturing the reality that Earth, much like a spaceship, has finite resources and boundaries that demand careful management. In an analogy between our current global environmental crisis and the infamous voyage of the Titanic, where overconfidence and mismanagement led to the ship’s demise, researchers identify critical aspects of human behaviour that serve as barriers or opportunities for addressing global challenges.

Just as the Titanic was equipped with the latest technological advancements yet sunk due to human error, so too does Spaceship Earth face significant challenges that cannot be solved by technology alone. The Beijer Institute BEN programme (see pages 10–11) convened a team of authors to study this issue, led by programme director Therese Lindahl and including several Beijer Institute researchers and fellows. In the study, the team point out that despite the abundance of scientific data and early warning signals, humanity often fails to respond adequately to environmental threats. This is reminiscent of the Titanic’s crew, who, despite receiving multiple iceberg warnings, did not take sufficient precautionary measures.

Three capacities to improve collective action

The metaphor of Spaceship Earth underscores the interconnectedness and interdependence of all passengers – that is, humankind. Unlike the Titanic, however, there is no singular captain to steer us clear of danger. Instead, collective action and cooperation are essential.

Using behavioural insights, the team identifies three key public goods that can help mitigate negative aspects of human behaviour while leveraging the positive: standards and best practices; mechanisms for large-scale coordination; and the curation of information to raise awareness and promote action.

“These capacities could address the failure to recognise the fragility of the biosphere, the urgency to act, and the hesitancy to take the necessary actions. They could also create institutional incentives to leverage pro-social and pro-environmental values”, the team argues.

Learning from international large-scale organisations

By examining nine international organisations that provide one or more of these critical public goods, the researchers draw

valuable lessons that can be applied to global environmental protection efforts. These organisations spanned a range of sectors, from Amnesty International, to FIFA and the International Space Station. For instance, the study looks at the World Health Organization (WHO) and the International Monetary Fund (IMF) as examples of institutions that have mechanisms for large-scale coordination and emergency response, but which nonetheless have seen unintended outcomes that may threaten their effectiveness in the long run. By studying these, the research team draws insights into how institutional designs can be adapted to better account for human behaviour and improve collective decision-making.

“While it may be easy to dismiss current environmental organisations, like the UNEP, because they currently fail to protect the Earth’s life-support system, our analysis highlights that these entities are essential for providing the three critical public goods. However, our analysis also reveals that there is room for improvements”, Therese Lindahl explains.

Such improvements could for example include modifications to the funding model of an organisation, or enhancing the transparency of how costs, benefits and influence are distributed.

Such adaptations could lead to more effective institutions and could reduce side effects, such as corruption or the reinforcement of existing inequalities. Environmental agreements can also be improved by making standards and best practices cognitively easier to follow.

Behavioural insights for a safer journey

In conclusion, the lessons from the Titanic and the metaphor of Spaceship Earth offer a powerful framework for understanding and addressing the environmental challenges we face today. By integrating behavioural insights into institutional designs and fostering global cooperation, we can enhance our collective capacity to navigate the perils of environmental degradation and steer towards a sustainable future.

Lindahl, T., J. M. Anderies, A.-S. Crépin, K. Jónás, C. Schill, J. C. Cárdenas, C. Folke, G. J. Hofstede, M. A. Janssen, J.-D. Mathias, and S. Polasky. 2024. Titanic lessons for Spaceship Earth to account for human behavior in institutional design. *npj Climate Action* 3(1):1-9.

Cultivating interdisciplinary sustainability research

The Beijer Young Scholars (BYS) Programme was started in 2012 with the aim of creating an international network of early-career researchers and stimulating the emergence of new research paths and new ways of interdisciplinary collaboration on global sustainability topics. Conducting collaborative, integrative and interdisciplinary research is a time-consuming endeavour that is not always well recognised in the academic incentives system. One important aim of the BYS programme is to facilitate and provide space for such research.

In May 2024, the fourth cohort of Beijer Young Scholars met for the first time in a weeklong workshop at the Academy and in the Stockholm Archipelago. The group consisted of 18 PhD students and early post-docs from various fields, including economics, ecology, psychology, mathematics, sustainability science, environmental science and human geography. In addition, senior researchers took part as mentors.

Over the course of five intensive days, the young scholars convened to discuss and explore the multifaceted nature of interacting shocks within the biosphere. The initial day was dedicated to presentations by each participant, where they shared their current research and identified potential intersections between their work. The presentations were interspersed with movement and breath work, as well as a walk in the botanical garden nearby. These activities fostered a collaborative environment, encouraging scholars to find common ground and initiate discussions on how their individual research efforts could collectively advance the understanding of interacting shocks.

On the second day, the group travelled to the Idöborg island in the Stockholm Archipelago. This change of setting facilitated in-depth discussions on several critical research questions, including the movement of shocks through systems, and the potential of shocks to reveal unexpected system connections, setting the stage for the subsequent days' activities.



Photo: Jaqueline Hamilton

The group conceptualised potential case studies to illustrate interacting shocks and brainstormed methods to visualise these interactions, which is crucial for both research and policy communication. By proposing diverse case studies, the group aimed to cover a wide range of scenarios, thereby enriching the collective understanding of how shocks interplay in different contexts.

The days were spent both in workshop sessions but also with fun activities in the beautiful surroundings, and enjoying good food and lively conversations over dinner.

The final day was dedicated to clarifying the group's collective research agenda, and the workshop concluded with the formation of research tasks, subgroups and the establishment of a common communication platform. The scholars agreed to meet online bi-monthly and initiated collaboration on several projects. Through presentations, discussions, case studies and collaborative planning, the group laid a strong foundation for ongoing research and action. Social activities and the workshop environment facilitated a very easy-going and friendly atmosphere throughout the week, and created a sense of group feeling.

The participants' commitment to regular future meetings and joint projects underscores their enthusiasm for continued collaboration and the potential for significant advancements in this critical field.

Photo: Bernie Bastien



Back row: Siddharth Sachdeva (Stanford University), Felipe Benra (Leuphana University), Adam Wiechman (Arizona State University), Jaechol Lee (UC Berkley), Bernie Bastien-Olvera (UC San Diego), Noah Linder (GEDB), mentors Steve Polasky, Belinda Reyers, Carl Folke and Anne-Sophie Crépin, Emmy Wassénus (GEDB), Sarah Redicker (University of Exeter), Louis Delannoy (GEDB), Nic Choquette-Levy (Boston University), Marie Huss (Beijer Institute co-organiser), Marius von Essen (Stanford University). Front row: Amanda Manyani (Stellenbosch University), Giorgio Dini (University of Bologna), Jordana Composto (Princeton University), Niak Sian Koh (SRC and University of Oxford), Marie Kawakatsu (University of Pennsylvania), Jaqueline Hamilton (McGill University), Zoë Kitchel (Occidental College in Los Angeles, California).



Above and right: Group discussions on different aspects of biosphere shocks during the Beijer Young Scholars meeting, May 2024.

Evaluating climate risk in cities with AI

A grant of USD 5 million has been awarded by Google.org for continued development and scaling of *ClimateIQ*, an Artificial Intelligence (AI) powered climate risk evaluation tool, built on multiple urban climate hazard models. The tool will help cities to better visualise and anticipate climate risks and plan accordingly using adequate mitigation strategies.

As extreme weather events accelerate, causing devastating impacts on cities and towns across the globe, decision-makers across all sectors and scales need advanced tools to prioritise effective climate adaptation and resilience investments, especially to protect the most vulnerable.

The development of *ClimateIQ* is led by Professor Timon McPhearson at the New School's Urban Systems Lab, who is also a senior research fellow at the Beijer Institute. Within the *ClimateIQ* collaboration, SEK 3 million accrue to the Beijer Institute where programme director Victor Galaz and affiliated researcher Stefan Daume (both also affiliated with the Stockholm Resilience Centre) will contribute to the project's strategic research focus on responsible use of AI. The programme has also partnered with the Cary Institute of Ecosystem Studies, the Virginia Climate Center at George Mason University and climate tech start-up ClimaSens. The team will co-operate with cities to co-develop, test and validate the approach. The City of New York will be the inaugural partner.

Food preparedness and food system resilience

The Swedish research funding agency Mistra has decided to continue funding the research programme Mistra Food Futures for research on a sustainable and resilient food system. In this second phase, the programme is allocated SEK 64 million for a period of four and a half years. In its first phase, which started in autumn 2020, the research programme has worked on scenarios and goals for Sweden's future food system, food system targets and indicators, and barriers



The city of New York will be the inaugural partner to co-develop, test and validate *ClimateIQ*.

and bridges to food system transformation. In phase two, the aim is to continue this work, but also to address additional complex and pressing questions related to food preparedness and resilience, in response to increased geopolitical tensions and resource scarcity.

The programme takes a holistic approach to all stages of the food system, which includes tackling challenges across agriculture, food production, processing, retail and consumption.

Beijer researcher Malin Jonell will be the deputy lead of a work package centring on identifying and applying a set of overarching and holistic sustainability indicators, allowing actors in the food system to monitor progress. The role of indicators in encouraging transformation will be explored, as well as the necessary conditions for translating indicators and data for food companies to act on. The research will build on earlier work within the programme, identifying key



indicators of relevance for food system transformation and setting climate, biodiversity, diet quality and health targets for the Swedish food system.

Therese Lindahl, programme director at the Beijer Institute, will be the lead of the work package on policy development. This work package will explore the feasibility and effectiveness of different policy options and the potential trade-off between these two features. This is critical for the design and implementation of robust policy interventions that take into account both the urgency of the situation and the need for long-lasting change.

The Mistra Food Futures programme is hosted by the Swedish University of Agricultural Sciences SLU, and the main partners are the Stockholm Resilience Centre at Stockholm University, RISE and the Beijer Institute. The programme has many partners from academia, state agencies, industry organisations and businesses.

Seafood business for ocean stewardship

Seafood business for ocean stewardship (SeaBOS) is a collaboration between leading scientists and CEOs of global seafood businesses driving a science-based global transformation towards sustainable seafood production and a healthy ocean. SeaBOS member companies operate in 65 countries through 465 subsidiaries and represent around 19% of the world's seafood production. The collaboration was initiated in 2016 by the Stockholm Resilience Centre, and the Beijer Institute has been a member of the scientific and organising team from the start.

At a Keystone Dialogue in Busan, South Korea, in October 2023, SeaBOS released its first impact report demonstrating joint action for ocean stewardship and reaffirming its members' commitment to enhancing transparency and sustainable practices in the seafood industry.

The report demonstrates the scientific anchoring of the collective efforts of the SeaBOS member companies and highlights concrete cases of individual and joint action. It sets out the actions taken by companies in 2022–2023 and progress made on the challenges defined in the SeaBOS goals and commitments:

- **Illegal, unreported, and unregulated (IUU) Fishing & Modern Slavery:** Conducted risk assessments to identify and mitigate risks associated with forced labour and IUU fishing across member companies' operations and supply chains.
- **Biodiversity & Ecosystems:** Launched initiatives to evaluate and manage biodiversity risks and impacts, including advancing the protection of endangered species.
- **Anti-Microbial Resistance:** Implemented a roadmap to reduce antibiotic use in seafood operations and enhance transparency in measurement and reporting.

CEOs of SeaBOS member companies CP Foods, Cermaq Group, Maruha Nichiro, Skretting, Thai Union, Cargill Aqua Nutrition, Dongwon Industries (Vice President), Kyokuyo, Nissui, Dongwon Industries (CEO) at the APEC House in Busan, Korea, October 2023.



Beijer Institute researchers Patrik Henriksson and Max Troell with HRH Crown Princess Victoria of Sweden and Henrik Österblom, director of the Anthropocene Laboratory, at a SeaBOS meeting at Sånge Sånge outside Stockholm, April 2024.

- **Climate Resilience:** All companies set ambitious emissions reduction targets, with public reporting on emissions.
- **Ocean Plastic Reduction:** A global ocean clean-up campaign led to the recovery of 25 tonnes of oceanic plastic, complemented by measures to reduce plastic usage and assess packaging footprints in operations.

At the Keystone Dialogue, CEOs also agreed to implement the "Keystone Project on Antimicrobial Resistance in Aquaculture (AMR)". The project aims to leverage the collective agency and expertise within the SeaBOS initiative to address this pressing issue, demonstrating how science and business can work together to deliver action.

The AMR Keystone Project is a collaboration between SeaBOS member companies and science partners, spanning multiple continents and fields of expertise. The project, involving several Beijer Institute researchers, is aimed at devising an

industry-aligned methodology to monitor and quantify resistance genes in bacteria associated with farmed aquatic animals. This allows both companies and researchers to gain invaluable insights into the risks posed by these production systems and identify targeted interventions. Moreover, the project seeks to engage governments in developing supportive policies, aiming for real-world transformation.

Response diversity in a European security context

At a one-day conference in Brussels, arranged by the Brussels Dialogue on Climate Diplomacy (BDCD), on 24 November 2023, participants discussed how the European Union and its member states could develop proactive measures to deal with multiple and interacting crises, and how the concept of response diversity could be interpreted and implemented in European policy. The article “Response diversity as a sustainability strategy” – a product of the Beijer Institute’s Askö meeting that was published in *Nature Sustainability* in 2023 – was one of three essential readings for the conference. Co-author Thomas Elmquist was invited to present the article’s key findings.

The BDCD is an informal network for the exchange of information and the promotion of cooperation among European institutions, international organisations, NGOs and think tanks active in the nexus between climate change and international, national, human and environmental security. Among the participants were EU and NATO officials and members of national parliaments.



Sustainable and healthy eating – from science to policy

At the launch of the report “Policy tools for sustainable and healthy eating” – providing guidance and recommendations for policy interventions to enable dietary shifts, published by the Nordic Council – policymakers, thought leaders and scientific experts, among others, discussed the policies needed to

create food environments that enable better diets. Beijer Institute programme director Therese Lindahl took part in a panel discussion on how to translate science into policy. The event took place on 14 March at the Nobel Prize Museum in Stockholm, and was arranged by the Nordic Council of Ministers and the Nordic research institute Nordregio.



Beijer researcher Malin Jonell discussing improved food preparedness in the Swedish Parliament.
Photo: Jessica Bergh, Mistra

A sustainable food system transition is part of crises preparedness

The current security situation requires improved food preparedness, and the food system needs to become more sustainable and resilient. How can these questions be linked together for best results? This was discussed by researchers (within the research programme Mistra Food Futures) and politicians at a seminar in the Swedish Parliament hosted by members of the Parliament’s Defence Committee.

Beijer Institute researcher Malin Jonell held a presentation titled *Improved food preparedness through resilience in a cost-effective way*.

Mistra Food Futures works for a sustainable Swedish food system until 2045 (read more at page 26). The researcher’s main message was that improved food security and a sustainable transition in the food system need to be managed in an integrated way so that the investments strengthen each other.

“Swedish consumption of food transgresses five out of six planetary boundaries”, explained Malin Jonell. “It is important that when we plan for preparedness and a sustainable shift, we also consider nutrition according to our national goals”, she continued.

“The knowledge to create sustainable preparedness exists, take advantage of it.”

For members of parliament, the discussion raised questions about organic versus conventional cultivation, the responsibility of municipalities and authorities and what a modern emergency stockpile should look like. The group also discussed blue food, agriculture’s electricity supply, construction on farmland and ways of strengthening the entire food chain.

In a new policy brief, *Improved food preparedness through resilience* (in Swedish), Mistra Food Futures provides several recommendations for how sustainable transition within the food system and food preparedness should go hand in hand.

“It is with concern we see that the focus on a sustainable transition has decreased due to an increased focus on preparedness. Treat these issues instead as linked policy areas and complement short-term solutions with long-term strategies for increased resilience. The knowledge to create sustainable preparedness exists, take advantage of it”, concluded Malin Jonell.



Recommendations for nature-related risk management and disclosure

After two years of design and development through an open innovation process, the Taskforce on Nature-related Financial Disclosures (TNFD) published its final recommendations for nature-related risk management and disclosure in September 2023. These recommendations are a milestone in the relationship between business and financial capital and nature, positioning nature risk alongside financial, operational and climate risk and helping to shift capital flows to nature-positive outcomes.

The recommendations aim to inform better decision-making by companies and capital providers, and ultimately contribute to a shift in global financial flows towards nature-positive outcomes in line with the goals of the Kunming-Montreal Global Biodiversity Framework.

Led by 40 Taskforce members representing over USD 20 trillion in assets under management, the TNFD initiative has drawn on the support and active input of market and

non-market stakeholders from almost 60 countries around the world. The Beijer Institute is one of 19 knowledge partners, along with its close partner the GEDB Academy programme. Beijer Institute director Carl Folke, GEDB executive director Beatrice Crona and Beijer Fellow Stephen Polasky (University of Minnesota) have been active in the recommendations process, contributing with input and advice.

“The TNFD provides inspirational direction for how to redirect global financial flows towards nature-positive outcomes and nature-related risks into opportunities. This is fundamental, exciting and urgently needed”, commented Carl Folke, in connection with the launch.

Supporting sustainability in the business sector

In addition to the recommendations described above, Beijer Institute director Carl Folke has been interacting with the business sector in numerous ways, with the aim of building knowledge and supporting transformation towards sustainability. For example:

- In September 2023, he delivered a keynote speech on *Resilience thinking in uncertain times*, at a virtual meeting with leaders of the European Bank for Reconstruction and Development (EBRD). The EBRD is committed to integrating a comprehensive understanding of resilience into practical, bankable applications within the private sector. This effort requires a deep grasp of the analytical concepts and measurement techniques related to resilience, along with the practical expertise needed to implement resilience strategies when designing and selecting investment projects. The EBRD operates in nearly 40 economies across three continents and is owned by 73 countries, as well as the European Union and the European Investment Bank.

Carl Folke with Emily McKenzie (Technical director of TNFD) at Ecosperity Week, arranged by Temasek in April 2024.



- In December 2023, Carl Folke gave a presentation in Stockholm for HM King Carl Gustaf of Sweden, and Swedish business leaders, on the subject *Our planet, challenges and opportunities in an interwoven world of geopolitics, climate, environment and economy*.
- At the Ecosperity week, arranged by the global investment company Temasek and held in Singapore in April 2024, he presented the science of Earth resilience. The three-day event convened global business leaders, policymakers, investors and civil society actors across industries to discuss concrete actions needed to find common ground for decarbonisation, integrate nature-positivity and to raise capital for sustainable growth in Asia. Carl Folke is also part of Temasek's sustainability advisory board.

Design students and researchers collaborate in exhibition on AI

The exhibition “There is no such thing as magic” was a collaboration between the Beijer Institute, Beckmans School of Design and design firm Svenskt Tenn, shown from 22 March to 1 April at Svenskt Tenn's store in Stockholm. With humour, imagination and design, Beckmans students shed light on the Beijer

Institute's and Stockholm Resilience Centre's research on artificial intelligence (AI), spotlighting its risks and opportunities in relation to both social and ecological sustainability.

The students received lectures and tutoring from the researchers, allowing them to discuss issues together in smaller groups.

“By allowing visual communication and research to meet and interact, knowledge is shaped and conveyed both intellectually and emotionally. For the students, it is a fantastic opportunity to work with highly topical research in close dialogue with leading experts in the field”, said Sophia Wood, lecturer in charge of the course at Beckmans School of Design.

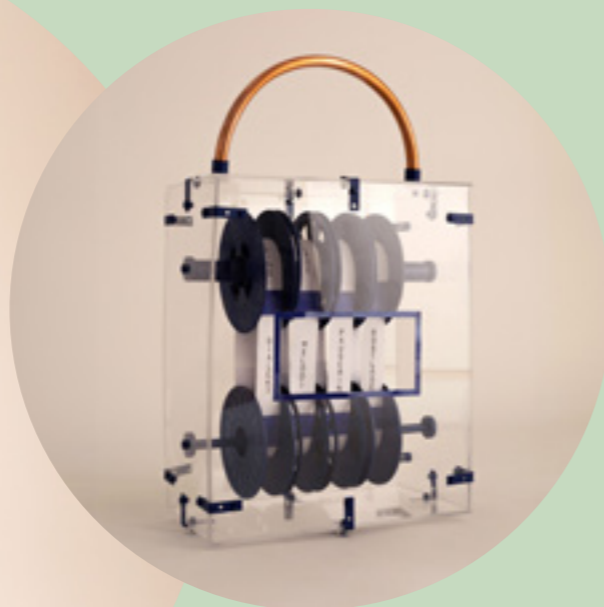
The title of the exhibition reflects the students' insight that AI is often talked about as if it were something mysterious that came out of nowhere, out of our control – as if it were magic. In reality, the technology is the result of years of decision-making by actors in technology, economics, politics and research. The processes behind AI can be understood, questioned and improved. With an understanding of how AI works, we can make informed decisions and retain influence over how AI will affect our society and the living planet.

“The students tackled this multifaceted issue with a large dose of creativity and integrity. It is fantastic to see cutting-edge research and art interplay so nicely in their work”, said Victor Galaz, programme leader at the Beijer Institute.



Seashell Resonance by Amanda Artberger, Lina Sundkvist Strindberg and Sofia Di Marco.

Is this really you? By Frank Torsson Szyber and Gabriella Roos Redemo. Photos: Jonatan Modin



Opening of the Exhibition *There is no such thing as Magic* in March 2024.

“By allowing visual communication and research to meet and interact, knowledge is shaped and conveyed both intellectually and emotionally.”

In his lecture he pointed out that large language models, such as ChatGPT, have a massive impact on the climate due to the vast amount of energy required to train and run them.

Other participating researchers were Stefan Daume (Beijer Institute and SRC), Fredrik Moberg (SRC) and Nanda Wijermans (SRC).

The students' interpretations varied in both theme and form. At the entrance, there was a giant sculpture of a pumped-up Jiminy Cricket, Pinocchio's conscience in the Disney movie. The students Elvin Odelholm and Jonatan Modin reflected on whether AI could be used to help humanity with critical moral issues and asked: “What if a future artificial intelligence could

work in symbiosis with human intelligence, acting as a kind of conscience for us? A super strong conscience?”

The students learned, among many other things, that AI is used to try to decode the language of other species, for instance the sperm whale. In a piece called *Seashell Resonance*, Amanda Artberger, Lina Sundkvist Strindberg and Sofia Di Marco, emphasised the importance of listening to our fellow species, if we ever learn to communicate with them.

This collaboration between the Beijer Institute, Beckmans College of Design and Svenskt Tenn was initiated in 2016. The design firm Svenskt Tenn is owned by the Beijer Foundation, which in turn provides the core funding for the Beijer Institute.

The Anthropocene Laboratory

The Anthropocene Laboratory at the Royal Swedish Academy of Sciences is now up and running and brings together perspectives and knowledge from the natural and social sciences, the humanities and other fields of knowledge. The laboratory will act as both a think tank and a meeting place for collaborations.

The Beijer Institute and its close collaborators the Stockholm Resilience Centre (SRC) and the Global Economic Dynamics and the Biosphere (GEDB) Academy Programme, along with other leading research groups and centres, will serve as a critical asset for the Anthropocene Laboratory. Beijer Institute researcher Caroline Schill, former Beijer Young Scholars Juan Rocha and Lan Wang Erlandsson and GEDB researcher Peter S. Jørgensen act as mentors for the post-docs and research assistants, and are central in forming the research agenda. Carl Folke is chair of the scientific committee.

Through respectful dialogue and interdisciplinary collaboration, its researchers aim to catalyse positive change and inspire a future where our relationships with the living planet are revitalised.

The Anthropocene Laboratory is funded by the Marianne and Marcus Wallenberg Foundation, and the Marcus and Amalia Wallenberg Foundation.

anthropocenelab.se



Inauguration of the Anthropocene Laboratory at the Royal Swedish Academy of Sciences, 13 February 2024. Photo: Patrik Lundin.

The Global Economic Dynamics and the Biosphere (GEDB) Academy Programme

The GEDB Academy Programme, focuses on two broad areas of research. The first, Biosphere Finance, links the study of finance and capital markets to the latest research on planet Earth as a system. This new research area is rapidly emerging and involvement by companies and financial actors is increasing. During the year, GEDB researchers have engaged with diverse actors, including banks, pensions funds, asset owners and investment companies. GEDB plays a central role in the Vinnova-funded Sustainable Finance Lab and in the Finance and Biodiversity Mistra programme at SRC.

The second area of research, Global Health and Biosphere Stewardship, involves collaborations with several research groups, including medical professionals, psychologists, behavioural economists and food actors, to tackle issues ranging

from antibiotic resistance to human health, habitats and food production. New diseases and agricultural pest organisms, also known as emerging pests and pathogens (EPPs), have been a major focus of the theme for several years. Chemicals and biotechnology are other target areas.

GEDB is a significant channel for research, synthesis and synergies between the Beijer Institute and the Stockholm Resilience Centre.

GEDB is funded by the Erling-Persson Foundation.

gedb.se

Stockholm Resilience Centre

The close collaboration with the Stockholm Resilience Centre (SRC) continues to be very productive, with numerous synergies and benefits through joint projects, grants, workshops and publications. SRC researchers are engaged in the Beijer Institute's research programmes and in other major research projects. Beijer researchers are active in SRC themes and participate in seminars, teaching, supervision, projects etc. The communication, outreach and policy engagements of the Beijer Institute are substantially amplified through the interplay with SRC.

Stanford collaboration

Work funded by the significant grant for Fundamental Research in Biosphere-based Sustainability Science from the Marianne and Marcus Wallenberg Foundation is delivered in the form of collaboration between the Beijer Institute, the SRC and Stanford University. A new five-year grant for further developing collaborations, specifically the project *Advancing the Research Frontier of Biosphere Stewardship*, has been secured from the foundation. These grants provide a research platform for developing new theory, analyses and syntheses on stewardship of natural capital and the biosphere, for social-ecological resilience, human well-being and sustainability. They draw on the long legacy of Beijer Institute collaborations with Stanford researchers and on new collaborations within the Beijer/GEDB/SRC cluster. Beijer Institute director Carl Folke and Beijer Fellow Gretchen Daily (Stanford University) serve as project leaders.

Executive programme in resilience thinking

The executive programme in resilience thinking was launched by SRC 2018. Within the programme, selected CEOs and board members of influential companies from diverse business sectors in Sweden meet with scientists and leading thinkers to deepen their understanding of the latest research and accelerate transformation towards sustainability.

Members of the Stanford Advisory Council to the Natural Capital Project, and the Stanford Doerr School of Sustainability visiting the Beijer Institute and the Academy in February, 2024.



So far, it has educated 75 chairpersons and CEOs from Sweden's largest companies. In 2023, the SRC invited Swedish trade unions to attend a course for becoming leaders in a just climate transformation.

"We hope to contribute with increased knowledge and ability of the Swedish unions and their 3.5 million members to help shape the transition to a fossil free society," said Lisen Schultz, deputy director at the SRC, who organises the course.

In total, 34 trade union presidents and secretaries, including leaders of the three Swedish union umbrella organisations, took the course.

Carl Folke is science director for the programme.

executive.stockholmresilience.org/ | stockholmresilience.org

HiG Urban Studio, University of Gävle

The Beijer Institute's *Urban social-ecological systems* programme collaborates with HiG Urban Studio at the University of Gävle. Beijer Institute programme leader professor Johan Colding leads the research at HiG Urban Studio, which aims to support urban development confined within the Earth's carrying capacity while maintaining a focus on human well-being. A key mission of the HiG Urban Studio is to promote collaboration with other prominent research settings in Sweden working on sustainable urban development. These include the SMOG group at Chalmers Technical University (Sweden), which is a world leader in research related to architecture and urban morphology, and environmental psychology groups at Aalto University (Finland) and Uppsala University (Sweden).

SARAS – The South American Institute for Resilience and Sustainability Studies

The Beijer Institute has been engaged in the South American Institute for Resilience and Sustainability Studies (SARAS) since 2007. SARAS, an interdisciplinary research institute based in Maldonado, Uruguay, aims to catalyse high-impact science that can enhance South America's long-term resilience and sustainable development. SARAS is working towards becoming a regional centre cooperating closely with the scientific community and relevant funding agencies in several South American countries and with an established set of international key scientists. Beijer Fellows Marten Scheffer, Steve Carpenter, Frances Westley and Carl Folke have been deeply engaged in setting up SARAS over the years and are now Honorary Fellows. Beijer Institute programme leader Therese Lindahl is a SARAS associate.

saras-institute.org

Stanford Center for Ocean Solutions

Through its research programme *Aquaculture and Sustainable Seafood*, the Beijer Institute is part of a two-year project

evaluating the potential of blue foods in climate adaptation and mitigation strategies, led by the Stanford Center for Ocean Solutions, Stanford University. The project team, including partners from CARE USA, the Environmental Defense Fund, the Stockholm Resilience Centre and WorldFish, synthesises existing research to help international climate negotiators assess how blue foods can contribute to low-carbon food systems. The research findings can also shed light on certain high-emission blue food species with a large environmental footprint, exacerbating environmental pressures.

oceansolutions.stanford.edu

WorldFish

WorldFish is an integral part of the Consultative Group on International Agricultural Research (CGIAR). This international, non-profit, scientific research centre was created to conduct, stimulate and accelerate research on fisheries, aquaculture and other living aquatic resources for the sustainable benefits of present and future generations in low-income countries. WorldFish was early to pick up on contemporary resilience research, upon which it bases its research and actions in poor and vulnerable communities. During the past 10 years, the mode of cooperation between the Beijer Institute and WorldFish has developed from mainly informal partnerships to collaborative research projects. One project investigates changes in shrimp farming practices in Vietnam.

worldfishcenter.org

Environment and Development Economics

The journal *Environment and Development Economics* (EDE) was founded by, and is published in association with, the Beijer Institute. EDE is positioned at the intersection of environmental, resource and development economics and encourages submissions from researchers in both developed and developing countries.

The journal is divided into two main sections, *Theory and Applications*, which includes regular academic papers, and *Perspectives*, which from 2024 replaced the *Policy Options* section. Papers published in the *Perspectives* section may be shorter than regular papers and relate to policy issues or point to gaps in research, or they may be think pieces on methodological or other issues.

The number of manuscripts submitted to EDE has shown an upward trend since the inception of the journal. The number of submissions received in 2023 was 479, and as of 30 June 2024, the journal has received 310 submissions.

The editors are Carlos Chavez, Susana Ferreira, E. Somanathan and Beijer Fellow Jeff Vincent. The journal focuses on encouraging and giving maximum support to authors of high-quality theoretical and empirical research on environmental and development economics, paying special attention to papers submitted from developing areas without compromising the quality of papers published. EDE also plans and publishes special issues that focus on specific areas of policy interest.

The Beijer way of doing science



Photo: Cecilia Nordstrand

Revisiting in my mind these years since 2018, when I first joined the Beijer Institute Board, brings a number of memorable flashbacks. From specific instances at the Askö research station, at the Royal Swedish Academy of Sciences, or during long walks between the Academy and our hotel, to the more general excitement that my family saw in me around August when I would start getting ready for the long trip to cross the Atlantic to join the board meetings and the Askö group retreats.

“There are no bad ideas. As confusing, obvious or complex as they may seem, they are always heard.”

Coming to Stockholm and to the island became one of those special times that I cherish every year for the true intellectual environment that has been built around the Beijer Institute. The guilt from the carbon footprint of traveling from Bogotá always contrasted with the positive emotions of feeling part of something that every year would give me joy, pride and a sense that our work will hopefully help researchers, students and policymakers become better citizens and make better decisions that would offset those kilograms of carbon emitted in my trip.

Various factors make working with the Beijer Institute such a unique intellectual process. We all appreciate the genuine interdisciplinary dialogue that has characterised the Beijer way of doing science. From its inception, the Institute has attempted, successfully I might add, to bring together ecology, economics and other social sciences to think about hard problems. The collection of papers that has emerged from these collective efforts speaks for itself on novel ways of tackling challenges of grand scale regarding the interaction between humans and nature.

But the Beijer way of doing science goes beyond this. Whether this has been carefully planned by its founders and Carl as director, or it is an emergent property, there is a particular way of creating an intellectually creative and humanely kind

process where every voice counts, regardless of status, recognition, discipline or seniority. Moreover, I always admired and appreciated that this horizontal conversation happened among a mix of ages and experiences that make this a beautiful symphony of the young, energetic and disruptive ideas of the post-docs and young scholars along with the wisdom of the elders.

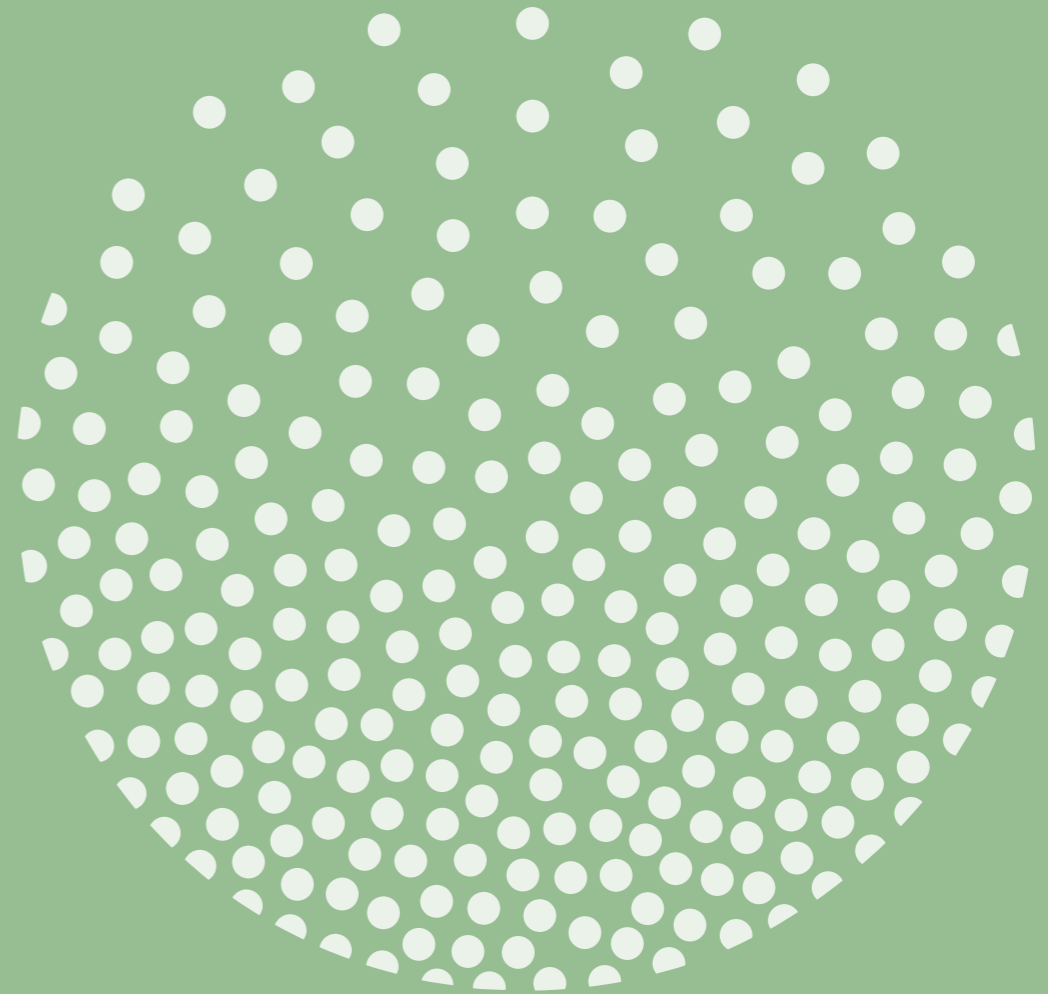
The Beijer way of doing science also has humour, that important ingredient that brings us together in communion, and my mind brings me to Umberto Eco’s novel “Name of the Rose”. A moment when we would otherwise be stuck in a difficult or tense situation would always be transcended by the touch of a good joke or witty comment by someone who would make us all feel humble in our ignorance, allowing the conversation to move forward.

In the Beijer way of doing science, there are no bad ideas. As confusing, obvious or complex as they may seem, they are always heard. Often, at the Askö island, we would all fall into a terrifying feeling of *“we are going nowhere with this”*. Then a pause, a lunch break or a walk shared among a few would bring back the spark, to be carried on into a much-improved level of conversation. I have witnessed these moments and cannot recall a time where a difficulty or a black hole in the collective thinking did not evolve into something grander. These transitions and cycles would be followed by some in the group taking the lead, and then a new paper being born. Those manuscripts where I have participated, some now published and some still in the process, are my testimonies to the Beijer way of doing science.

I have said often to family, students and colleagues that being part of this project is one of my most beloved treats in life for which I feel forever thankful. I hope the Beijer way of doing science continues for a better common good for all.

Juan Camilo Cárdenas
Board member 2018–2023

Appendix



Scientific advisory board

Board members of the Beijer Institute of Ecological Economics are appointed by the Royal Swedish Academy of Sciences for a three-year period and may not be re-elected more than once according to the standing instructions for the Beijer Institute approved by the Royal Swedish Academy of Sciences on 5 June 1991. The 33rd annual board meeting was held at The Royal Swedish Academy of Sciences on 11 September 2023. This meeting was the first for Professor Tatiana Filatova, Delft University (the Netherlands) and Professor Belinda Reyers, University of Pretoria (South Africa) who were welcomed as new members of the board. Professor Juan Camilo Cárdenas and Professor Reinette Biggs reached the end of their terms. The Beijer Institute wishes to express its warmest gratitude for their great effort for the Institute as members of the board.

Chair

Elke Weber

Professor, Princeton University (USA)

Ex-officio members

Anne-Sophie Crépin

Associate Professor, Deputy Director of the Beijer Institute

Hans Ellegren

Professor, Permanent Secretary of the Royal Swedish Academy of Sciences

Carl Folke

Professor, Director of the Beijer Institute

Members

Eli Fenichel

Professor, Yale University (USA)

Tatiana Filatova

Professor, Delft University (the Netherlands)

Claire Kremen

Professor, University of British Columbia (Canada)

Malin Pinsky

Associate Professor, Rutgers University (USA)

Belinda Reyers

Professor, University of Pretoria (South Africa)

Karen Seto

Professor, Yale School of the Environment (USA)

Rashid Sumaila

Professor, University of British Columbia (Canada)

Alessandro Tavoni

Professor, University of Bologna (Italy)

Staff members

Carl Folke

Professor, Director



Scientific advisory board meeting in September 2023.

Anne-Sophie Crépin

Associate Professor, Deputy Director

Rakel Alvstad

MSc, Research Assistant

Felix Barbour

MSc, Research Assistant

Gustav Engström

Associate Professor, Researcher

Johan Gars

PhD, Researcher

Amare Teklay Haily

PhD, Senior Research Assistant

Marie Huss

Operations Manager

Malin Jonell

PhD, Researcher

Sofia-Kristin Kokinelis

MSc, Finance and HR Administrator

Therese Lindahl

PhD, Researcher, Programme Director

Arvid Marklund

MSc, Research Assistant

Caroline Schill

PhD, Researcher

Agneta Sundin

Communications Officer

Anna Tompsett

PhD, Researcher

Max Troell

Associate Professor, Researcher, Programme Director

Dineke Verkleij

MSc, Research Assistant

Beijer Institute and GEDB staff at a staff day dedicated to AI technology. March 2024. Photo: Max Troell.



Affiliated researchers

John. M. Anderies

Professor, Programme Director, Arizona State University (USA)

Johan Colding

Professor, Researcher, Programme Director, Gävle University (Sweden).

Stefan Daume

PhD, Researcher, Stockholm Resilience Centre, Stockholm University (Sweden)

Victor Galaz

Associate Professor, Programme Director, Stockholm Resilience Centre, Stockholm University (Sweden)

Patrik Henriksson

PhD, Researcher, Leiden University (the Netherlands) and Stockholm Resilience Centre, Stockholm University (Sweden)

Chuan-Zhong Li

Professor, Researcher, Uppsala University (Sweden)

Timon McPhearson

Professor, Researcher, The New School (USA)

Belinda Reyers

Professor, Researcher, University of Pretoria (South Africa)

Staff news

Dr Amare Teklay Hailu joined the Beijer Institute on 1 February to work in the Governance, Technology and Complexity programme. Amare has dual professions: he is both an economist and a software developer. His research interests encompass a broad spectrum, ranging from human behaviour and environmental issues to natural resources, incentives for behaviour change, the interaction between technology (specifically AI) and human behaviour.

After completing his PhD at the Norwegian University of Life Sciences (NMBU) in 2018, he was a Måler scholar at the Beijer Institute from September 2018 to March 2019, after which he served as a postdoctoral researcher at the Swedish University of Agricultural Sciences (SLU).

Dineke Verkleij joined the Beijer Institute in February 2024 as a research assistant and works mainly within the Inequality and the Biosphere project (see page 18). She contributes to research on the trade-offs and synergies between reducing social inequality and safeguarding the biosphere, as well as assisting the wider project coordination.

Dineke holds a BSc degree in Cultural Anthropology and Sociology from Utrecht University and an MSc degree in Environmental Sciences from the same institution (part of the faculty at Copernicus Institute), with a specialization in Earth System Governance.

Research assistant **Arvid Marklund** left us in December 2023 to go back to his earlier profession as a psychologist. We thank him for his efforts within the *Governance, Technology and Complexity programme*.

We also thank research assistants **Rakel Alvstad** and **Felix Barbour** for their time at the Beijer Institute.

Beijer Fellows

John. M. Anderies

Professor, Arizona State University (USA)

Scott Barrett

Professor, Columbia University (USA)

Elena Bennett

Professor, McGill University (Canada)

Reinette “Oonsie” Biggs

Professor, Stellenbosch University (South Africa)

Fikret Berkes

Professor, University of Manitoba (Canada)

William “Buz” Brock

Professor Emeritus, University of Wisconsin, Madison (USA)

Juan Camilo Cárdenas

Professor, Los Andes University (Colombia)

Stephen R. Carpenter

Professor Emeritus, University of Wisconsin, Madison (USA)

Stuart “Terry” Chapin III

Professor Emeritus, University of Alaska Fairbanks (USA)

Kanchan Chopra

Professor Emerita, University of Delhi (India)

Gretchen C. Daily

Professor, Stanford University (USA)

Partha Dasgupta

Professor Emeritus, University of Cambridge (UK)

Paul R. Ehrlich

Professor Emeritus, Stanford University (USA)

Joern Fisher

Professor, Leuphana University (Germany)

Lance Gunderson

Professor, Emory University (USA)

Michael Hoel

Professor Emeritus, University of Oslo (Norway)

Terry Hughes

Professor, ARC Centre of Excellence for Coral Reef Studies, James Cook University (Australia)

Eric Lambin

Professor, Stanford University (USA), and Université Catholique de Louvain (Belgium)

Sander van der Leeuw

Professor, Arizona State University (USA)

Simon A. Levin

Professor, Princeton University (USA)

Jane Lubchenco

Professor, Oregon State University (USA)

Karine Nyborg

Professor, University of Oslo (Norway)

Rosamond. L. Naylor

Professor, Stanford University (USA)

Stephen Polasky

Professor, University of Minnesota (USA)

Johan Rockström

Professor, Potsdam Institute for Climate Impact Research (PIK) and Potsdam University (Germany)

Thomas Rosswall

Professor Emeritus, Member of the Royal Swedish Academy of Sciences (Sweden)

Marten Scheffer

Professor, Wageningen University & Research (the Netherlands)

Kathleen Segerson

Professor, University of Connecticut (USA)

Jason Shogren

Professor, University of Wyoming (USA)

David A. Starrett

Professor Emeritus, Stanford University (USA)

Thomas Sterner

Professor, University of Gothenburg (Sweden)

M. Scott Taylor

Professor, University of Calgary (Canada)

Jeffrey Vincent

Professor, Duke University (USA)

Brian Walker

PhD, Honorary Post-Retirement Fellow, CSIRO (Australia)

Frances Westley

Professor Emerita, University of Waterloo (Canada)

James Wilen

Professor Emeritus, University of California, Davis (USA)

Anastasios Xepapadeas

Professor, Athens University of Economics and Business (Greece)

Aart de Zeeuw

Professor Emeritus, Tilburg University (the Netherlands)

Fellows’ Prizes and Awards

Scott Barrett, Lenfest-Earth Institute Professor of Natural Resource Economics, School of International and Public Affairs and Earth Institute, Columbia University (USA) was elected as a Member of the US National Academy of Sciences in April

2024. Members are elected in recognition of their distinguished and continuing achievements in original research.

Scott Barrett is a leading scholar on transnational and global challenges, ranging from climate change to disease eradication, to biodiversity conservation and ocean governance. His research focuses on how institutions like customary law and treaties can be used to promote international cooperation.

Two Beijer Fellows were awarded the BBVA Foundation Frontiers of Knowledge Awards for 2024. The Frontiers of Knowledge Awards recognise and encourage world-class research and artistic creation, prizing contributions of broad impact for their originality and significance.

The committee awarded the 16th edition of the BBVA Foundation Frontiers of Knowledge Awards in Economics, Finance and Management to **Partha Dasgupta**, University of Cambridge, for laying the foundations of environmental economics through his pioneering work “on the interaction between economic life and the natural environment, including biodiversity”. His research, dating back to the 1970s, has provided “a basis for analysing how societies with a fixed quantity of depletable resources should allocate resources over time and invest in alternative technologies to facilitate their conservation.”

Elke Weber (Gerhard R. Andlinger professor in Energy and the Environment at Princeton University) was awarded the 16th edition of the BBVA Foundation Frontiers of Knowledge Award in Humanities and Social Sciences in recognition of her work on “environmental decision-making and human responses to climate change from an interdisciplinary perspective that draws on psychology, neuroscience, behavioural economics, sociology and environmental science.”



The awardees received EUR 400,000, a diploma and a commemorative work of art.

Johan Rockström was awarded the 2024 Tyler Prize “for his leadership in pioneering a science-based approach to sustainable development for people on a stable and resilient planet and formalising the notion that stable functioning of the Earth system is a prerequisite for thriving societies”.

The Tyler Prize announcement states further: “In 2009, Rockström’s leadership of a global team of 28 internationally renowned scientists led to the development of the Planetary Boundaries.

“In disseminating the Planetary Boundaries research, Rockström has engaged with political, civic and business leaders, environmentalists, academics and figures from popular culture. [...] Driven by Rockström’s vision, the Planetary Boundaries framework has influenced high-level discussions on climate change, such as the United Nations Sustainable Development Goals, and has had considerable impact in both scientific and policymaking communities”.

Johan Rockström is director of the Potsdam Institute for Climate Impact Research, professor in Earth System Science at Potsdam University (Germany), and professor in Water Systems and Global Sustainability at Stockholm University. He also co-founded the Stockholm Resilience Centre.

The Tyler Prize for Environmental Achievement is considered to be the world’s most prestigious prize for efforts in environmental science, environmental health and energy. The prize is USD 250,000 and is sometimes called the “Nobel Prize in the Environment”.

Member of the Beijer Institute scientific board, **Rashid Sumaila** was named among the 100 most influential Africans of 2023 by New Africa Magazine for his work as a “global champion of the oceans.”

Rashid is a professor at the University of British Columbia (Canada), and the magazine emphasised that, among other things, “His pioneering work includes applying game theory to fisheries, rethinking discount rates for natural resource projects, analysing government subsidies to global fisheries, documenting employment in fisheries, estimating the benefits of rebuilding fish stocks and establishing marine reserves.”

Administration

Office location

The Beijer Institute is located in a wing of the early 20th century building of the Royal Swedish Academy of Sciences at Frescati, a science and university area about 2km north of Stockholm City. The area is situated in one of Stockholm’s green belts, Ekoparken, which also includes some inlets of the Baltic Sea. Ekoparken has been declared a Royal National City Park by the Swedish parliament. The Institute’s visiting address is Lilla Frescativägen 4A, Stockholm.

Johan Rockström receiving the 2024 Tyler Prize for Environmental Achievement.
Photo: Jadranko Marjanovic

Organisation

The Institute’s administration is partly carried out by, or coordinated with, the Royal Swedish Academy of Sciences; for example, accounting and maintenance of premises and computers. Other administrative procedures are performed independently by the Beijer Institute.



Funding

Core funding for the Beijer Institute is provided by the Kjell and Märta Beijer Foundation, founded in 1974 through a donation from Kjell and Märta Beijer. The Foundation’s purpose is not only to support research and education, but also culture, including design, interior decoration, music and literature. The Beijer Institute is its single largest beneficiary, but the Kjell and Märta Beijer Foundation also makes large donations to research in genetic science, neuroscience and pharmaceutical research at Uppsala University and to dairy cattle research at the Swedish University of Agricultural Sciences.

Kjell Beijer was a Swedish businessman who met his wife Märta when she was working in the furniture and design store Svenskt Tenn in Stockholm, which is renowned for classical designs and high quality. This store was later bought by the Kjell and Märta Beijer Foundation and the profits go to the Foundation.

Funding for the Beijer Institute’s research activities between 1 July 2023 and 30 June 2024 was also provided by:

- Marianne and Marcus Wallenberg Foundation
- Mistra – the Swedish foundation for strategic environmental research
- Riksbankens Jubileumsfond (RJ)
- Stichting IKEA Foundation
- The Board of Trustees of the Leland Stanford Junior University
- The Crafoord Foundation
- The New School, University in New York City
- The Research Council of Norway
- The Swedish Research Council for Sustainable Development, Formas
- Western Indian Ocean Marine Science Association, WIOMSA

Teaching and training

In addition to the Master’s course modules organised by the Beijer Institute described below, a number of institute researchers give lectures within courses run by other institutions (see under staff members’ individual activities).



Stockholm Seminar with Michele Barnes (James Cook University) in October 2023.

Governance and management of social-ecological systems: Economic perspectives

Beijer Institute researchers Gustav Engström, Johan Gars and Therese Lindahl, together with the SRC’s David Collste, taught the recurring module “Economic perspectives”, which is a part of the course “Governance and management of social-ecological systems” in the Master’s programme “Social-Ecological Resilience for Sustainable Development” offered at the Stockholm Resilience Centre. The course provides an introduction to and overview of the concepts and methods in economics that are most relevant for analysing issues related to sustainability. The topics covered include basic economic theory, different schools of economic thought, policy instruments, international trade, growth, income inequality, uncertainty and behavioural economics. Given the diverse interests and academic backgrounds of the students, this course is different from a typical course in environmental economics, as it has more focus on the fundamental underlying ideas and less on the technical details of economic theory. Many of the students have opinions about both economic theory and the current global economic system. This leads to many interesting in-class discussions.

Theories and methods for governance of the commons

Students are introduced to different theoretical and methodological approaches to understanding and analyzing the use of the commons, and common-pool resources in particular, in the context of social-ecological systems. This module is part of the same Master’s course and course leaders are Caroline Schill (Beijer Institute) and Nanda Wijermans (SRC).

The Askö meetings

Since 1993, the Beijer Institute has organised an annual meeting each September for informal discussions between ecologists and economists at

the Stockholm Centre for Marine Research on Askö, a Swedish island in the Baltic Sea (with the exception of the pandemic years 2020-2021, when the meeting was held online). Over the years, the Askö meetings have generated unique cooperation between these disciplines that has extended outwards to other disciplines. Each year, an exciting frontier issue is discussed, and this generally results in a full paper, often published in a leading scientific journal. Read more on page 19.

Stockholm Seminars – Frontiers in Sustainability Science and Policy

The Stockholm Seminars are arranged by Albaeco, the Beijer Institute, Future Earth and the Stockholm Resilience Centre. They cover a broad range of perspectives on sustainability issues and focus on the need for a sound scientific basis for sustainable development policy. Over 200 Stockholm Seminars have been held since the series was initiated.

Three Stockholm Seminars were held during the past year:

11 October 2023

How relationships contribute to and can help solve grand sustainability challenges
Dr Michele Barnes, James Cook University (Australia)

9 November 2023

Hope in the Anthropocene
A whole day event organised by the Anthropocene Laboratory at the Royal Swedish Academy of Sciences, in collaboration with Stockholm Seminars and the art centre Accelerator at Stockholm University.

25 January 2024

10 Principles and a Protocol: How cities and businesses can translate Earth System Boundaries
Professor Xuemei Bai, Australian National University (Australia)

Staff members’ publications and activities



John M. (Marty) Anderies
Professor, Programme Director of BEN and Affiliated Researcher

Research focus

Robust management and robust institutional design for coupled social-ecological systems. Looking at a range of archaeological, historical and present-day examples of social-ecological systems using multiple methods including human subject experiments, qualitative case-study analysis, and formal mathematical modelling to analyse how ecological, behavioural, social and institutional factors generate vulnerability and/or enhance resilience and robustness in social-ecological systems.

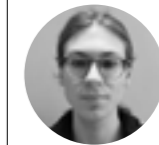
Publications

Journal articles

- Anderies, J. M., and C. Folke. 2024. Connecting human behaviour, meaning and nature. *Philosophical Transactions of the Royal Society B: Biological Sciences* 379(1903):20220314
- Mathias, J.-D., J. M. Anderies, A.-S. Crépin, M. Dambrun, T. Lindahl, and J. Norberg. 2024. Emergence of social-psychological barriers to social-ecological resilience: from causes to solutions. *Ecology and Society* 29(2).

Working papers

- Anderies, J., and J.-D. Mathias. 2024. The what, when, and how of translating knowledge to action in nature-society systems for sustainability. Research Square preprint.



Felix Barbour
MSc, Research Assistant

Research focus

Social impacts of moving and mining ocean sand. Anatomy of the global dredging fleet. Ecologically unequal exchange.

Conferences, workshops and presentations

- PEFR24, Conference, Uppsala University, Sweden, January 2024. Presenter.
- Coding Club Stockholm Resilience Centre, *Introduction to input-output analysis*, Stockholm Resilience Centre, April 2024. Organiser.
- ESEE–Degrowth 2024. Conference, Pontevedra, Spain, June 2024. Participant.



Johan Colding
Professor, Programme Director and Affiliated Researcher

Research focus

Urban ecology, institutions, natural resource management, resilience science, urban social-ecological systems, urban planning, design.

Publications

Journal articles

- Colding, J., C. Nilsson, and S. Sjöberg. 2024. Smart Cities for All? Bridging Digital Divides for Socially Sustainable and Inclusive Cities. *Smart Cities* 7(3):1044-1059.
- Egegård, C.H., M. Lindborg, Å. Gren, L. Marcus, M.B. Pont, and J. Colding. 2024. Climate Proofing Cities by Navigating Nature-Based Solutions in a Multi-Scale, Social–Ecological Urban Planning Context: A Case Study of Flood Protection in the City of Gothenburg, Sweden. *Land* 13(2):143.
- Marcus, L., and J. Colding. 2024. Placing Urban Renewal in the Context of the Resilience Adaptive Cycle. *Land* 13(1):8.
- Nilsson, C., T. Levin, J. Colding, S. Sjöberg, and S. Barthel. Navigating complexity with the four pillars of social sustainability. *Sustainable Development*, in press.

Reports and briefs

- Rex, A., M. Lilja, M. Svensson Wiklander, S. Barthel, S. Sjöberg, N. Nässén, K. Nordin, P. Andersson, and J. Colding. 2023. *Fairtrans Politiskt utvärderingsrapport 3: Digitaliseringens roll för Sveriges klimatomställning*. FAIRTRANS.

Conferences, workshops and presentations

- Yearly Academic Research Conference, University of Gävle, Sänga-Säby, Sweden, August 2023. Participant.
- FAIRTRANS research meeting (Status on Work Package 4), Stockholm Resilience Centre, Stockholm, Sweden, September 2023. Participant, presenter.
- Academic Research Conference, University of Gävle, Högbo, Sandviken, Sweden, October 2023. Participant.
- Stadens offentliga rum för hållbara hälsa och välbefinnande (Research program Urban Commons). Urban Commons Conference, University of Gävle, Sweden, October 2023. Participant.
- Yearly autumn meeting in Future Proof Cities Research School, University of Dalarna, Dalarna, Sweden, November 2023. Participant.
- International Symposium on Urban Sustainability (ISUS) conference, Winn Clarion Hotel, Gävle, Sweden, November 2023. Participant.
- FAIRTRANS workshop, Tjänstemännens Centralorganisation (TCO), Stockholm, Sweden, November 2023. Participant.
- FAIRTRANS research meeting (Status on Work Package 4), Stockholm Resilience Centre, Stockholm, Sweden, January 2024. Participant, presenter.
- Yearly spring meeting in Future Proof Cities Research School, University of Mälardalen, Eskilstuna, Sweden, March 2024. Participant.

Teaching and training

- Main supervisor of one PhD student, two Master's students and one undergraduate student, and co-supervisor of one PhD student, all at University of Gävle, Sweden.
- Lecturer, undergraduate course in *Environmental Technology/Environmental Strategy*, (*Sustainable development: A time odyssey*), University of Gävle, Sweden, autumn 2023.

- Lecturer, undergraduate course in *Environmental Technology/Environmental Strategy (Resilience and ecosystem services)*, University of Gävle, Sweden, autumn 2023.
- Lecturer, Master's course *Environment and Decision Making (History of Social-Ecological Systems)*, University of Gävle, Sweden, autumn 2023.
- Lecturer, Master's course *Environment and Decision Making (Resilience management of natural resources and ecosystems)*, University of Gävle, Sweden, autumn 2023.
- Lecturer, Master's course *Environment and Decision Making (The role of institutions in natural resource management)*, University of Gävle, Sweden, autumn 2023.
- Course examiner at the Master's *Natural resource management and resilience building of social-ecological systems (7.5 cr.)*, 2023-2024, Master in Sustainability Science, University of Gävle, Sweden.
- Lecturer, undergraduate course in *Environmental Technology/Environmental Strategy* (Studies of social-ecological systems), University of Gävle, Sweden, spring 2024.

Commissions

- Chair, half-time PhD seminar of Tarina Levin, University of Gävle, Sweden, autumn 2023.
- Co-director, SFO-program on Urban Commons, University of Gävle, Sweden.
- Steering board member, Swedish Knowledge Foundation's Research School "Företagsforskarskolan Future-Proof Cities".
- Course evaluation board member, University of Gävle, Sweden.
- Working group member, "Smarta hållbara städer och samhällen" (Smart sustainable cities and societies), Region Gävleborg, Sweden.
- Founding member of the research consortium Social-Ecological Urbanism, Stockholm, Sweden. Since 2013.
- Member, Scandinavian Turfgrass Research Foundation (STERF), Sweden. Since 2009.



Anne-Sophie Crépin
Associate Professor,
Deputy Director

Research focus

Modelling social-ecological systems, regime shifts and economics, decisions under uncertainty, global dynamics and resilience, complex system approach on the Arctic Ocean, behavioural responses to regime shifts.

Publications

Journal articles

- Li, C. Z., A.-S. Crépin, and T. Lindahl. The economics of tipping points some recent modelling and experimental advances. *International Review of Environmental and Resource Economics*, in press.
- Lindahl, T., J. M. Anderies, A.-S. Crépin, K. Jónás, C. Schill, J. C. Cárdenas, C. Folke, G. J. Hofstede, M. A. Janssen, J.-D. Mathias, and S. Polasky. 2024. Titanic lessons for Spaceship Earth to account for human behavior in institutional design. *npj Climate Action* 3(1):1-9.

- Mathias, J.-D., J. M. Anderies, A.-S. Crépin, M. Dambrun, T. Lindahl, and J. Norberg. 2024. Emergence of social-psychological barriers to social-ecological resilience: from causes to solutions. *Ecology and Society* 29(2).
- Søgaard Jørgensen, P., R. E. V. Jansen, D. I. A. Ortega, L. Wang Erlandsson, J. Donges, H. Österblom, P. Olsson, M. Nyström, S. Lade, T. Hahn, C. Folke, G. D. Peterson, and A.-S. Crepin. 2023. Evolution of the polycrisis: Anthropocene traps that challenge global sustainability. *Philosophical Transactions of the Royal Society London, Biological Sciences* 379:20220261.
- Wu, T., J. C. Rocha, K. Berry, T. Chaigneau, M. Hamann, E. Lindqvist, J. Qiu, C. Schill, A. Shephon, A.-S. Crepin, and C. Folke. 2024. Triple bottom line or trilemma? Global tradeoffs between prosperity, inequality, and the environment. *World Development* 178:106595.

Book chapter

- Crépin, A.-S. Regime shifts and Management, in Lundgren, T., Bostian, M. and Managiú S. Eds. *Encyclopedia of Energy, Natural Resource, and Environmental Economics*, Second Edition. Elsevier Inc., in press.

Conferences, workshops and presentations

- Annual Professional Association for China's Environment (PACE) International Conference on "Theory and Policy of Green and Low-carbon Development in China" Hangzhou, China, August 2023. Invited plenary speaker (online).
- Askö meeting in the memory of Karl-Göran Måler: The Frontier of Social-Ecological Regime Shifts, Royal Swedish Academy of Sciences and Stockholm, Sweden, September 2023. Co-organiser.
- Annual meeting of the project *Marine Arctic Resilience*, Adaptations and Transformations (MARAT), University of Anchorage Alaska, December 2023. Participant.
- Annual meeting of the project *Winners and losers in the climate casino: Arctic marine resources under climate change*, The Norwegian College of Fishery Science, University of Tromsø, Norway, April 2024. Participant.
- Third International Conference on Ecosystem Approach to Management in Arctic Large Marine Ecosystems, Tromsø, Norway, April 2024. Invited Speaker.
- Beijer Young Scholars IV, The Beijer Institute of Ecological Economics at the Royal Swedish Academy of Sciences and Idöborg, Stockholm, May 2024. Co-organiser and resource person.
- Inequality and the Biosphere Project, Beijer Young Scholars II consortium meeting, Royal Swedish Academy of Sciences, and Askö, Sweden, May 2024. Participant and scientific advisor.

Commissions

- Member, Environmental Research Council of the Swedish Environmental Protection Agency (Miljöforskningsrådet för naturvårdsverket). Since 2018.
- Chair, Council for evidence-based environmental analysis (Rådet för evidensbaserad miljöanalys), FORMAS. Since June, 2024. Member since 2020, vice chair, since 2023.

- Journal Editor for *Ecological Economics*. Since 2019.
- Scientific Advisory board member, Biodiversity and Ecosystem Services in a Changing Climate (BECC), Lund University, Lund, Sweden.
- Principal Researcher, Stockholm Resilience Centre, Stockholm, Sweden.
- Expert group member for a project assessing environmentally harmful subsidies for Menon Economics, commended by World Wildlife Fund, Norway.



Stefan Daume
PhD, Researcher

Research focus

Connections between digital technologies and sustainability, with a particular focus on the promises and risks of AI and social media for public engagement with environmental challenges.

Publications

Journal articles

- Daume, S., P. Bjersér, and V. Galaz. 2023. Mapping the automation of Twitter communications on climate change, sustainability, and environmental crises — a review of current research. *Current Opinion in Environmental Sustainability* 65:101384.
- Daume, S. 2024. Online misinformation during extreme weather emergencies: Short-term information hazard or long-term influence on climate change perceptions? *Environmental Research Communications*, 6(2):022001.

Conferences, workshops and presentations

- International conference on Digitalization and Artificial Intelligence in Agricultural Management, Conference hosted and funded by Digital Futures, Royal Institute of Technology (KTH), Stockholm, Sweden, November 2023. Co-organiser.

Teaching and training

- Co-supervisor of one PhD student at Stockholm Resilience Centre, Stockholm University.
- Lecturer, PhD course *Quantitative Methods For Studying Social-Ecological Systems*, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, spring 2024.
- Scientific advisor, Collaboration between the Beijer Institute, Svenskt Tenn, and Beckmans School of Design: *There is no such thing as magic*. Focus theme: AI and sustainability, spring 2024.



Gustav Engström
Associate Professor, Researcher

Research focus

Economic aspects of global environmental change, in particular the economics of climate change and issues related to energy supply and tipping points in the climate system. Other research interests include urban economics and

other aspects of the interactions between the economy and the environment.

Publications

Working papers

- Avila Ortega, D. I., S. Garcidueñas Nieto, D. D. Moran, S. Cornell, J. Cravioto, P. Søgaard Jørgensen, C. Flores-Santana, R. García Ochoa, and G. Engstrom. 2023, August 16. *Mexico's Carbon Inequality: Why Income Matters*. SSRN Scholarly Paper, Rochester, NY.

Conferences, workshops and presentations

- Technological change for strong planetary sustainability, Seminar, the Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden, March 2024. Participant.

Teaching and training

- Lecturer, Master's course *Governance and management of social-ecological systems: Economic perspectives*, Stockholm Resilience Centre, Stockholm University, spring 2024.

Other

- Radio program: July, 2023. Studio Ett (SR). Interview on the economics of extreme weather
- TV program: July, 2023. TV4 Nyhetsmorgon. Interview on the economics of extreme weather.



Carl Folke
Professor, Director

Research focus

Social-ecological systems, resilience, ecological economics, transformations, biosphere stewardship, sustainability science, Anthropocene biosphere.

Publications

Journal articles

- Anderies, J. M., and C. Folke. 2024. Connecting human behaviour, meaning and nature. *Philosophical Transactions of the Royal Society B: Biological Sciences* 379(1903):20220314.
- Currie, T. E., M. Borgerhoff Mulder, L. Fogarty, M. Schlüter, P. S. Jørgensen, L. J. Haider, G. Caniglia, A. Tavoni, R. E. V. Jansen, C. Folke, and T. M. Waring. 2023. Integrating evolutionary theory and social-ecological systems research to address the sustainability challenges of the Anthropocene. *Philosophical Transactions of the Royal Society B: Biological Sciences* 379: 20220262.
- Keys, P., L. Wang-Erlandsson, M.-L. Moore, A. Pranindita, F. Stenzel, O. Varis, R. Warrier, B. Wong, P. d'Oodorio, and C. Folke. 2024. The dry sky: Future scenarios for humanity's modification of the atmospheric water cycle. *Global Sustainability* 7:e11, 1-13.
- Moore, M.-L., L. Wang-Erlandsson, Ö. Bodin, J. Enqvist, F. Jaramillo, K. Jónás, C. Folke, P. Keys, S. J. Lade, M. Mancilla Garcia, R. Martin, N. Matthews, A. Pranindita, J. C. Rocha, and S. Vora. 2024. Moving from fit to fitness for governing water in the Anthropocene. *Nature Water* 2(6):511-520.

- Rockström, R., L. J. Kotzé, S. Milutinović, F. Biermann, V. Brovkin, J. Donges, J. Ebbesson, D. French, J. Gupta, R. E. Kim, T. M. Lenton, D. Lenzi, N. Nakićenović, B. Neumann, F. Schupert, R. Winkelmann, K. Bosselmann, C. Folke, W. Lucht, D. Schlosberg, K. Richardson, and W. Steffen. 2024. The Planetary Commons: A new paradigm for safeguarding Earth's regulating systems in the Anthropocene. *Proceedings of the National Academy of Sciences* 121(5): e230153112.
- Søgaard Jørgensen, P., R. E. V. Jansen, D.I.A. Ortega, L. Wang Erlandsson, J. Donges, H. Österblom, P. Olsson, M. Nyström, S. Lade, T. Hahn, C. Folke, G. D. Peterson, and A.-S. Crepin. 2023. Evolution of the polycrisis: Anthropocene traps that challenge global sustainability. *Philosophical Transactions of the Royal Society B: Biological Sciences* 379(1893):20220261.
- Sumaila, U. R., C. C. C. Wabnitz, L. S. L. Teh, L. C. L. Teh, V. W. Y. Lam, H. Sumaila, W. W. L. Cheung, I. Issifu, K. Hopewell, J. E. Cinner, N. J. Bennett, C. Folke, S. Gulati, and S. Polasky. 2024. Utilizing basic income to create a sustainable, poverty-free tomorrow. *Cell Reports Sustainability* 1:100104.
- Wu, T., J. C. Rocha, K. Berry, T. Chaigneau, M. Hamann, E. Lindqvist, J. Qiu, C. Schill, A. Shephon, A.-S. Crepin, and C. Folke. 2024. Triple bottom line or trilemma? Global tradeoffs between prosperity, inequality, and the environment. *World Development* 178:106595.

Special issue scientific journal

- Malhi, Y., G. C. Daily, I. Bateman, R. Bierbaum, S. Diaz, C. Folke, S. Polasky, and K. Willis (eds.). 2024. Bringing Nature into Decision-Making. *Philosophical Transactions of the Royal Society B* (1903).

Conferences, workshops and presentations

- Askö meeting in memory of Karl-Göran Måler: The Frontier of Social-Ecological Regime Shifts, Royal Swedish Academy of Sciences and Stockholm, Sweden, September 2023. Organiser, participant.
- Meeting of the International Scientific Advisory Council (ISAC), Stockholm Resilience Centre, Stockholm, Sweden, September 2023. Science director, participant.
- European Bank for Reconstruction and Development, virtual meeting with EBRD leaders, September 2023. Invited keynote speaker: *Resilience thinking in uncertain times*.
- Beijer Foundation Day, Uppsala, Sweden, October 2023. Speaker.
- SeaBOS CEO Annual Meeting, Busan, South Korea, October 2023. Presenter: *Reflections on SeaBOS*
- Empirics of Hope workshop, Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm, Sweden, November 2023. Participant.
- Volvo Environment Prize Ceremony, Gothenburg, Sweden, November 2023. Presenter.
- Invited presentation for H.M. King. Carl-Gustaf and business leaders, Stockholm, Sweden, December 2023. Presenter: *Our planet, challenges and opportunities in an interwoven world of ge-*

opolitics, climate, environment, and economy.

- Dialogue with OECD on interlinkages across climate, biodiversity and pollution. Online, December 2023.
- Earth Commission workshop, Nacka, Sweden, January–February 2024. Participant.
- The intertwined biosphere workshop, Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm, Sweden, February 2024. Presenter: *The Anthropocene biosphere: the intertwined planet.*
- Visit by the Natural Capital Project, Stanford, Stanford Doerr School of Sustainability, to the Beijer Institute/Royal Swedish Academy of Sciences, Stockholm Resilience Centre, and Biosphere Intelligence, Stockholm and Fjällnäs, Sweden, February 2024. Host.
- Executive course alumni gathering, Stockholm Resilience Centre, Stockholm, Sweden, February 2024. Science presentation.
- Earth Resilience in the Anthropocene (ERA ERC project), Stockholm, Sweden March 2024. Presenter.
- The Beijer Institute and the Royal Swedish Academy of Sciences, March 2024. Presenter.
- Ecosperity week of Temasek, Singapore, Indonesia, April 2024. Presenter: *Earth resilience.*
- SeaBOS 7th working meeting, Sånge-Såby, Sweden, April 2024. Participant.
- Stockholm Resilience Centre science retreat, Ulvsunda Slott, Sweden, April 2024. Participant.
- Beijer Young Scholars IV, Interacting shocks and the biosphere, Royal Swedish Academy of Sciences and Idöborg, Sweden, May 2024. Presenter and mentor.
- The 2nd intertwined biosphere workshop and seminar, Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm, Sweden, May 2024. Speaker and panellist.
- Inequality and the Biosphere Project, Beijer Young Scholars II consortium meeting, Royal Swedish Academy of Sciences, and Askö, Sweden, May 2024. Scientific advisor.

Teaching and training

- Lecturer, CEO Executive Programme in *Resilience Thinking: Transformative Business Leadership for a Prosperous Planet*, Stockholm Resilience Centre, Stockholm University, spring 2024.
- Lecturer, Master’s course, *Scientific advocacy*, Wageningen University, Wageningen, the Netherlands, spring 2024.
- Lecturer, undergraduate and PhD-courses, Stockholm University, Stockholm, Sweden.

Commissions

- Founder, Chair of the Scientific Committee, The Anthropocene Laboratory, Royal Swedish Academy of Science, Stockholm, Sweden. Since 2007.
- Founding Director, Chair of the Board, Stockholm Resilience Centre, Stockholm, Sweden.
- Co-director (with Beatrice Crona), Erling-Persson Family Academy Programmes, New Approaches to the Grand Challenge: Global Finance, Global Health and the Biosphere, The Royal Swedish Academy of Sciences, Stockholm, Sweden. Since 2012.
- Principal investigator (with. Gretchen Daily, Stanford University), Research collaboration

program *Fundamental Research in Biosphere-based Sustainability Science* (funded by the Marianne and Marcus Wallenberg Foundation, Stockholm University, Stockholm, Sweden.

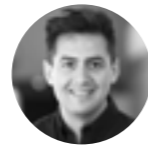
- Member, the Royal Swedish Academy of Sciences, Stockholm, Sweden.
- International Member, United States National Academy of Sciences, Washington, United States of America.
- Member, the Royal Norwegian Society of Sciences and Letters (DKNVS), Trondheim, Norway.
- Member of the Royal Swedish Academy of Agriculture and Forestry (KSLA).
- Member, High Council of Trustees of the Nobel Foundation (Nobelfullmäktige). Since 2021
- Member, the Earth Commission, Future Earth.
- Scientific Advisory Board, Max Planck Institute for Geoanthropology, Jena, Germany.
- Member, Monaco Ocean Science Federation, Monaco, France. Since 2019.
- Member, the Earth Resilience and Sustainability Initiative, Princeton, United Kingdom, Potsdam Institute for Climate Impact Research, Stockholm Resilience Centre.
- Member, the Misum Center Board, Stockholm School of Economics, Stockholm, Sweden.
- Partnership, Committee of the Natural Capital Project, Stanford University, Standford, United Kingdom.
- Lead Faculty, the Earth System Governance Project.
- Academic Advisory Board of STIAS, Stellenbosch Institute for Advanced Study, South Africa.
- Fellow, the Resilience Alliance.
- Honorary Fellow, South American Institute for Resilience and Sustainability Studies (SARAS), Maldonado, Uruguay.
- Scientific Director, the CEO Executive Programme in Resilience Thinking: Transformative Business Leadership for a Prosperous Planet, Stockholm Resilience Centre, Stockholm, Sweden. Since 2018.
- Member, SeaBOS Steering Committee SeaBOS and Board of the SeaBOS Foundation. Since 2016.
- Member, Advisory board of EAT and EAT Forum, Oslo, Norway. Since 2014.
- Advisor, Biosphere Intelligence (start-up), Stockholm, Sweden. Since 2022.
- Member, the Temasek Sustainability Advisory Panel (TSAP), Singapore, Indonesia. Since 2019.
- Core knowledge partner, Taskforce on Nature-related Financial Disclosures (TNFD). Since 2022.
- Member, the SEB External Sustainability Advisory Board (SESAB), Stockholm, Sweden. Since 2021.
- Member, Ethics Advisory Council, Axel Johnson, Stockholm, Sweden. Since 2022.
- Member, International McKinsey Sustainability Advisory Council. Since 2023.
- Reference group for international climate collaborations, Energimyndigheten (the Swedish Energy Agency).
- Chair, Scientific Committee of the Volvo Environment Prize. Since 2012.
- Member of Jury 100, Frontiers Planet Prize,

Frontiers Research Foundation.

- Advisory and editorial board member of *Proceedings of the National Academy of Sciences USA, Ambio, the Anthropocene Review, Anthropocene Science, Ecology and Society, Environment and Development Economics, Environmental Innovation and Societal Transitions, Geography and Sustainability, Global Sustainability, One Earth, and Sustainability Science.*

Other

- Organiser of a dialogue on forestry for HRH Crown Princess Victoria, Haga Castle, January 2024.
- Founder of the Stockholm Resilience Foundation.
- Collaborating with composer Jacob Mühlrad on a symphony on the Biosphere.
- Recognised as Highly Cited Researcher by Thompson Reuters. 2014–2023.



Victor Galaz
Associate Professor,
Programme Director
and Affiliated Researcher

Research focus

Exploring the societal and political challenges created by rapid global change, including accelerating technological change. The research includes studies of governance dimensions of geo-engineering technologies, machine intelligent early warning systems of epidemic outbreaks, uses of social media to detect ecological change, algorithmic trade in financial markets, and the potential for planetary responsible AI.

Publications

Journal articles

- Daume, S., P. Bjersér, and V. Galaz. 2023. Mapping the automation of Twitter communications on climate change, sustainability, and environmental crises — a review of current research. *Current Opinion in Environmental Sustainability* 65:101384.
- Galaz, V., J. Rocha, P. A. Sánchez-García, A. Dauriach, T. Roukny, and P. S. Jørgensen. 2023. Financial influence on global risks of zoonotic emerging and re-emerging diseases: an integrative analysis. *The Lancet Planetary Health* 7(12):e951-e962.
- Galaz, V., O. P. Dube, and W. Solecki. 2024. Editorial Overview: Open Issue 2023: Sustainability Science, Digitization, and Artificial Intelligence. *Current Opinion in Environmental Sustainability* 68:101452.

Working papers

- Galaz, V., and M. Meacham. 2024, April 19. *Redirecting Flows – Navigating the Future of the Amazon.* asXiv:2403.18521
- Galaz, V., H. Metzler, S. Daume, A. Olsson, B. Lindström, and A. Marklund. 2023, June 26. *AI could create a perfect storm of climate misinformation.* arXiv:2306.12807

Conferences, workshops and presentations

- Arctic Frontiers, January–February 2024. Invited keynote speaker: *Planetary Responsible use of AI.*

about what AI can do here and now.”), Hellberg, A. *Aktuellt Hållbarhet*, 13 December 2023.

- Popular science article: Victor Galaz: I upphetsningen över Nato får vi inte glömma offren för vår militära säkerhet (In the excitement about NATO, we must not forget the victims of our military security). Galaz, V. *Dagens Nyheter*. 11 March 2024.
- Popular science article: Är det I år som klimatpolitiken dör? (Is this the year climate policy dies?). Galaz, V. *Svenska Dagbladet*, Kultur, 15 April 2024.
- Expert interview, I P1 Morgon in SR (Swedish national radio) about digital twins in the Arctic and AI risks, April 2024.
- Popular science article: Klimatmanipulation: Privata företag utmanar med ny Teknik, (Climate manipulation: Private companies challenge with new technologies). Galaz, V. *Forskning och Framsteg*, 15 June 2024.

New funding

- *ClimateIQ* – funding from Google.org and New School (New York, USA). SEK 3 million, 2024–2026.



Johan Gars
PhD, Researcher

Research focus

Economic aspects of environmental issues, energy and natural resources.

Publications

Working papers

- Spiro, D., H. Wachtmeister, and J. Gars. 2024, June 10. *Assessing the impact of oil sanctions on Russia.* SSRN Scholarly Paper, Rochester, NY.
- Wachtmeister, H., J. Gars, and D. Spiro. 2023, July 1. *The Price Cap on Russian Oil: A Quantitative Analysis.* SSRN Scholarly Paper, Rochester, NY.

Reports and briefs

- Becker et al., Sanctions on Russia: Getting the Facts Right, FREE Network Policy brief

Conferences, workshops and presentations

- Swedish University of Agricultural Sciences (SLU), seminar, Uppsala, Sweden, October 2023. Presenter: *The Price Cap on Russian Oil: A Quantitative Analysis.*
- Swedish Network for European Studies in Economics and Business, annual conference, Lund, Sweden, May 2024. Presenter: *The Price Cap on Russian Oil: A Quantitative Analysis.*

Teaching and training

- Lecturer, Master’s course *Management of Biological Resources*, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden, autumn 2023.
- Lecturer and module leader, Master’s course *Governance and Management of Social-Ecological Systems: Economic Perspectives*, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, spring 2024.

Commissions

- Journal reviewer for *Macroeconomic Dynamics, Public Choice, Environmental and Resource Economics, and The B.E. Journal of Macroeconomics.*



Amare Teklay Haily
PhD, Senior Research Assistant

Research focus

Background in both economics and software development, applying experimental methods and leveraging technology, particularly AI, to understand human behaviour in the context of environmental sustainability. Keen interest in exploring how technology influences and interacts with human behaviour and utilizing AI as a novel tool for studying these interactions.



Patrik J.G. Henriksson
PhD, Affiliated Researcher

Research focus

Background in marine biology and working on evaluating aquaculture production using life cycle assessment (LCA), positioning seafood in the global food portfolio and evaluating use of antimicrobials in aquaculture.

Publications

Journal articles

- Chary, K., A.-J. van Riel, A. Muscat, A. Wilfert, S. Harchaoui, M. Verdegem, R. Filgueira, M. Troell, P. J. G. Henriksson, I. J. M. de Boer, and G. F. Wiegertjes. 2024. Transforming sustainable aquaculture by applying circularity principles. *Reviews in Aquaculture* 16(2):656-673.
- Cousins, M., E. J. Parmley, A. L. Greer, E. Neiterman, I. A. Lambraki, T. Graells, A. Léger, P. J. G. Henriksson, M. Troell, D. Wernli, P. S. Jørgensen, C. A. Carson, and S. E. Majowicz. 2023. Is scientific evidence enough? Using expert opinion to fill gaps in data in antimicrobial resistance research. *PLOS ONE* 18(8):e0290464.
- Cousins, M., E. J. Parmley, A. L. Greer, E. Neiterman, I. A. Lambraki, T. Graells, A. Léger, P. J. G. Henriksson, D. Wernli, P. S. Jørgensen, C. A. Carson, and S. E. Majowicz. 2024. Using a fuzzy cognitive map to assess interventions to reduce antimicrobial resistance in a Swedish One Health system context under potential climate change conditions. *Research Directions: One Health* 2:e6.
- Nyberg, O., A. Novotny, A. S. Sbaay, A. M. Nasr-Allah, D. A. R. Al-Kenawy, C. M. Rossignoli, and P. J. G. Henriksson. 2024. Poultry manure fertilization of Egyptian aquaculture ponds brings more cons than pros. *Aquaculture* 590:741040.
- Rossignoli, C. M., T. Manyise, K. M. Shikuku, A. M. Nasr-Allah, E. B. Dompreeh, P. J. G. Henriksson, R. D. Lam, D. Lozano Lazo, N. Tran, A. Roem, A. Badr, A. S. Sbaay, R. Moruzzo, A. Tilley, H. Charo-Karisa, and A. Gasparatos. 2023. Tilapia aquaculture systems in Egypt: Characteristics, sustainability outcomes and entry points for sustainable aquatic food systems. *Aquaculture* 577:739952.

- Troell, M., C. Hurd, T. Chopin, B. A. Costa-Pierce, and M. J. Costello. 2024. Seaweeds for carbon dioxide removal (CDR) – Getting the science right. *PLOS Climate* 3(3):e0000377.
- Wernli, D., P. S. Jørgensen, E. J. Parmley, S. E. Majowicz, I. Lambraki, C. A. Carson, M. Cousins, T. Graells, P. J. G. Henriksson, A. Léger, S. Harbarth, and M. Troell. 2023. Scope and applicability of social-ecological resilience to antimicrobial resistance. *The Lancet Planetary Health* 7(7):e630-e637.

Working papers

- Luthman, O., D. Robb, P. J. G. Henriksson, P. Søgaard Jørgensen, and M. Troell. 2024, January 30. *Global Overview of National Regulations for Antibiotic Use in Aquaculture Production*. SSRN Scholarly Paper, Rochester, NY.
- Nyberg, O. C. P., R. Heijungs, and P. J. G. Henriksson. 2023, November 3. *Ecotoxicological Hc20-Values and Their Statistical Distribution: A Nonlinear Weighted Regression Applied to Thousands of Chemicals*. SSRN Scholarly Paper, Rochester, NY.

Report and briefs

- Delval, M., Thonemann, N., Henriksson, PJG., Behrens, P. 2024. *Strategies for the Evaluation and Assessment of Ocean based Carbon Dioxide Removal – A common LCA framework*.

Conferences, workshops and presentations

- MARE 2023, conference, Amsterdam, the Netherlands, June 2023. Participant.
- ISIE 2023, conference, Leiden, the Netherlands, July 2023. Participant.
- SeaBOS, workshop, Busan, South Korea, October 2023. Participant.
- HESTIA, workshop, Oxford University, United Kingdom, January 2024. Participant.

Teaching and training

- Co-supervisor of one PhD student at the DEEP Stockholm University (Department of Marine Ecotoxicology).
- Co-supervisor of one PhD student at the University of Oxford (Department of Biology).
- Co-supervisor of one PhD student at the University of Leiden (Institute of Environmental Sciences).

Commissions

- Editor for journal *Sustainability Science*. Since 2021.
- Scientific advisor, SeaBOS. Since 2018.
- Scientific advisor, HESTIA. Since 2019.
- Theme leader *Food for resilience theme* (together with Malin Jonell), Stockholm Resilience Centre, Stockholm University, Since 2020.



Marie Huss
Operations Manager

Coordinates the Beijer Institute's operational activities. This includes planning and organising international research meetings and structuring the internal and operational work at the Institute,

administration of travel and meetings, archiving, and responsibility for the administration of an international environmental award. Marie was responsible for the administration of the Board and Askö meetings in September 2023 at the Academy and in Stockholm. In addition, she was the co-organiser of the symposium “Small-scale food producers’ role for sustainable food systems” in November 2023 at the Academy. Moreover, she assisted with the practical organisation of the NatCap Stanford Tour, January 2024 in Stockholm. Lastly, she was a co-organiser for the Beijer Young Scholars IV workshop in May 2024, at the Academy and the island Idöborg.



Malin Jonell
PhD, Researcher

Research focus

Food systems, sustainable aquatic production and the role of private regulatory mechanisms in transforming food production and consumption.

Publications

Journal articles

- Herzon, I., R. Mazac, M. Erkkola, T. Garnett, H. Hansson, M. Kaljonen, T. Kortetmäki, A. Lonkila, M. Jonell, M. Niva, A. M. Pajari, T. Tribaldos, M. Toivonen, H. L. Tuomisto, K. Koppelmäki, and E. Röö. 2023. A rebalanced discussion of the roles of livestock in society. *Nature Food*:23-24.
- Partelow, S., F. Asif, C. Béné, S. Bush, A. O. Manlosa, B. Nagel, A. Schlüter, V. M. Chadag, A. Choudhury, S. M. Cole, R. S. Cottrell, S. Gelcich, R. Gentry, J. A. Gephart, M. Glaser, T. R. Johnson, M. Jonell, G. Krause, A. Kunzmann, H. Kühnhold, D. C. Little, M. J. Marschke, D. D. Mizuta, A. O. Paramita, N. Pin, N. D. Salayo, G. D. Stentiford, J. Stoll, M. Troell, and G. M. Turchini. 2023. Aquaculture governance: five engagement arenas for sustainability transformation. *Current Opinion in Environmental Sustainability* 65:101379.
- Ran, Y., C. Cederberg, M. Jonell, K. Bergman, I. J. M. De Boer, R. Einarsson, J. Karlsson, H. K. Potter, M. Martin, G. S. Metson, T. Nemecek, K. A. Nicholas, Å. Strand, P. Tidåker, H. Van der Werf, D. Vanham, H. H. E. Van Zanten, F. Veronesi, and E. Röö. 2024. Environmental assessment of diets: overview and guidance on indicator choice. *The Lancet Planetary Health* 8(3):e172-e187.
- Ran, Y., P. Van Rysselberge, B. Macura, U.M. Persson, A. A. Hatab, M. Jonell, T. Lindahl, and E. Röö. 2024. Effects of public policy interventions for environmentally sustainable food consumption: a systematic map of available evidence. *Environmental Evidence* 13:10.

Report and briefs

- Alvstad, R., M. Jonell, and T. Lindahl. 2024. *Synergies and trade-offs between crisis preparedness and environmental sustainability of school meals in Sweden*. Mistra Food Futures Report #22.
- Jonell, M., R. Alvstad, K. Eitrem Holmgren, J. Bengtsson, M. Persson, G. D. Peterson, E. Röö, L. J. Gordon, I. Fetzer, and A. Wood. 2024. *Climate, biodiversity and health targets for*

Swedish food production and consumption. Mistra Food Futures Report #20.

Conferences, workshops and presentations

- WWF's climate webinar for food companies. Theme: Consumer behaviour. WWF, August 2023, Presentation: *Nudging and limited supply – What does the consumer say?*
- Round table discussion on research for increased food security, Formas, Stockholm, Sweden, January 2024. Participant.
- Mistra Food Futures, Seminar in the Swedish Parliament, Stockholm, Sweden, February 2024. Presenter: *Improved food preparedness through resilience in a cost-effective way*.
- Matsmart, Stockholm, Seminar in the Swedish Parliament, Stockholm, Sweden, March 2024. Presenter: *Healthy and sustainable food – What is it and how to get there?*
- Mistra Food Futures, researcher seminar, Uppsala, Sweden, March 2024. Presenter.
- The Swedish Food Agency Uppsala, seminar, Sweden, May 2024. Presenter: *Improved food preparedness through resilience*.
- Biodiversity and food – almost as hot as the climate issue, AGFO talk, Stockholm, Sweden, June 2024. Panellist.

Teaching and training

- Lecturer, Course: *Sustainability perspectives on contemporary fisheries* – Where have all the fishes gone? Swedish University of Agricultural Sciences, online, September 2023.
- Lecturer, Master's course: *Diet and health – scientific evidence, recommendations and sustainability*, Karolinska Institute, Stockholm, Sweden, September 2023.
- Module leader and lecturer, undergraduate course: *Sustainability science II, Module II Corporations and sustainable development in the Anthropocene II*, Stockholm University, Stockholm, Sweden.
- Main supervisor of PhD student at the Stockholm Resilience Centre, Stockholm University (Sustainability Science).

Commissions

- Theme leader: *Food for Resilience theme* (together with Patrik Henriksson), Stockholm Resilience Centre, Stockholm University. Since 2020.
- Editorial board member, Environmental Research: *Food Systems*. Since 2023.

Other

- Interview Swedish radio: *Food in the year 2100 - how we can eat without destroying the planet?* December 2023.
- Debate article in ATL Lantbrukets Affärstidning: Researchers: “Sooner or later even the stocks will run out”, February 2024.

New Funding

- *Mistra Food Futures (2nd phase)*, Mistra, SEK 86 million, 2024-2028. Academic and non-academic partners include the Swedish Agricultural University, Stockholm Resilience Centre, Stockholm University, Swedish Food Agency, Swedish Health Authority, Coop, Axfood, Orkla,

LRF, and others. Role: Executive Team, Work package leader.



Sofia-Kristin Kokinelis
HR Administrator

Works for both the Beijer Institute and the Global Economics Dynamics and the Biosphere programme (GEBD) at the Royal Swedish Academy of Sciences. Deals with accounting, financial reporting and budgeting, provides support and financial information to researchers about their projects, and assists them with budgeting and financial reporting. In her role as HR administrator, she prepares staff contracts and assists staff members with different issues. Due to the research collaboration between Beijer Institute and the Stockholm Resilience Centre (SRC), her tasks also require close cooperation with the administration team at SRC.



Chuan-Zhong Li
Professor, Senior Research Fellow

Research focus

Energy and environmental economics, economic growth and dynamic welfare, sustainability studies, tipping points and resilience analysis.

Publications

Journal publications

- Li, C.Z., A.-S. Crépin, and T. Lindahl. The economics of tipping points: some recent modeling and experimental advances. *International Review of Environmental and Resource Economics* 18(3), in press.
- Wei, C., J. Ni, and C.-Z. Li. 2024. CO2 allocation and equity issues under China's carbon neutrality targets: Recent advances and a review. *China Economic Review* 83:102108.

Conferences, workshops and presentations

- Annual Conference on Environmental and Resource Economics (PACE), Hangzhou, China, August 2023. Presenter: *Climate shocks, adaptation and policy implementation*.
- 5th International Conference on Resource Security and Economic Sciences, Xiamen, China, May 2024. Keynote presentation: *On the analytics of carbon taxes*.



Therese Lindahl
PhD, Programme Director

Research focus

Human behaviour in social-ecological systems. Linking individual motivators and actions to emergent large-scale behavioural patterns, institutions and sustainability outcomes. Behavioural responses to ecosystem dynamics (e.g. threshold effects, uncertainty and resource variability) and implications for cooperation and resource management. Attitudes and perceptions towards the

environment and towards environmental policy. Methods for changing behaviour.

Publications

Journal publications

- Isacs, L., Håkansson, C., Lindahl, T., Gunnarsson-Östling, U., and P. Andersson. 2024. “I didn't count ‘willingness to pay’ as part of the value”: Monetary valuation through respondents’ perspectives. *Environmental Values* 33(2):163-188.
- Linder, N., Sörqvist, P., Lindahl, T. and R. Ljung. 2023. Managing waste behavior by manipulating the normative appeal of trash bins: Lessons from an urban field experiment. *Resources, Conservation & Recycling Advances* 19:200186.
- Lindahl, T., J. M. Anderies, A.-S. Crépin, K. Jónás, C. Schill, J. C. Cárdenas, C. Folke, G. J. Hofstede, M. A. Janssen, J.-D. Mathias, and S. Polasky. 2024. Titanic lessons for Spaceship Earth to account for human behavior in institutional design. *npj Climate Action* 3(1):1-9.
- Li, C.-Z., Crépin, A.-S., and T. Lindahl. The economics of tipping points - some recent modeling and experimental advances. *International Review of Environmental and Resource Economics*, in press.
- Mathias, J.-D., J. M. Anderies, A.-S. Crépin, M. Dambrun, T. Lindahl, and J. Norberg. 2024. Emergence of social-psychological barriers to social-ecological resilience: from causes to solutions. *Ecology and Society* 29(2).
- Ran, Y., P. Van Rysselberge, B. Macura, U.M. Persson, A. A. Hatab, M. Jonell, T. Lindahl, and E. Röö. 2024. Effects of public policy interventions for environmentally sustainable food consumption: a systematic map of available evidence. *Environmental Evidence* 13:10.

Working papers

- Lindahl, T. 2024. Beijer discussion paper 280: Citizen support for taxes and subsidies implemented to achieve more sustainable food consumption: the role of policy design and presentation. *Beijer Discussion Paper Series*.

Report and briefs

- Alvstad, R., M. Jonell, and T. Lindahl. 2024. *Synergies and trade-offs between crisis preparedness and environmental sustainability of school meals in Sweden*. Mistra Food Futures Report #22.
- Hansson H., P.-A. Hansson, G. Carlsson, C. Eriksson, L. Gordon, M. Hellström, M. Jonell, T. Lindahl, E. Röö, and U. Sonesson. 2024. *Agriculture and Food. Improved preparedness with respect to food can be achieved through sustainable and resilient food systems – examples from Sweden*. Mistra Food Futures policy brief. Mistra Food Futures.

Conferences, workshops and presentations

- Economics Seminar Series, Seminar, Department of Economics, Swedish Agricultural University (SLU), Stockholm, Sweden, November 2023. Invited speaker.
- Mistra Food Futures Dialogue Series, Seminar, Mistra Food Futures, February 2024. Presenter.
- Nordic Council of Minister Report Launch, Nordregio, March 2024. Invited panellist.

- Norms and Behavioural Change in the climate crises, Workshop, Mistra Food Futures, Capri, Italy, April 2024. Invited speaker.
- Framtidens Proteinförsörjning (Future's protein supply). Workshop, Mistra Food Futures, Gothenburg, Sweden, May 2024. Participant.
- Policies for sustainable food consumption, Conference, Minstra Sustainable Consumption, Lerum, Sweden, June 2024. Presenter.

Teaching and training

- Co-supervisor of PhD student at The Norwegian College of Fishery Science, Arctic University of Norway.
- Lecturer, Master's course, *Governance and management of social-ecological systems: Challenges of environmental decision-making*, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, spring 2024.
- Lecturer, Undergraduate course, *Ekologisk ekonomi (Ecological economics)*, Department of Physical Geography and Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, autumn 2023.
- Lecturer, Undergraduate course, *Environmental management in planning*, Department of Physical Geography, Stockholm University, Stockholm, Sweden, autumn 2023.
- Lecturer, Undergraduate course, *Världen eko (World's echo)*, Stockholm University, Stockholm, Sweden, autumn 2023.

Commission

- Associate, South American Institute for Resilience and Sustainability Studies (SARAS). Since 2018.
- Reserve committee member, PhD examination for Charlotte Bunge, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, April 2024.
- Journal reviewer for *Nature Sustainability*, *Ecological Economics*, and *Journal of Economic Behaviour and Organization*.

Other

- Participating in podcast “Bryta bröd” (break bread) with baker and influencer Sébastien Boudet. February 2024.

New Funding

- *Mistra Food Futures (2nd phase)*, Mistra, SEK 86 million, 2024-2028. Academic and non-academic partners include the Swedish Agricultural University, Stockholm Resilience Centre, Stockholm University, Swedish Food Agency, Swedish Health Authority, Coop, Axfood, Orkla, LRF, and others. Role: Executive Team, Work package leader.



Timon McPhearson
Professor, Senior Research Fellow

Research focus

Understanding complex urban system dynamics based on ecology in, of and for cities, and urban resilience, systems thinking and urban ecology. Explores how rapid advances in urban datascience, availability of real-time data, advanced

spatial modelling, machine learning, cloud-based GPU processing and cutting-edge visualisation of urban social and infrastructure systems are coming together in relation to climate change.

Publications

Journal articles

- Balk, D., T. McPhearson, E. M. Cook, K. Knowlton, N. Maher, P. Marcotullio, T. Matte, R. Moss, L. Ortiz, J. Towers, J. Ventrella, and G. Wagner. 2024. NPCC4: Concepts and tools for envisioning New York City's futures. *Annals of the New York Academy of Sciences*. 2024;1–46.
- Braneon, C., L. Ortiz, D. Bader, N. Devineni, P. Orton, B. Rosenzweig, T. McPhearson, L. Smalls-Mantey, V. Gornitz, T. Mayo, S. Kadam, H. Sheerazi, E. Glenn, L. Yoon, A. Derras-Chouk, J. Towers, R. Leichenko, D. Balk, P. Marcotullio, and R. Horton. 2024. NPCC4: New York City climate risk information 2022—observations and projections. *Annals of the New York Academy of Sciences* 2024;1–36.
- Creutzig, F., S. Becker, P. Berrill, C. Bongs, A. Bussler, B. Cave, S. M. Constantino, M. Grant, N. Heeren, E. Heinen, M. J. Hintz, T. Ingen-Housz, E. Johnson, N. Kolleck, C. Liotta, S. Lorek, G. Mattioli, L. Niamir, T. McPhearson, and A. Zekar. 2024. Towards a public policy of cities and human settlements in the 21st century. *npj Urban Sustainability* 4(1):1–14
- Frantzeskaki, N., D. L. Childers, S. Pickett, F.-A. Hoover, P. Anderson, A. Barau, J. Ginsberg, M. Grove, M. Lodder, A. E. Lugo, T. McPhearson, T. A. Muñoz-Erickson, M. Quartier, S. Schepers, A. Sharifi, and K. van de Sijpe. 2024. A transformative shift in urban ecology toward a more active and relevant future for the field and for cities. *Ambio* 53:871–889.
- McPhearson, T. 2024. Greener cities: A necessity or a luxury? *Nature* 626(8000):713–715.
- Pickett, S. T. A., A. T. Simone, P. Anderson, A. Sharifi, A. Barau, F.-A. Hoover, D. L. Childers, T. McPhearson, T. A. Muñoz-Erickson, C. Pacteau, M. Grove, N. Frantzeskaki, H. Nagendra, and J. Ginsberg. 2024. The relational shift in urban ecology: from place and structures to multiple modes of coproduction for positive urban futures. *Ambio* 53:845–870.

Book

- McPhearson, T., N. Kabisch, and N. Frantzeskaki (Eds.). 2023. *Nature-based solutions for cities*. Edward Elgar Publishing.

Conferences, workshops and presentations

- FUTURE FORUM 2023, *From crises to resilience*. German Center for Research and Innovation (DWIH), New York, USA, 20 October 2024. Introducing sustainability board game.
- Geo for Good Summit 2023, Mountain View, CA, USA, October 2023. Speaker: *ClimateIQ: Democratizing Access to Climate Risk Data Through AI*.
- NYC Climate Week, The New School, New York, USA, September 2023. Speaker: *ClimateIQ: Advancing next generation climate risk assessment through AI*.

Commissions

- Member, New York City Panel on Climate Change, NYC Mayor's Office of Resiliency, 2020 – present.
- Member, Zolberg Institute's Cities and Human Mobility Research Collaborative, 2020 – present.
- Member of editorial board for journals *Urban Transformations*, *Nature Based Solutions* and *Urban Climate*
- Founding Associate Editor for journal *Nature npj Urban Sustainability*
- Associate Editor for journal *Ecology and Society*



Belinda Reyers
Professor, Senior Research Fellow

Research focus

Social-ecological systems perspective in sustainable development: research and practice.

Publications

Journal articles

- Bennett, E. M., and B. Reyers. 2024. Disentangling the complexity of human–nature interactions. *People and Nature* 6(2):402–409.
- Biggs, R., B. Reyers, R. Blanchard, H. Clements, J. Cockburn, G. S. Cumming, G. Cundill, A. de Vos, L. Dziba, K. J. Esler, C. Fabricius, M. Hamann, R. Henriksson, K. Kotschy, R. Lindborg, L. Luvuno, V. Masterson, J. L. Nel, P. O'Farrell, C. G. Palmer, L. Pereira, S. Pollard, R. Preiser, D. J. Roux, R. J. Scholes, O. Selomane, C. Shackleton, S. Shackleton, N. Sitas, J. A. Slingsby, M. Spierenburg, and M. Tengö. 2023. The Southern African Program on Ecosystem Change and Society: an emergent community of practice. *Ecosystems and People* 19(1):2150317.
- Clements, H. S., et al. 2024. The bii4africa dataset of faunal and floral population intactness estimates across Africa's major land uses. *Scientific data* 11:1:191.
- Reyers, B., and E.M. Bennet. Whose conservation revisited: How a focus on people nature relationships spotlights new directions for conservation science. *Philosophical Transactions B*, in press.

Report and briefs

- Echeverri, L. G., H. Hackmann, et al. 2023. UN-DESA *Synergy Solutions for a World in Crisis: Tackling Climate and SDG Action Together*. United Nations Department of Economic and Social Affairs and UNFCCC.

Conferences, workshops and presentations

- Sustainability Science: 20 years on. Sustainable Science Thinktank, Future Africa. October 2023.
- Inaugural lecture at Future Forests and Transformative Change, Wageningen University, the Netherlands, November 2023. Keynote speaker: *Sustainability transformations in a complex world – shifting perspectives*.
- Can mainstreaming bend the curve of biodiversity loss? Natural Capital Symposium, Stanford University, June 2024.

Teaching and training

- Main supervisor of two Postdocs at University of Pretoria, in collaboration with Stanford University and the Beijer Institute.
- Lecturer, (Africa public sector focus) Catalysing Change programme, Swedish Institute and Stockholm Resilience Centre.

Commissions

- Advisory board member, United National Development Program – Human development report, New York, U.S.
- Member, the Scientific Council of Montpellier University's Advanced Knowledge Institute on Transitions (MAK'IT), Montpellier, France. Since 2019.
- Editorial board member: Global Environmental Change. Since 2021.
- Subject Editor, Current opinion in environmental sustainability. Since 2019.
- Review Editor, Intergovernmental Science Policy Platform for Biodiversity and Ecosystem Services: Transformative change assessment. Since 2022.
- Assembly member, Future Earth.

Other

- Faculty member, Cambridge Institute for Sustainability Leadership Program (Business leaders Africa), Cambridge, United Kingdom.
- Mentor, Beijer Young Scholars workshop 2024.



Caroline Schill
PhD, Researcher

Research focus

Human behaviour in intertwined social-ecological systems. How human behaviour shapes, and is shaped by different social-ecological contexts. Particular interest in the commons, collective action and sustainability in contexts of environmental change and uncertainty.

Publications

Journal articles

- Lindahl, T., J. M. Anderies, A.-S. Crépin, K. Jónás, C. Schill, J. C. Cárdenas, C. Folke, G. J. Hofstede, M. A. Janssen, J.-D. Mathias, and S. Polasky. 2024. Titanic lessons for Spaceship Earth to account for human behavior in institutional design. *npj Climate Action* 3(1):1–9.
- Wu, T., J. C. Rocha, K. Berry, T. Chaigneau, M. Hamann, E. Lindqvist, J. Qiu, C. Schill, A. Shephon, A.-S. Crepin, and C. Folke. 2024. Triple bottom line or trilemma? Global tradeoffs between prosperity, inequality, and the environment. *World Development* 178:106595.

Reports and briefs

- Flores Santana, C., A. Hatttle, D. Ningrum, C. Schill, P. Sogaard Jørgensen. 2023. *Studying the Empirics of Hope. The Anthropocene Laboratory*, Royal Swedish Academy of Sciences, Stockholm.
- Hatttle, A., C. Flores Santana, D. Ningrum, C. Schill, and P. Sogaard Jørgensen. 2023. *Initiatives and data platforms for the empirics of hope*. The Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm.

- Kaandorp, C., L. Wang-Erlandsson, F. Gelves-Gomez, C. Folke, J. Rocha, A. Hatttle, D. Ningrum, P. Sogaard Jørgensen, C. Schill, C. Flores Santana, and H. Österblom. 2024. *A call for collective inquiries in the intertwined biosphere*. Workshop Brief. The Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm.
- Ningrum, D., C. Flores Santana, A. Hatttle, C. Schill, and P. Sogaard Jørgensen. 2023. *Hope and change in the Anthropocene*. The Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm.

Working papers

- J. C. Cárdenas, S. M. Constantino, and C. Schill 2024. Beijer Discussion Paper 281: Harnessing Behavioral Tailwinds for Climate Action. *Beijer Discussion Paper Series*.

Conferences, workshops and presentations

- Askö meeting in the memory of Karl-Göran Måler: The Frontier of Social-Ecological Regime Shifts, Royal Swedish Academy of Sciences and Stockholm, Sweden, September 2023. Invited participant.
- Regime shifts and transformations seminar I, hosted by Interacting Complexities theme at Stockholm Resilience Centre, Stockholm University, Sweden, September 2023. Organiser and presenter: *Behavioural responses and collective action in the face of critical thresholds*.
- Regime shifts and transformations seminar series (September 2024–February 2024), hosted by Interacting Complexities theme at Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, September 2023. Co-host.
- Empirics of Hope workshop, Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm, Sweden, November 2023. Co-organiser, co-host and presenter: *Empirics of Hope – where to start?*
- Hope in the Anthropocene, public seminar at Royal Swedish Academy of Sciences, organized by the Anthropocene Laboratory, in collaboration with Stockholm Seminars, and Accelerator at Stockholm University, Stockholm, Sweden, November 2023. Moderator.
- Scoping review workshop, Inequality and the Biosphere project, Falmouth, Cornwall, United Kingdom, November 2023. Co-organiser and participant.
- Seminar with Åsa Persson (SEI) on Making the Global Sustainable Development Report 2023 (GSDR23): "Times of Crisis, Times of Change: Science for Accelerating Transformations to Sustainable Development", Environmental Humanities Laboratory, Royal Institute of Technology (KTH), Stockholm, Sweden, January 2024. Invited participant.
- Intertwined Biosphere workshop, Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm, Sweden, February 2024. Participant.
- Earth Resilience 2024 Symposium and Discussion seminar, final event for European Research Council-funded project Earth Resilience in the Anthropocene (ERA), Royal Swedish Academy of Sciences and Stockholm University, Stock-

holm, Sweden, March 2024. Invited participant.

- Inequality and the Biosphere project management meeting, Högberga Gård, Lidingö, Sweden, April 2024. Co-organiser and participant.
- Intertwined Biosphere workshop, Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm, Sweden, May 2024. Participant. Flash talk: *A perspective on Humans as embedded in the Anthropocene-Biosphere and some ongoing empirical work*.
- Inequality and the Biosphere Project consortium meeting, Beijer Young Scholars II, Royal Swedish Academy of Sciences, Stockholm, Sweden, May 2024. Co-organiser and participant.

Teaching and training

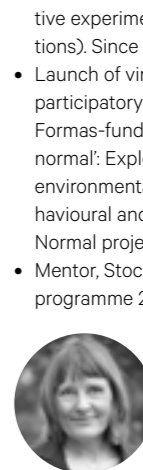
- Module leader, lecturer and examiner, Master's course, *Governance and management of social-ecological systems: Theories and methods for governance of the commons*, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, spring 2024.
- Lecturer, PhD course *Quantitative Methods*, Sustainability Science PhD programme, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, spring 2024. Topic: *Interpretive and behavioural (positivist) methodological approaches, a mixed methods approach*.
- Mentor of Postdoc (Empirics of Hope) at the Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm.
- Main supervisor of two Master's students at Stockholm Resilience Centre, Stockholm University (Social-Ecological Resilience for Sustainable Development).
- Main supervisor of one Master's student at University of Magdalena, Santa Marta, Colombia (Sustainable Territorial Development).
- Main supervisor of ERASMUS+ trainee at the Beijer Institute, Royal Academy of Sciences (Inequality and the Biosphere project).
- Main supervisor of one Master's trainee at the Stockholm Resilience Centre, Stockholm University (Social-Ecological Resilience for Sustainable Development, Empirics of Hope topic, Anthropocene Laboratory, Royal Swedish Academy of Sciences).
- External reviewer of Individual Study Plan for PhD student at Stockholm Resilience Centre, Stockholm University (Sustainability Science).

Commissions

- Theme Leader, Interacting Complexities research theme (together with Emilie Lindqvist and Juan C. Rocha), Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden. Since August 2020.
- External member of two PhD student selection committees, Sustainability Science PhD programme, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden. December 2023 and February 2024.
- Journal reviewer for *Ecological Economics*, *Ecosystems and People*, *Environmental Science and Policy*, *Global Sustainability*, and *Philosophical Transaction of the Royal Society B*.

Other

- Member, the Careoperative (leadership collec-



Agneta Sundin
Communications Officer

Agneta is responsible for developing and editing the website and the annual report and administering the Beijer publication series, as well as organising and moderating workshops, seminars and other events. During the year, among other things, she co-organised the symposium "Small-scale food producers' role for sustainable food systems" in November 2023 at the Academy; she was Beijer Institute project leader for collaboration with Beckmans College of Design and Design firm Svenskt Tenn, resulting in the exhibition "There is no such thing as magic" in spring 2024; and she co-organised and co-facilitated the Beijer Young Scholars IV workshop in May 2024, at the Academy and the island of Idöborg. A member of Stockholm Resilience Centre's (SRC) communications team, she is involved in activities arranged jointly with SRC. Agneta also works for the Academy's GEDB programme.



Anna Tompsett
PhD, Researcher

Research focus

Development economics, environmental economics, public good provision, infrastructure.

Publications

Journal articles

- Scaini, A., J. Mulligan, H. Berg, A. Brangarí, V. Bukachi, S. Carenzo, D. Chau Thi, C. Courtney-Mustaphi, A. Eklblom, H. Fjelde, M. Fridahl, A. Hansson, L. Hicks, M. Höjer, B. Juma, J.-H. Kain, R. W. Kariuki, S. Kim, P. Lane, A. Leizeaga, R. Lindborg, J. Livsey, S. W. Lyon, R. Marchant, J. R. McConville, L. Munishi, D. Nilsson, L. Olang, S. Olin, L. Olsson, P. M. Rogers, J. Rousk, H. Sandén, N. Sasaki, A. Shoemaker, B. Smith, L. Thai Huynh Phuong, A. Varela Varela, M. Venkatappa, G. Vico, N. Von Uexkull, C. Wamsler, M. Wondie, P. Zapata, M. J. Zapata Campos, S. Manzoni, and A. Tompsett. 2024. Pathways from research to sustainable development: Insights from ten research projects in sustainability and resilience. *Ambio* 53(4):517–533.

Conferences, workshops and presentations

- World Water Week, Conference, Stockholm, Sweden, August 2023. Speaker: *Leveraging Science to Accelerate Change in Practice*.

- London School of Economics Environment Week, London, United Kingdom, September 2023. Presenter: *Participation can increase sustainability*.
- Seminar at SLU Uppsala, Sweden, September 2023. Speaker: *Time is not money: An experiment with community contribution requirements in cash and labour*.
- Association for Swedish Development Economists Annual Conference. Stockholm, Sweden, November 2023. Presenter: *Participation can increase sustainability*.
- European Development Research Network Scientific Conference, Milan, Italy. January 2024. Presenter: *Time is not money: An experiment with community contribution requirements in cash and labour*.
- Seminar at ETH Zurich, Switzerland, January 2024. Speaker: *Time is not money: An experiment with community contribution requirements in cash and labour*.
- SusDeveR Occasional Symposium, April 2024. Presenter: *Participation can increase sustainability*.
- Infra4Dev Conference: The Future of Infrastructure Financing. Rabat, Morocco. May, 2024. Presenter: *Time is not money: An experiment with community contribution requirements in cash and labour*.
- WASH Economics Conference. Marseille, France. May, 2024. Presenter: *Participation can increase sustainability*.

Teaching and training

- Co-supervisor of one PhD student at the Royal Institute of Technology KTH (Defended January 2024).
- Co-supervisor of one PhD student at Eidgenössische Technische Hochschule (ETH) Zurich (Defended January 2024).
- Co-supervisor of one PhD student at Institute of International Economic Studies, Stockholm University (Defended June 2024).
- Main supervisor of two PhD students, and co-supervisor of one PhD student, all at Stockholm University.
- Co-supervisor of one PhD student at Institute of International Economic Studies, Stockholm University.
- Course leader, PhD course, *Development Economics I*, Stockholm University, Stockholm, Sweden, autumn 2023.
- Co-lecturer, Master’s course, *Environment and local communities*, Stockholm University, Stockholm, Sweden, autumn 2023.
- Co-lecturer, Master’s course, *Environment, markets and politics*, Stockholm University, Stockholm, Sweden, autumn 2023.
- Course leader, PhD course, *Towards clarity and grace in academic writing*, spring 2024.
- Co-lecturer, PhD course, From idea to paper: *Writing a paper in development and experimental economics*, spring 2024.

Commissions

- External reviewer for one PhD student at Swedish University of Agricultural Sciences (SLU) Umeå.
- Journal reviewer for *Economic Journal*, *Environmental Health Insights*, *Environmental Science and Technology*, *Journal of Development Economics*, *PNAS* and *World Development*.



Max Troell
Associate Professor,
Senior Researcher

Research focus

Sustainability of global seafood system, aquaculture, capture fisheries, governance, coastal and marine ecosystems, resource management, coastal livelihoods, ecosystem functions and services, mangroves, biodiversity, resilience, regime shifts, food systems, nutrition and food security, integrated aquaculture, food/seafood trade dynamics, sustainability metrics, life-cycle analysis, certification standards, and AMR – antibiotic resistance.

Publications

Journal articles

- Chary, K., A.-J. van Riel, A. Muscat, A. Wilfart, S. Harchaoui, M. Verdegem, R. Filgueira, M. Troell, P. J. G. Henriksson, I. J. M. de Boer, and G. F. Wiegertjes. 2024. Transforming sustainable aquaculture by applying circularity principles. *Reviews in Aquaculture* 16(2):656–673.
- Chopin, T., B. A. Costa-Pierce, M. Troell, C. L. Hurd, M. J. Costello, S. Backman, A. H. Buschmann, R. Cuhel, C. M. Duarte, F. Gröndahl, K. Heasman, R. J. Haroun, J. Johansen, A. Jueterbock, M. Lench, S. Lindell, H. Pavia, A. M. Ricart, K. S. Sundell, and C. Yarish. 2024. Deep-ocean seaweed dumping for carbon sequestration: Questionable, risky, and not the best use of valuable biomass. *One Earth* 7(3):359–364.
- Cousins, M., E. J. Parmley, A. L. Greer, E. Neiterman, I. A. Lambraki, T. Graells, A. Léger, P. J. G. Henriksson, M. Troell, D. Wernli, P. S. Jørgensen, C. A. Carson, and S. E. Majowicz. 2023. Is scientific evidence enough? Using expert opinion to fill gaps in data in antimicrobial resistance research. *PLOS ONE* 18(8):e0290464.
- Lavitra, T., F. Moridy, M. Rabearison, C. Rodine, C. Rakotomahazo, A. Nomenisoa, L. Ravnivoarivelo, R. Rasolofonirina, A. Rakotoarimana, C. Franberg, M. Troell, I. Eeckhaut, and G. Todinanahary. 2024. Local perceptions of the socioeconomic and environmental impacts of sea cucumber farming in southwestern Madagascar. *BECHE-DE-MER information bulletin* 4: 48–58.
- Partelow, S., F. Asif, C. Bénédicte, S. Bush, A. O. Manlosa, B. Nagel, A. Schlüter, V. M. Chadag, A. Choudhury, S. M. Cole, R. S. Cottrell, S. Gelcich, R. Gentry, J. A. Gephart, M. Glaser, T. R. Johnson, M. Jonell, G. Krause, A. Kunzmann, H. Kühnhold, D. C. Little, M. J. Marschke, D. D. Mizuta, A. O. Paramita, N. Pin, N. D. Salayo, G. D. Stentiford, J. Stoll, M. Troell, and G. M. Turchini. 2023. Aquaculture governance: five engagement arenas for sustainability transformation. *Current Opinion in Environmental Sustainability* 65:101379.
- Troell, M., C. Hurd, T. Chopin, B. A. Costa-Pierce, and M. J. Costello. 2024. Seaweeds for carbon dioxide removal (CDR) – Getting the science right. *PLOS Climate* 3(3):e0000377.
- Wernli, D., P. Søgaard Jørgensen, E. J. Parmley, S. E. Majowicz, I. Lambraki, C.A. Carson, M. Cousins, T. Graells, P. J. G. Henriksson, A. Léger, S. Harbarth, and M. Troell. 2023. Scope and applicability of social-ecological resilience to

antimicrobial resistance. *Lancet Planet Health* 7(7):e630–e637.

Working paper

- Luthman, O., D. Robb, P. J. G. Henriksson, P. Søgaard Jørgensen, and M. Troell. 2024. January 30. *Global Overview of National Regulations for Antibiotic Use in Aquaculture Production*. SSRN Scholarly Paper, Rochester, NY.

Conferences, workshops and presentations

- Net Zero Emissions Food Systems, workshop, The Aspen Global Change Institute, Aspen, United States of America, August 2023. Invited speaker.
- Aquatic production and blue carbon, Lunch Seminar with Key Swedish Food actors, “*Food for thought – Blue Food*”, Stockholm Resilience Centre, Stockholm, Sweden, Mistra Future Project, September 2023. Presenter.
- Antibiotika forum (Antibiotics Forum), Jordbruksverket (The Swedish board of Agriculture), Jönköping, November 2023. Participant.
- 21st International Conference on Diseases of Fish and Shellfish (EAFF XXI), symposium, Aberdeen, Scotland, September 2023. Keynote presenter.
- Symposium: Antibiotika och livsmedel – arbete i praktiken (Antibiotics and food – work in practice). Axfoundation, Torsåker, February 2024. Presenter: *Antibiotikaanvändning & livsmedelsproduktion – nuläge & lagstiftning sjömat (Antibiotics use and food production – current state and legislation for seafood)*.
- SeaBOS 7th working meeting, Sångra-Såby, Stockholm, Sweden, April 2024. Presenter.
- Innovations for a Blue Planet, symposium, Stockholm, Sweden, April 2024. Keynote presenter.
- Beijer-Beckman AMR exhibition for “Global Leaders on AMR”, Torsåker gård, Sweden, May 2024. Presenter.

Teaching and training

- Co-supervisor of one PhD at Södertörns Högskola (Defended November 2023).
- Member of evaluation committee of one Doctoral Thesis at University of Gothenburg (Dep. Marine, Tjärnö Marine Laboratory).
- Supervisor of Master’s student at DEEP Stockholm University.
- Internal reviewer of one PhD at Stockholm University.

Commissions

- Researcher responsible for joint work on Antibiotics, SeaBOS.
- Review editor, *Journal of Aquaculture Environment Interactions (AEI)* and *Frontiers in Marine Science*.
- Handling editor, *Frontiers in Aquaculture*.
- Editorial board member, *Western Indian Ocean Journal of Marine Science*.
- Member, Blue/Aquatic Food Action Coalition.
- Member “Kommittén för miljö och energi” (Committee for environment and energy), Royal Swedish Academy of Sciences, Stockholm, Sweden, 2023.
- Member “Nationalkommittén för Globala miljö-

förändringar” (National Committee for Global Environmental Change), Royal Swedish Academy of Sciences, Stockholm, Sweden, 2024.

- Member, International advisory board Australia’s Cooperative Research Centre for Solving Antimicrobial Resistance in Agribusiness, Food and Environments (CRC SAAFE), 2023-2024.
- Reviewer on communication research project, FORMAS, 2023-2024.
- Scientific Adviser, Dutch Research Council project 2022-2025: Regional innovation for circular low trophic aquaculture production in the Dutch North Sea (CIRCAQUA).
- Expert on the “How We Fix This” episode of “VOLTA GREENTECH”, a podcast series hosted and narrated by Alexander Skarsgård (Norrskan and Spotify), released June 2024.



Dineke Verkleij
MSc, Research assistant

Research focus

Socio-ecological transformations and Earth systems governance, with a particular interest in social networks and collective action in the transition to sustainable agriculture. Works as a research assistant within the Inequalities and the Biosphere project, contributing to research on the trade-offs and synergies between reducing social inequality and safeguarding the biosphere as well as assisting the wider project coordination.

Conferences, workshops and presentations

- Inequalities and the Biosphere project, Agent Based Modelling workshop, Stockholm Resilience Centre, Stockholm, May 2023. Participant.
- Inequalities and the Biosphere project consortium meeting, Beijer Young Scholars II, Askö and Royal Swedish Academy of Sciences, May 2023. Co-organiser and participant.

All publications

Journal articles

- Anderies, J. M., and C. Folke. 2024. Connecting human behaviour, meaning and nature. *Philosophical Transactions of the Royal Society B: Biological Sciences* 379(1903):20220314.
- Balk, D., T. McPhearson, E. M. Cook, K. Knowlton, N. Maher, P. Marcotullio, T. Matte, R. Moss, L. Ortiz, J. Towers, J. Ventrella, and G. Wagner. 2024. NPCC4: Concepts and tools for envisioning New York City’s futures. *Annals of the New York Academy of Sciences*. 2024;1–46.
- Bennett, E. M., and B. Reyers. 2024. Disentangling the complexity of human-nature interactions. *People and Nature* 6(2):402–409.
- Biggs, R., B. Reyers, R. Blanchard, H. Clements, J. Cockburn, G. S. Cumming, G. Cundill, A. de Vos, L. Dziba, K. J. Esler, C. Fabricius, M. Hamann, R. Henriksson, K. Kotschy, R. Lindborg, L. Luvuno, V. Masterson, J. L. Nel, P. O’Farrell, C. G. Palmer, L. Pereira, S. Pollard, R. Preiser, D. J. Roux, R. J. Scholes, O. Selomane, C. Shackleton, S. Shackleton, N. Sitas, J. A. Slingsby, M. Spierenburg, and M. Tengö. 2023. The Southern

African Program on Ecosystem Change and Society: an emergent community of practice. *Ecosystems and People* 19(1):2150317.

- Braneon, C., L. Ortiz, D. Bader, N. Devineni, P. Orton, B. Rosenzweig, T. McPhearson, L. Smalls-Mantey, V. Gornitz, T. Mayo, S. Kadam, H. Sheerazi, E. Glenn, L. Yoon, A. Derras-Chouk, J. Towers, R. Leichenko, D. Balk, P. Marcotullio, and R. Horton. 2024. NPCC4: New York City climate risk information 2022—observations and projections. *Annals of the New York Academy of Sciences* 2024;1–36.
- Chary, K., A.-J. van Riel, A. Muscat, A. Wilfart, S. Harchaoui, M. Verdegem, R. Filgueira, M. Troell, P. J. G. Henriksson, I. J. M. de Boer, and G. F. Wiegertjes. 2024. Transforming sustainable aquaculture by applying circularity principles. *Reviews in Aquaculture* 16(2):656–673.
- Chopin, T., B. A. Costa-Pierce, M. Troell, C. L. Hurd, M. J. Costello, S. Backman, A. H. Buschmann, R. Cuhel, C. M. Duarte, F. Gröndahl, K. Heasman, R. J. Haroun, J. Johansen, A. Jueterbock, M. Lench, S. Lindell, H. Pavia, A. M. Ricart, K. S. Sundell, and C. Yarish. 2024. Deep-ocean seaweed dumping for carbon sequestration: Questionable, risky, and not the best use of valuable biomass. *One Earth* 7(3):359–364.
- Clements, Hayley S., et al. 2024. The bi4africa dataset of faunal and floral population intactness estimates across Africa’s major land uses. *Scientific data* 11(1):191.
- Colding, J., C. Nilsson, and S. Sjöberg. 2024. Smart Cities for All? Bridging Digital Divides for Socially Sustainable and Inclusive Cities. *Smart Cities* 7(3):1044–1059.
- Cousins, M., E. J. Parmley, A. L. Greer, E. Neiterman, I. A. Lambraki, T. Graells, A. Léger, P. J. G. Henriksson, M. Troell, D. Wernli, P. S. Jørgensen, C. A. Carson, and S. E. Majowicz. 2023. Is scientific evidence enough? Using expert opinion to fill gaps in data in antimicrobial resistance research. *PLOS ONE* 18(8):e0290464.
- Cousins, M., E. J. Parmley, A. L. Greer, E. Neiterman, I. A. Lambraki, T. Graells, A. Léger, P. J. G. Henriksson, D. Wernli, P. S. Jørgensen, C. A. Carson, and S. E. Majowicz. 2024. Using a fuzzy cognitive map to assess interventions to reduce antimicrobial resistance in a Swedish One Health system context under potential climate change conditions. *Research Directions: One Health* 2:e6.
- Creutzig, F., S. Becker, P. Berrill, C. Bongs, A. Bussler, B. Cave, S. M. Constantino, M. Grant, N. Heeren, E. Heinen, M. J. Hintz, T. Ingen-Housz, E. Johnson, N. Kolleck, C. Liotta, S. Lorek, G. Mattioli, L. Niamir, T. McPhearson, and A. Zekar. 2024. Towards a public policy of cities and human settlements in the 21st century. *npj Urban Sustainability* 4(1):1–14
- Currie, T.E., M. Borgerhoff Mulder, L. Fogarty, M. Schlüter, P.S. Jørgensen, L.J. Haider, G. Caniglia, A. Tavoni, R.E.V. Jansen, C. Folke, and T.M. Waring. 2023. Integrating evolutionary theory and social-ecological systems research to address the sustainability challenges of the Anthropocene. *Philosophical Transactions of the Royal Society B: Biological Sciences* 379: 20220262.
- Daume, S., P. Bjersér, and V. Galaz. 2023. Mapping the automation of Twitter communications on climate change, sustainability, and environ-

mental crises — a review of current research. *Current Opinion in Environmental Sustainability* 65:101384.

- Daume, S. 2024. Online misinformation during extreme weather emergencies: Short-term information hazard or long-term influence on climate change perceptions? *Environmental Research Communications* 6(2):022001.
- Egegård, C.H., M. Lindborg, Å. Gren, L. Marcus, M.B. Pont, and J. Colding. 2024. Climate Proofing Cities by Navigating Nature-Based Solutions in a Multi-Scale, Social–Ecological Urban Planning Context: A Case Study of Flood Protection in the City of Gothenburg, Sweden. *Land* 13(2):143.
- Frantzeskaki, N., D. L. Childers, S. Pickett, F.-A. Hoover, P. Anderson, A. Barau, J. Ginsberg, M. Grove, M. Lodder, A. E. Lugo, T. McPhearson, T. A. Muñoz-Erickson, M. Quartier, S. Schepers, A. Sharifi, and K. van de Sijpe. 2024. A transformative shift in urban ecology toward a more active and relevant future for the field and for cities. *Ambio* 53:871–889.
- Galaz, V., O. P. Dube, and W. Solecki. 2024. Editorial Overview: Open Issue 2023: Sustainability Science, Digitization, and Artificial Intelligence. *Current Opinion in Environmental Sustainability* 68:101452.
- Herzon, I., R. Mazac, M. Erkkola, T. Garnett, H. Hansson, M. Kaljonen, T. Kortetmäki, A. Lonkila, M. Jonell, M. Niva, A. M. Pajari, T. Tribaldos, M. Toivonen, H. L. Tuomisto, K. Koppelmäki, and E. Röö. 2023. A rebalanced discussion of the roles of livestock in society. *Nature Food*:23–24.
- Isacs, L., Håkansson, C., Lindahl, T., Gunnarsson-Östling, U., and P. Andersson. 2024. “I didn’t count ‘willingness to pay’ as part of the value”: Monetary valuation through respondents’ perspectives. *Environmental Values* 33(2): 163–188.
- Keys, P., L. Wang-Erlandsson, M.-L. Moore, A. Pranindita, F. Stenzel, O. Varis, R. Warrier, B. Wong, P. d’Odorico, and C. Folke. 2024. The dry sky: Future scenarios for humanity’s modification of the atmospheric water cycle. *Global Sustainability* 7:e11, 1–13.
- Lavitra, T., F. Moridy, M. Rabearison, C. Rodine, C. Rakotomahazo, A. Nomenisoa, L. Ravnivoarivelo, R. Rasolofonirina, A. Rakotoarimana, C. Franberg, M. Troell, I. Eeckhaut, and G. Todinanahary. 2024. Local perceptions of the socioeconomic and environmental impacts of sea cucumber farming in southwestern Madagascar *BECHE-DE-MER information bulletin* 4: 48–58.
- Lindahl, T., J. M. Anderies, A.-S. Crépin, K. Jónás, C. Schill, J. C. Cárdenas, C. Folke, G. J. Hofstede, M. A. Janssen, J.-D. Mathias, and S. Polasky. 2024. Titanic lessons for Spaceship Earth to account for human behavior in institutional design. *npj Climate Action* 3(1):1–9.
- Linder, N., Sörqvist, P., Lindahl, T and R. Ljung. 2023. Managing waste behavior by manipulating the normative appeal of trash bins: Lessons from an urban field experiment. *Resources, Conservation & Recycling Advances* 19:200186.
- Marcus, L., and J. Colding. 2024. Placing Urban Renewal in the Context of the Resilience Adaptive Cycle. *Land* 13(1):8.
- Mathias, J.-D., J. M. Anderies, A.-S. Crépin, M. Dambrun, T. Lindahl, and J. Norberg. 2024.

- Emergence of social-psychological barriers to social-ecological resilience: from causes to solutions. *Ecology and Society* 29(2).
- McPhearson, T. 2024. Greener cities: A necessity or a luxury? *Nature* 626(8000):713–715.
 - Moore, M.-L., L. Wang-Erlandsson, Ö. Bodin, J. Enqvist, F. Jaramillo, K. Jónás, C. Folke, P. Keys, S. J. Lade, M. Mancilla Garcia, R. Martin, N. Matthews, A. Pranindita, J. C. Rocha, and S. Vora. 2024. Moving from fit to fitness for governing water in the Anthropocene. *Nature Water* 2(6):511-520.
 - Nyberg, O., A. Novotny, A. S. Sbaay, A. M. Nasr-Allah, D. A. R. Al-Kenawy, C. M. Rossignoli, and P. J. G. Henriksson. 2024. Poultry manure fertilization of Egyptian aquaculture ponds brings more cons than pros. *Aquaculture* 590:741040.
 - Partelow, S., F. Asif, C. Béné, S. Bush, A. O. Manlosa, B. Nagel, A. Schlüter, V. M. Chadag, A. Choudhury, S. M. Cole, R. S. Cottrell, S. Gelcich, R. Gentry, J. A. Gephart, M. Glaser, T. R. Johnson, M. Jonell, G. Krause, A. Kunzmann, H. Kühnhold, D. C. Little, M. J. Marschke, D. D. Mizuta, A. O. Paramita, N. Pin, N. D. Salayo, G. D. Stentiford, J. Stoll, M. Troell, and G. M. Turchini. 2023. Aquaculture governance: five engagement arenas for sustainability transformation. *Current Opinion in Environmental Sustainability* 65:101379.
 - Pickett, S. T. A., A. T. Simone, P. Anderson, A. Sharifi, A. Barau, F.-A. Hoover, D. L. Childers, T. McPhearson, T. A. Muñoz-Erickson, C. Pacteau, M. Grove, N. Frantzeskaki, H. Nagendra, and J. Ginsberg. 2024. The relational shift in urban ecology: from place and structures to multiple modes of coproduction for positive urban futures. *Ambio* 53:845–870.
 - Ran, Y., C. Cederberg, M. Jonell, K. Bergman, I. J. M. De Boer, R. Einarsson, J. Karlsson, H. K. Potter, M. Martin, G. S. Metson, T. Nemecek, K. A. Nicholas, Å. Strand, P. Tidåker, H. Van der Werf, D. Vanham, H. H. E. Van Zanten, F. Verones, and E. Röö. 2024. Environmental assessment of diets: overview and guidance on indicator choice. *The Lancet Planetary Health* 8(3):e172-e187.
 - Ran, Y., P. Van Rysselberge, B. Macura, U.M. Persson, A. A. Hatab, M. Jonell, T. Lindahl, and E. Röö. 2024. Effects of public policy interventions for environmentally sustainable food consumption: a systematic map of available evidence. *Environmental Evidence* 13:10.
 - Rockström, R., L. J. Kotzé, S. Milutinović, F. Biermann, V. Brovkin, J. Donges, J. Ebbesson, D. French, J. Gupta, R. E. Kim, T. M. Lenton, D. Lenzi, N. Nakićenović, B. Neumann, F. Schuppert, R. Winkelmann, K. Bosselmann, C. Folke, W. Lucht, D. Schlosberg, K. Richardson, and W. Steffen. 2024. The Planetary Commons: A new paradigm for safeguarding Earth's regulating systems in the Anthropocene. *Proceedings of the National Academy of Sciences USA* 121(5): e230153112.
 - Rossignoli, C. M., T. Manyise, K. M. Shikuku, A. M. Nasr-Allah, E. B. Dompok, P. J. G. Henriksson, R. D. Lam, D. Lozano Lazo, N. Tran, A. Roem, A. Badr, A. S. Sbaay, R. Moruzzo, A. Tilley, H. Charo-Karisa, and A. Gasparatos. 2023. Tilapia aquaculture systems in Egypt: Characteristics, sustainability outcomes and entry points for

sustainable aquatic food systems. *Aquaculture* 577:739952.

- Scaini, A., J. Mulligan, H. Berg, A. Brangari, V. Bukachi, S. Carenzo, D. Chau Thi, C. Courtney-Mustaphi, A. Ekblom, H. Fjelde, M. Fridahl, A. Hansson, L. Hicks, M. Höjer, B. Juma, J.-H. Kain, R. W. Kariuki, S. Kim, P. Lane, A. Leizeaga, R. Lindborg, J. Livsey, S. W. Lyon, R. Marchant, J. R. McConville, L. Munishi, D. Nilsson, L. Olang, S. Olin, L. Olsson, P. M. Rogers, J. Roush, H. Sandén, N. Sasaki, A. Shoemaker, B. Smith, L. Thai Huynh Phuong, A. Varela Varela, M. Venkatappa, G. Vico, N. Von Uexkull, C. Wamsler, M. Wondie, P. Zapata, M. J. Zapata Campos, S. Manzoni, and A. Tompsett. 2024. Pathways from research to sustainable development: Insights from ten research projects in sustainability and resilience. *Ambio* 53(4):517-533.
- Søgaard Jørgensen, P., R. E. V. Jansen, D. I. A. Ortega, L. Wang Erlandsson, J. Donges, H. Österblom, P. Olsson, M. Nyström, S. Lade, T. Hahn, C. Folke, G. D. Peterson, and A.-S. Crepin. 2023. Evolution of the polycrisis: Anthropocene traps that challenge global sustainability. *Philosophical Transactions of the Royal Society B: Biological Sciences* 379: 20220261.
- Sumaila, U. R., C. C. C. Wabnitz, L. S. L. Teh, L. C. L. Teh, V. W. Y. Lam, H. Sumaila, W. W. L. Cheung, I. Issifu, K. Hopewell, J. E. Cinner, N. J. Bennett, C. Folke, S. Gulati, and S. Polasky. 2024. Utilizing basic income to create a sustainable poverty-free tomorrow. *Cell Reports Sustainability* 1: 100104.
- Troell, M., C. Hurd, T. Chopin, B. A. Costa-Pierce, and M. J. Costello. 2024. Seaweeds for carbon dioxide removal (CDR) – Getting the science right. *PLoS Climate* 3(3):e0000377.
- Wei, C., J. Ni, and C.-Z. Li. 2024. CO2 allocation and equity issues under China's carbon neutrality targets: Recent advances and a review. *China Economic Review* 83:102108.
- Wernli, D., P. S. Jørgensen, E. J. Parmley, S. E. Majowicz, I. Lambraki, C. A. Carson, M. Cousins, T. Graells, P. J. G. Henriksson, A. Léger, S. Harbarth, and M. Troell. 2023. Scope and applicability of social-ecological resilience to antimicrobial resistance. *The Lancet Planetary Health* 7(7):e630-e637.
- Wu, T., J. C. Rocha, K. Berry, T. Chaigneau, M. Hamann, E. Lindqvist, J. Qiu, C. Schill, A. Shephon, A.-S. Crepin, and C. Folke. 2024. Triple bottom line or trilemma? Global tradeoffs between prosperity, inequality, and the environment. *World Development* 178:106595.

Book

- McPhearson, T., N. Kabisch, and N. Frantzeskaki (Eds.). 2023. *Nature-based solutions for cities*. Edward Elgar Publishing.

Special issues

- Malhi, Y., G. C. Daily, I. Bateman, R. Bierbaum, S. Díaz, C. Folke, S. Polasky, and K. Willis (eds.). 2024. Bringing Nature into Decision-Making. *Philosophical Transactions of the Royal Society B* (1903).
- Vasbinder, J., S. van der Leeuw, and V. Galaz. 2024. Special Collection: The Illusion of Control. *Global Perspectives*. University of California Press.

Beijer Discussion Papers

- Cárdenas, J. C., Constantino, S. M., and C. Schill. 2024. Beijer Discussion Paper 281: Harnessing Behavioral Tailwinds for Climate Action. *Beijer Discussion Paper Series*.
- Lindahl, T. 2024. Beijer discussion paper 280: Citizen support for taxes and subsidies implemented to achieve more sustainable food consumption: the role of policy design and presentation. *Beijer Discussion Paper Series*.

Reports and briefs

- Alvstad, R., M. Jonell, and T. Lindahl. 2024. *Synergies and trade-offs between crisis preparedness and environmental sustainability of school meals in Sweden*. Mistra Food Futures Report #22.
- Echeverri, L. G., H. Hackmann, et al. 2023. UN-DESA *Synergy Solutions for a World in Crisis: Tackling Climate and SDG Action Together*. United Nations Department of Economic and Social Affairs and UNFCCC.
- Flores Santana, C., A. Hattler, D. Ningrum, C. Schill, P. Søgaard Jørgensen. 2023. *Studying the Empirics of Hope*. The Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm.
- Hansson H., Hansson, P.-A., Carlsson G., Eriksson, C., Gordon, L., Hellström M., Jonell, M., Lindahl, T., Röö E. and U. Sonesson. 2024. *Agriculture and Food. Improved preparedness with respect to food can be achieved through sustainable and resilient food systems – examples from Sweden*. Mistra Food Futures policy brief.
- Hattler, A., C. Flores Santana, D. Ningrum, C. Schill, and P. Søgaard Jørgensen. 2023. *Initiatives and data platforms for the empirics of hope*. The Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm.
- Jonell, M., R. Alvstad, K. Eitrem Holmgren, J. Bengtsson, M. Persson, G. D. Peterson, E. Röö, L. J. Gordon, I. Fetzer, and A. Wood. 2024. *Climate, biodiversity and health targets for Swedish food production and consumption*. Mistra Food Futures Report #20.
- Kaandorp, C., L. Wang-Erlandsson, F. Gelves-Gomez, C. Folke, J. Rocha, A. Hattler, D. Ningrum, P. Søgaard Jørgensen, C. Schill, C. Flores Santana, and H. Österblom. 2024. *A call for collective inquiries in the intertwined biosphere*. Workshop Brief. The Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm.
- Ningrum, D., C. Flores Santana, A. Hattler, C. Schill, and P. Søgaard Jørgensen. 2023. *Hope and change in the Anthropocene*. The Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm.

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