

**Beijer
Institute**
OF ECOLOGICAL ECONOMICS



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THE ROYAL SWEDISH ACADEMY OF SCIENCES



Beijer Institute of Ecological Economics

Annual report 2022/2023

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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

*Earth. A biosphere.
A complex, subtly balanced life support system.*

These are the opening lyrics of the Enigma song 'Morphing thru time' from 1996. They give credit to the biosphere, the thin layer of life on our planet, a unique place in an immense universe. Over the past century or so, contemporary society distanced itself from the connection to the biosphere and environmental issues were often considered a hindrance to progress and development. The situation is now rapidly changing. Climate change and the pervasive loss of biodiversity have made people aware of the fact that progress and development are fundamentally dependent on suitable living conditions on planet Earth, provided by the biosphere, by life in interplay with the broader Earth system of water cycles, soil formation and the climate system.

The biosphere is not external. On the contrary, families, communities, nations, cultures and civilisations exist as part of the biosphere. We humans have always been embedded in, shaped by, and shapers of the biosphere, from hunter-gatherers to farmers to an urbanised population in a globalised world. Humanity is now a dominant global force in the dynamics and operation of our planet. We have recently shifted from the Holocene geological epoch into the new trajectory of the Anthropocene – the age of humankind. The Anthropocene situation requires reconnection of societal development to the biosphere foundation, both in mindsets and in actions, which is necessary to revitalise the resilience of the biosphere for securing and enhancing human wellbeing and prosperity. The opportunity space for such a transformation is rapidly emerging. These are exciting times!

“The biosphere is not external. On the contrary, families, communities, nations, cultures and civilisations exist as part of the biosphere.”

In this context, it is truly inspirational that the Beijer Institute continues to be a forerunner in research that provides a deeper understanding of the interplay between nature and social and economic development as part of the living biosphere. The Beijer institute is part of the Royal Swedish Academy of Sciences and ongoing constructive cooperation with the Academy is rewarding and a great pleasure. Over the years, the work of the Beijer Institute has expanded into very productive efforts and research centres, such as Stockholm Resilience Centre, the Global Economic Dynamics and the Biosphere Academy programme and, most recently, the Anthropocene Laboratory, the latter two hosted by the Academy. Our joint platform of dynamic collaborative activities provides a world-leading foundation in advancing science for sustainability. This is fantastic!

For more than thirty years, Anders Wall and the Beijer Foundation have provided core support to the Academy for its Beijer Institute of Ecological Economics. This support, which is unique, amazing and highly appreciated, allows us to explore, learn, experience and perform. New scientific findings and insights of great relevance are generated, inspiring new research and training, and providing guidance for engagement and action with practice, policy and business.

This Annual Report provides an overview of our activities and achievements in the past year. It reflects the impressive scientific performance of Beijer Institute colleagues, fellows and networks of collaborators over the period. I am truly thankful for all remarkable contributions, and I am most grateful for the opportunity to be the director of such a vibrant and important institute.



Carl Folke
Director of the Beijer Institute
June 2023

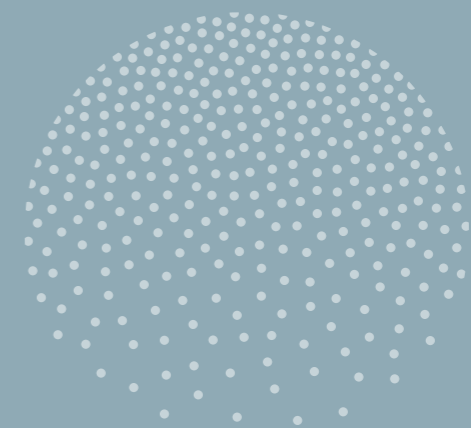


Research programmes

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 operation 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.



Behaviour, economics and nature (BEN)

Programme directors John M. (Marty) Anderies and Therese Lindahl

The mission of the BEN programme is to develop an understanding of human behaviour that can assist in the design of robust institutions for environmental stewardship and sustainable development. BEN researchers study behaviour and behavioural motivators at different levels, with multi-method approaches and an interdisciplinary expertise upon which the BEN programme relies.

Upscaling tribal behaviours for planetary stewardship

The challenges that societies face require global cooperation. Although many global organisations have emerged throughout modern history to enable this, they do not seem to be able to do so at the required scale and for the types of problems humankind now faces. But what if we can leverage our intrinsic tendencies for 'tribal-like behaviour', our innate social nature, to spur cooperative actions with global impact? To explore this timely topic, we organised a workshop at the Beijer Institute in May 2023. To obtain a broad range of expertise, we invited scholars from different disciplinary backgrounds. After three days full of reflections, conversations and inspiration, the participants agreed on a plan for the multitude of ideas that emerged. These ideas related to publications and research initiatives that we hope to report on in coming annual reports.

A temperature check for citizens' willingness to accept policy interventions

Behaviour change is urgently needed to tackle major challenges such as climate change and biodiversity loss, and interventions are sometimes necessary to achieve such change. Public opinion is a crucial factor in this, as it could limit the ability of policymakers to implement policies for sustainability. Support for government interventions is the topic of two BEN-related research projects led by programme director Therese Lindahl. Both projects investigate attitudes towards government policy interventions. In autumn 2022, a series of large-scale surveys were rolled out with the intention of measuring support for different types of interventions that aim to change food consumption behaviour and transportation behaviour in Sweden. Preliminary results indicate that the type of intervention matters for public support, with costly interventions (to the individual) in general having less support, which is perhaps

not surprising. However, the results also indicate that policy design is a crucial factor for support (e.g. the level of a tax, how a subsidy is funded, how revenues from a tax will be used and geographical coverage). We also found evidence that support for policy depends on the presentation of the policy. These preliminary results show that support for policy interventions is modifiable, and that policy design is more than just 'getting a policy in place'.

Influencing Swedish food policy

There is increasing recognition that transformation of food systems is critical for transition towards a more sustainable society. As a result, politicians in Sweden and internationally



The support for interventions aiming to change transportation behaviour and food consumption in Sweden is studied within BEN.

¹ Lindahl, T., and N. Linder. 2023. Beijer Discussion Paper 279: What factors influence the choice between fish and meat among grocery shoppers? Insights from an unsuccessful nudge intervention. *Beijer Discussion Paper Series*

² Gordon, L., H. Hansson, P.-A. Hansson, M. Jonell, M. Hellström, T. Lindahl, and U. Sonesson. 2023. En tryggare och godare värld. Ett inspel till Livsmedelsstrategi 2.0. (A safer and tastier world. A contribution to Sweden's National Food Strategy 2.0). *Mistra Food Futures Policy Brief. Mistra Food Futures.*

have moved the issue of sustainable food systems higher up on the political agenda. The research programme Mistra Food Futures (MFF), which involves several Beijer Institute researchers, aims to create a science-based platform that contributes to transformation of the current Swedish food system into a future system that is sustainable, resilient and capable of delivering healthy food. Considering the new risks in the food landscape, with several interconnected crises (e.g. pandemics, war in neighbouring regions, extreme weather events, inflation), the type of research conducted in MFF is in high demand. Over the past year, BEN researchers have responded to this demand by presenting their research findings in scientific articles¹ at various seminars organised by the Royal Swedish Agricultural Academy, the Nordic Council of Ministers and the Swedish Parliament, in policy briefs² and in op-eds.

Sustainability, emotions and intelligent machines

BEN programme director Therese Lindahl was part of a successful grant application to the prestigious Swedish Marianne and Marcus Wallenberg Foundation, with programme director John M. (Marty) Anderies in the advisory group. The project will be a collaboration with the Beijer Institute programme *Complexity, technology and governance* and will be led by its programme director Victor Galaz. The title of the project is "Sustainability, emotions and intelligent machines: The mechanisms, diffusion and effects of technology-mediated emotions on sustainability". Therese Lindahl and Andreas Olsson at the Department of Clinical Neuroscience, Karolinska Institute, will co-lead research on the behavioural impacts (online and offline) of emotionally charged online content, particularly content connected to sustainability issues, that can be found on digital platforms. They will do so with the help of behavioural experiments in combination with tools and methods from neuroscience. Read more on page 12.

The importance of trust

BEN researchers are involved in several other ongoing initiatives in collaboration with members of the BEN network. For example, together with Beijer Fellows Marten Scheffer and Stephen Polasky, John M. (Marty) Anderies is exploring mechanisms that cause trust to dissolve and how trust can be sustained or rebuilt in modern societies. Trust plays a critical role in lubricating modern market systems and is also essential for democratic institutions. Unfortunately, trust can be manipulated.

“In the same vein as trust among individuals, sustainable futures will require trust in information to make decisions.”

In the same vein as trust among individuals, sustainable futures will require trust in information to make decisions. How should we make decisions when we can only observe a few variables and can only control a few processes in complex social-ecological systems? Together with Jean-Denis Matthias, John M. (Marty) Anderies has performed a modelling study leveraging the concepts of "observability" and "controllability" to explore the impacts of using present, past and estimated



Group presentations, BEN programme workshop at the Academy, May 2023. Photo: Agneta Sundin

future information in managing human-environment systems. The results show that differences in what can be observed and whether past, present or estimated future information is used in decision making significantly affect mankind's capacity to keep a system in a safe operating space.

Spaceship Earth

In addition, Therese Lindahl led a study involving several BEN researchers in which Boulding's metaphor of "Spaceship Earth" was used to illustrate the necessary transition from the image of Earth as a limitless space to that of passengers on a cramped ship with definite boundaries. The team used behavioural lessons from the Titanic disaster to think about how human behaviour interacts with organisational structure in the face of a potential disaster. In particular, they explored whether the insights gained could be used to develop principles for designing more effective governance of "Spaceship Earth" in the turbulence of the Anthropocene.



Participants of BEN programme workshop at the Academy, May 2023. Photo: Agneta Sundin

Keith Smith, Sara Constantino, Nanda Wijermans, Alessandro Tavoni, Juan Camilo Cárdenas, Anne-Sophie Crépin, Timothy M. Waring, Krisztina Jónás, Stephen Polasky, Anna Tompsett, Carl Folke, Therese Lindahl, Caroline Schill (left to right, back to front; missing: Henrik Österblom)

Finally fieldwork again!

Much of the research within BEN relies heavily on data collection in the field. The past year was the post-pandemic year we had been longing for – finally we could conduct fieldwork in Colombia and Alaska (USA) that was originally scheduled for 2020, as well as continuing our collaboration with our Thai research partner and previous Mäler scholar, Rawadee Jarungratanapong (Sukhothai Thammathirat Open University).

The risks with monetary incentives

The voluntary contributions of time, money and effort that citizens provide to support environmental protection are always important but are critical in times of crisis. Policymakers may be tempted to incentivise such behaviour through monetary compensation, but this poses a risk of the payment crowding out intrinsic motivations to continue helping voluntarily once the monetary incentive is withdrawn. In an experimental study, Rawadee Jarungratanapong and BEN programme director Therese Lindahl examined the emergence of such effects using data obtained in field experiments with 256 villagers in eight communities in Thailand in January 2023. Preliminary results confirmed that payments can crowd out voluntary motivations to act, especially when voluntary contribution levels were already high before the payment.

Uncertain ecosystem change and cooperation

In August and December 2022, BEN researcher Caroline Schill co-led with Colombian collaborator Lina María Saavedra-Díaz (University of Magdalena) and her team, fieldwork on the Colombian Caribbean and Pacific coast. In a framed field experiment in the form of a dynamic common-pool resource game, in combination with interviews and focus groups, the team investigated collective responses of small-scale fishers to uncertain fishery decline due to ecosystem change. In total, more than 180 fishers participated.³ The collected data are also being



Ongoing experimental session with fishers in Bahía Solano Colombia. Photo: Nanda Wijermans

used to advance an agent-based model relating individual perceptions of ecosystem change with cooperation. This modelling work is being led by Nanda Wijermans from Stockholm Resilience Centre (SRC), who participated in the fieldwork on the Pacific coast.

The field experiment built on previous work and collaborations in Colombia, some of which are described in a paper published in *Ecological Economics*⁴ during the year. In behavioural economic experiments involving 256 small-scale fishers on the Colombian Caribbean coast, Caroline Schill and Juan C. Rocha (SRC) assessed the potential for local collective action to avert uncertain (to different degrees), yet catastrophic, ecosystem regime shifts. The results highlight the importance of policymakers and practitioners identifying and reporting ecosystem thresholds, and the potential consequences of exceeding these thresholds, rather than focusing on determining the precise likelihood of ecological thresholds. The results also emphasise the importance of testing for behavioural insights across different

“The results highlight the importance of policymakers and practitioners identifying and reporting ecosystem thresholds”

Local fishers close to Bahía Solano, Colombia, where BEN researchers conducted fieldwork in December 2022. Photo: Caroline Schill



³ Funding: Swedish Research Council-Project team Colombia fieldwork: Caroline Schill (Beijer Institute), Lina María Saavedra-Díaz (University of Magdalena, Santa Marta) and Master's student Jesús Manuel Jiménez Torres and their team (University of Magdalena, Santa Marta, Colombia).

⁴ Schill, C., and J.C. Rocha. 2023. Sustaining local commons in the face of uncertain ecological thresholds: Evidence from a framed field experiment with Colombian small-scale fishers. *Ecological Economics* 207:107695.

⁵ Ntuli, H., A.-S. Crépin, C. Schill, and E. Muchapondwa. 2023. Sanctioned Quotas Versus Information Provisioning for Community Wildlife Conservation in Zimbabwe: A Framed Field Experiment Approach. *Environmental and Resource Economics* 84:775-823.

⁶ Funding: Swedish government research council for sustainable development Formas. Project team: Caroline Schill (Beijer Institute) and Simon West (SRC) (lead), former Beijer Young Scholar Tracie Curry (local research partner, NorthernSER), Kinga Psiuk (research assistant, SRC), Ingrid Rieser (filmmaker).



Kinga Psiuk and Tracie Curry who conducted the fieldwork in Wainwright, Alaska (USA), in June 2023. Photo: Cheryl Panik

contexts and carefully determining which types of behavioural patterns can be generalised across different types of contexts.

A similar experimental design was applied in a study conducted in Zimbabwe by previous Mäler scholar Herbert Ntuli (University of Pretoria, South Africa) and his team. The study involved 384 villagers from communities managing common-pool wildlife and investigated the effect of three policy interventions—sanctioned quotas, information provisioning, and a combination of both⁵. Read more on page 21.

An unconventional marriage of methods

In June 2023, fieldwork took place in Wainwright (also known as Ulġuniq in the local language Iñupiaq), a small city on the

Arctic Ocean in Alaska (USA), in the scope of a project exploring human responses to drastic environmental change. The team, led by Caroline Schill (Beijer Institute) and Simon West (SRC), conducted a study enabling participants to share their experiences and stories of ecological change through photographs. The results will inform and frame subsequent controlled behavioural experiments to investigate how the community of Wainwright might respond to specific scenarios of ecological change⁶.

In a paper published in *Humanities and Social Sciences Communications*⁷, Caroline and Simon describe how bringing together research methods from behavioural and interpretive social science forced them to acknowledge the impor-

ance of recognising not only the different technical and quality criteria of their methods but also the different ethical-political aspects that influence how researchers select and use methods, engage with participants and contribute to society more generally. They suggest that improving the ability to recognise and negotiate these ethical-political aspects can lead to more rigorous, careful and socially responsible research – and hopefully also to more intriguing and interesting research projects. The paper has attracted considerable online attention and is now in the number 2 spot in online attention of all articles of the journal of similar age, and in the top 5% of all research outputs scored by Altmetric, which provides a measure of the quality and quantity of online attention.



Celebrating Nalukataq, the spring whaling festival, in Wainwright, Alaska, with performing the blanket toss. Photo: Kinga Psiuk

⁷ West, S., and C. Schill. 2022. Negotiating the ethical-political dimensions of research methods: a key competency in mixed methods, inter- and transdisciplinary, and co-production research. *Humanities and Social Sciences Communications* 9(1).

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.

In 2022, artificial intelligence (AI) machines began to make headlines around the world. When the company OpenAI released its version of an AI chatbot to the public in November 2022, the world was given a glimpse into the ability of artificial intelligence to create highly realistic synthetic content, including text, images, sound, computer code and video. The world woke up to the urgent need to find ways to regulate the impacts of a technology that is developing much faster than our abilities to control it.

“The world woke up to the urgent need to find ways to regulate the impacts of a technology that is developing much faster than our abilities to control it.”

The spread and impact of misinformation

Impressive (and at times controversial) advances in so-called generative AI have been in the making in the past few years. Increased use of such models may very well drastically change the arena for false news and misinformation online about climate and sustainability issues. Suddenly, anyone can, with relatively little effort, produce seemingly human-written text and highly realistic images – regardless of their veracity. Mis- and disinformation campaigns are not new and topics such as climate change have been in the line of fire more than once. Over time,

however, the digital aspects of such campaigns have become increasingly important for those interested in understanding and tackling the harmful effects of mis- and disinformation.

As part of the *Governance, technology and complexity* programme’s work on identifying the risks of automated mis- and disinformation, we organised a round table meeting at the Royal Swedish Academy of Sciences in November 2022 to explore what these risks could comprise and the most effective ways to mitigate them through new forms of governance. The meeting included scholars from other Swedish universities, AI experts from AI Sweden, journalists and public opinion experts. One conclusion from the conversation was the need to develop a portfolio of robust methods to better assess the real impacts of mis- and disinformation on public perceptions and opinions on climate and sustainability issues. Another conclusion was an increased need to focus on the ways in which security and climate misinformation are becoming increasingly aligned, for example through attempts by foreign actors to create and amplify false information about energy issues in the aftermath of Russia’s war on Ukraine.

Part of the diffusion of such information can be automated through so-called ‘social bots’ – automated social media accounts with the ability to build social communication networks and create online content. The extent to which social bots amplify climate mis- and disinformation has been debated in recent years, at times leading to poorly substantiated claims that these are main amplifiers of climate misinformation online. A study¹ led by programme researcher Stefan Daume shows that such claims are highly simplistic. On analysing one million social media (Twitter) posts related to the 2019/2020 Australian



bushfires, the study confirmed that social bots amplify information, but also showed that the information they amplify both supports and opposes climate action, thereby creating an artificial sense of polarisation. In addition, social bots appear mainly to amplify information appealing to emotions, such as sympathy or humour. Thus the study gives a much more nuanced picture of how social bots operate in our everyday digital environment.

Sustainability, emotions and intelligent machines

The connection between emotions, digital platforms and AI is an important area where human behaviour, our changing planet and algorithmic systems interplay. The emotional dimensions of human behaviour are attracting growing interest from the sustainability sciences. However, the ways in which expansion of digital social networks and advances in artificial intelligence could affect how people perceive and engage emotionally with nature, climate and sustainability issues have received limited attention. We are therefore delighted to have received a generous grant of SEK 5.6 million from the Marianne and Marcus Wallenberg Foundation for a project entitled “Sustainability, emotions and intelligent machines” that will explore these issues, in collaboration with Andreas Olsson at the Emotion Lab at Karolinska Institute. The project will also involve Beijer colleague Therese Lindahl, creating a tangible connection and synergies between this programme and the *Behaviour, economics and nature* programme at the Beijer Institute.

Reaching beyond the illusion of control

Understanding complexity and finding ways to reform institutions in ways that promote Earth stewardship and resilience will prove key as we move into a more turbulent future, and the *Governance, technology and complexity* programme has been active in shaping the international policy debate on these issues. As part of our ambition to explore these issues in depth with leading thinkers, the programme co-hosted a three-day symposium (15–17 May, 2023) called “Illusion of Control”, at the Royal Swedish Academy of Sciences, in collaboration with Para Limes, Princeton University, Stockholm Resilience Centre, and Arizona State University. The symposium delved into the issue of the limitations of governance and control in times of radical uncertainty and complexity. The line-up included prominent speakers such as Daniel Brooks (University of Toronto, Canada), Atsushi Iriki (Laboratory for Symbolic Cognitive Development, Japan), Helga Nowotny (ex-president European Research Council) and W. Brian Arthur (Santa Fe Institute, USA).

Programme contributions to international policy processes

The *Governance, technology and complexity* research programme is exploring how we can make wise decisions that allow us to thrive in the Anthropocene in the face of crisis, turbulence and disruptive technological innovations. The political and technological developments during 2022–2023 are all evidence of the programme’s great scientific and societal relevance. As proof of our international profile and recognition, the programme (through Victor Galaz) was invited to present

its work at the Pontifical Academy of Sciences in the Vatican on 13–14 July 2022, and at the global launch of the Human Development Report 2021/22 “*Uncertain Times, Unsettled Lives: Shaping our Future in a World in Transformation*” in the United Nations building in New York on 8 September 2022.



Programme director Victor Galaz at the Pontifical Academy of Sciences in the Vatican.

As our work progresses, we were honoured to have been invited to contribute to the Nobel Foundation and the American National Academy of Sciences Nobel Prize Summit in Washington D.C. on 24–26 May 2023. The Summit, entitled “Truth, Trust and Hope”, explored the dynamics and impacts of mis- and disinformation on society and democracies, and included leading academics, policy-makers and Nobel laureates such as Maria Ressa and Paul Romer. The *Governance, technology and complexity* programme co-organised a session on how to address health and climate misinformation. Victor Galaz presented programme work in a panel that included Dr. Anthony Fauci. The programme also compiled an online report, “*Climate Misinformation in a Climate of Misinformation*”², that combines insights from various research strands, including computational social sciences, sustainability sciences and neurosciences. It summarises what we know about how climate mis- and disinformation is amplified and the extent to which recent advances in AI pose new challenges for our ability to act collectively for a safe and just future.

We look forward to the next year as we, in collaboration with the Stockholm Resilience Centre, continue to build international partnerships and gain new insights about how a rapidly changing planet, in tandem with disruptive technological change, is shaping the prospects for a sustainable future.

Coffee break discussions at the Illusion of Control conference, at the Academy 15–17 May, 2023. Photo: Agneta Sundin



¹ Daume, S., V. Galaz, and P. Bjersér. 2023. Automated Framing of Climate Change? The Role of Social Bots in the Twitter Climate Change Discourse During the 2019/2020 Australia Bushfires. *Social Media + Society* 9(2).

² Galaz, V., H. Metzler, S. Daume, A. Olsson, B. Lindström, A. Markström. 2023. *Climate misinformation in a climate of misinformation*. Online research brief. Stockholm Resilience Centre and Beijer Institute of Ecological Economics.

Aquaculture and sustainable seafood

Programme director Max Troell

Seafood brings benefits for human health and the environment, and can play an important role in a sustainable food future. The *Aquaculture and sustainable seafood* research programme investigates how different “blue foods” contribute to environmental performance, nutritional qualities and food security, with the aim to informing policies to steer the food system towards sustainability.

Fighting antibiotic resistance

The discovery of penicillin in 1928 paved the way for the development of antibiotics, which are critical for modern health care. However, there is an emerging crisis with antibiotic resistance causing more than one million deaths every year and this number will rise unless antibiotic use changes. Aquaculture and other meat industries are the largest users of antibiotics. The *Aquaculture and sustainable seafood* programme is working actively to improve understanding of how antibiotics are used within the seafood sector, associated risks and opportunities for reductions. To help companies within The Seafood Business for Ocean Stewardship (SeaBOS) project become stewards and decrease their use of antibiotics, a structure for detailed mapping has been developed and used for yearly data collection. SeaBOS includes nine of the largest seafood companies in the world, together with researchers, wild-capture fisheries, feed producers and aquaculture businesses. A Roadmap, Code

of Conduct and global overview of antibiotic regulations have been produced. The next step is gene mapping to identify antimicrobial resistance in key regions where SeaBOS is active (read more at seabos.org).

In work on developing policy to decrease antibiotic use in food production, the programme and AxFoundation are in continuous dialogue with Swedish food retailers and the food industry regarding antibiotic use in seafood. The programme's research on antimicrobial resistance has been interpreted by students in visual design at Beckmans College of Design in Stockholm, resulting in exhibitions at the Academy, Uppsala University and Stockholm design store Svenskt Tenn (read more on page 27).

The role of blue foods for healthy and sustainable food systems

Two papers have been published within a set of papers issued by The Blue Food Assessment (BFA) outlining the vital role that blue foods can play for the global food system. A synthesis published in *Nature*¹ integrated overall findings from BFA into four policy objectives to help realise potential contributions of blue foods to national food systems worldwide: ensuring supplies of critical nutrients, providing healthy alternatives to terrestrial meat, reducing dietary environmental footprints, and

“Aquaculture and other meat industries are the largest users of antibiotics.”

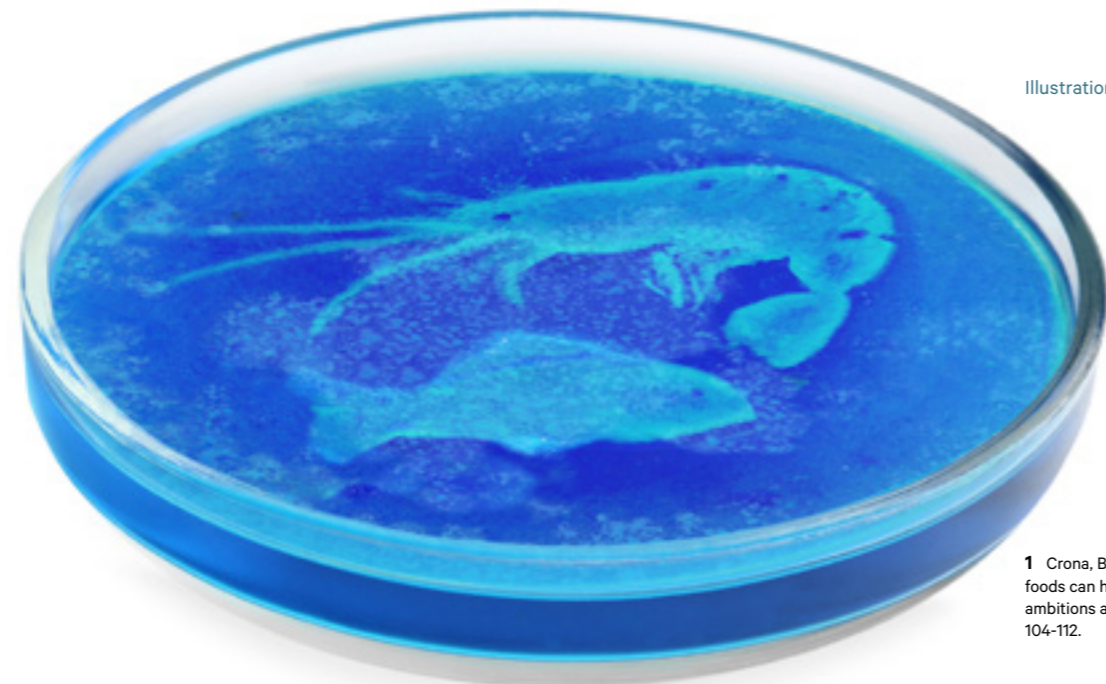


Illustration: J Lokrantz/Azote

¹ Crona, B. et al. 2023. Four ways blue foods can help achieve food system ambitions across nations. *Nature* 616: 104-112.

safeguarding blue food contributions to nutrition, fair economies and livelihoods under climate change. The synthesis assessed the relevance of each policy objective for individual countries and associated co-benefits and trade-offs at national and international scale. It showed that for many African and South American nations, consumption of culturally relevant blue food could address vitamin B₁₂ and omega-3 deficiencies, while Global North nations could lower cardiovascular disease and the carbon footprint of ruminant meat intake by moderate consumption of seafood with low environmental impact. A paper published in *Nature Sustainability*² mapped the global vulnerability of aquatic foods, in the first-ever global analysis of environmental stressors (17 in total) affecting production volumes and the safety of blue foods world-wide. It showed that over 90% of global blue food production, especially in Asia and the USA, faces substantial risks from environmental change.

The network established in BFA, led by Stanford University, acquired a two-year grant from the Moore Foundation for the project “Blue foods in national climate strategies” and also had the “Sustainable Blue Food Futures for People & Planet (Blue Food Futures)” project accepted as part of the UN Decade of Ocean Science for Sustainable Development.

Aquaculture and the SDGs

The FAO's global hybrid conference “Aquaculture Millennium +20” resulted in a special thematic issue in the *Journal of the World Aquaculture Society* entitled “Aquaculture for food and sustainable development”. One of the papers³ lays the foundation for aquaculture's future contributions to the Sustainable Development Goals (SDGs) by providing an in-depth understanding of the extraordinary diversity of aquaculture in terms of species and production systems, and its importance for the sector's present and future contributions to different SDGs. The authors call for greater integration between economic and environmental professionals engaged in planning and investments and a broader scope that includes terrestrial and aquatic food sectors and considers water, energy and natural resource use, rural development and human health systems.

Optimising food system by-products

A paper in *Nature Food*⁴ analysed opportunities for increased use of food system by-products and residues as feed, and how this would affect competition for food-quality resources within livestock and aquaculture production. The focus was on cereals, whole fish, vegetable oils and pulses. Considering the nutritional requirements of food-producing animals, including farmed aquatic species, ingredient replacement could increase the global food supply by 13% (10–16%) in terms of calories and 15% (12–19%) in terms of protein content. Work is continuing in collaboration with Wageningen University.

Transforming the Swedish seafood system

The five-year SEAWIN project mapped Swedish production and consumption of seafood and increased understanding of its environmental sustainability through life cycle assessment. Nutrition and consumer preferences and behaviour were also

studied. Several policy briefs and results produced in the project were presented at a hybrid seminar at the Royal Academy of Sciences in November 2022 (read more on page 25).

Navigating diverse coastal livelihoods

A paper in *One Earth*⁵ outlined an applied research agenda to assist livelihood project planning and management in tropical coastal communities. This agenda explicitly examines interactions between natural resources, industries and livelihoods and is based on three core activities: (1) governance review and assessment, (2) strategic partnership formation, and (3) diagnostics supported by science and shared outcomes. This work was led by “The Pacific Livelihoods Research Group” at James Cook University.

International Policy engagement – blue carbon

As part of Marine Scotland's Blue Carbon International Policy Challenge (BCIPC), a workshop on the potential for carbon offset by macroalgal aquaculture was held in September 2022. The discussions centred around various concepts and hypotheses on carbon drawdown by seaweed aquaculture and the potential for mitigation of atmospheric CO₂. The output was a policy brief, co-authored by Max Troell, that highlights important areas for future research, uncertainties and challenges faced by the industry, policymakers and other stakeholders (www.blue-carbon.scot).



Fish market in Banda Aceh, Indonesia.

Inequalities in Indonesia's seafood industry

Within the Beijer Institute's Inequality and the Biosphere project, multidimensional inequalities (economic, human wellbeing) in Indonesia's seafood value chains are being evaluated. The aim is to identify environmentally friendly and nutritious diets to alleviate stunted child growth and reduce environmental degradation in Indonesia. Seafood from farmed and capture fisheries will play a key role in this.

² Cao, L. et al. 2023. Vulnerability of blue foods to human-induced environmental change. *Nature Sustainability*.

³ Troell, M. et al. 2023. Perspectives on aquaculture's contribution to the Sustainable Development Goals for improved human and planetary health. *Journal of the World Aquaculture Society* 54(2):251-342.

⁴ Sandström, V. et al. 2022. Food system by-products upcycled in livestock and aquaculture feeds can increase global food supply. *Nature Food* 3(9):729-740.

⁵ Diedrich et al. 2022. An applied research agenda for navigating diverse livelihood challenges in rural coastal communities in the tropics. *One Earth* 5(11): 1205-1215.

Urban social-ecological systems

Programme director Johan Colding

The role of urban form in enhancing the liveability, inclusivity and climate resilience of cities 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 various 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, in order to create sustainable and resilient cities.

In the past year, significant efforts within the programme have been dedicated to organising various workshops, seminars and science-based policy initiatives within the Fairtrans initiative. It has the overarching objective of promoting a fair and fossil-free future and is hosted by the Stockholm Resilience Centre and jointly funded by the Swedish research councils Formas and Mistra. Research conducted within Fairtrans is guided by a collaborative approach, involving the co-creation of roadmaps. The objective is to develop strategies and policies that adhere to the limits on greenhouse gas emissions set by the Paris Agreement while also considering the principle of equity, which recognises the varying contributions and capacities of different countries in addressing climate change.

This effort involves trade unions and other prominent Swedish popular movement organisations, which together represent over three million members. Popular movement organisations operate at grassroots level to mobilise and engage large numbers of people in collective action to address social, economic or political issues. In the context of climate change, these organisations play a crucial role in advocating sustainable practices, influencing policy decisions and raising awareness among the general public. Through these collaborations, Fairtrans ensures a diverse and inclusive approach to research, incorporating the perspectives and expertise of a wide range of stakeholders.

Can co-working accelerate Sweden's climate transformation

The Fairtrans work package, which is led by Beijer programme director Johan Colding, is dedicated to researching the role of digitalisation in climate transformation. As part of this effort, a two-day workshop was held in Östersund, Sweden, in March 2023. The workshop explored how co-working and digitalisation can contribute to transition towards a fossil-free society, with a special focus on increased citizen participation, fairness and sustainable rural development. During the discussions, workshop participants primarily emphasised creating justice in terms of reduced working hours due to remote work, fair working conditions and equitable access to digital technology. They also proposed investigating the possibility of developing guidelines for how a green transition through digitalisation can occur in a way that benefits as many people as possible and making sure that investments in digital infrastructure also

promote rural development. In a time when technological advances can result in job losses, workshop participants emphasised that it is important to reconsider, adapt and re-evaluate the perception of work so that more people can work remotely, to mitigate the impact on the climate and better support a green transition.

“The objective is to develop strategies and policies that adhere to the limits on greenhouse gas emissions set by the Paris Agreement while also considering the principle of equity”



Programme director Johan Colding, and Associate Professor Stefan Sjöberg at the two-day conference/workshop in Östersund, March 2023. Photo: Katarina Nordin

Social-ecological urbanism and urban commons

The 3rd Social-Ecological Urbanism Symposium took place at the University of Gävle in December 2022. The social-ecological urbanism discourse aims to inform urban planning and design practices, promoting strategies that prioritise the well-being of individuals. Last year's symposium centred around the nested

scales of urban form and green urban infrastructure in a full-day public event that included speakers from different parts of Europe. The symposium explored current research frontiers and addressed knowledge gaps regarding the role of urban form and urban green infrastructure in mitigating climate change, enhancing human well-being and fostering resilient cities at various scales. Programme researcher Åsa Gren was one of the invited speakers and delivered a presentation on the factors that promote resilient and healthy cities.

In conjunction with the symposium, researchers linked to the *Urban social-ecological systems* programme organised a topic issue in *Frontiers of the Built Environment*¹. In a selected set of articles, the issue describes how cities can be perceived as continuous landscapes where the shape and structure of urban social-ecological systems cannot be captured in isolated terms.

Besides this, significant efforts were dedicated to a strategic research project on urban commons, co-led by programme director Johan Colding and involving collaborations with several Swedish universities and research institutions. In March 2023, a seminar titled “Community work and collective mobilisation for sustainable urban development”, held at the University of

Gävle, provided a platform for sharing insights and knowledge on community-driven initiatives and collective mobilisation for achieving sustainable urban development.

A new project on digital tools for land evaluation

The current structure of the Swedish urban planning process restricts understanding of how different spatial scales are interconnected, ranging from the local neighbourhood level to the entire city and even the regional urban agricultural landscape. It fails to recognise how interventions at one scale can have significant impacts on other scales, both in social and ecological contexts. In response, a new research project called “Digital tools for the evaluation of land in urban development projects (DITO)” has been initiated collaboratively by Chalmers Technical University in Gothenburg, Gävle University in Gävle and the *Urban Social-Ecological Systems* programme. The project, led by Åsa Gren, is primarily looking at the spatial aspects of cities, with the aim of developing digital planning tools to understand how multiple and cross-scale interactions influence urban planning, with the view that cities are complex social-ecological systems.



¹ Berghauser Pont, M., S. Barthel, J. Colding, Å. Gren, A. Legeby, and L. Marcus. 2022. Social-ecological urbanism: Developing discourse, institutions and urban form for the design of resilient social-ecological systems in cities. *Frontiers in Built Environment* 8:982681

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.

Anthropocene research

In the Anthropocene (the age of humankind), the magnitude, speed, spread and connectivity of the human dimension are unparalleled in Earth's history. Humanity and its actions are now the major force in the evolution of life on Earth. All aspects of human lives (social conditions, health, culture, democracy, power, justice, inequity, security) are intertwined with the Earth system and the biosphere in a complex and dynamic interplay of local, regional and global interactions and dependencies. Recognising that we are dependent on a healthy biosphere is rapidly becoming the norm in how we relate to the planet in terms of progress, development and prosperity.

“Recognising that we are dependent on a healthy biosphere is rapidly becoming the norm”



Inequality and the Biosphere

The *Inequality and the Biosphere* project team continues to combine approaches and methods to identify and investigate trade-offs and synergies between inequalities and biosphere dynamics.

¹ Rockström, J., A.V. Norström, N. Mathews, R. Biggs, C. Folke, A. Harikishun, S. Huq, N. Krishnan, L. Warszawski, and D. Nel. Reshaping a Resilient Future in Response to COVID-19. *Nature Sustainability* 1-11.

² Walker, B. et al. 2023. Response Diversity as a Sustainability Strategy. *Nature Sustainability* 6:621-629.

³ Hahn, T., G. Sioen, A. Gasparatos, T. Elmqvist, E. Brondizio, E. Gómez-Baggethun, C. Folke, M. Jarzebski, K. Takeuchi, K. Fukushi, M. Setiawati, E. Arini, and T. Atmaja. 2023. Insurance Value of Biodiversity in the Anthropocene is the Resilience Value? *Ecological Economics* 208:107799.

⁴ Wood, A., C. Queiroz, L. Deutsch, B. González-Mon, M. Jonell, L. Pereira, H. Sinare, U. Svedin, and E. Wassénius. 2023. Reframing the local-global food systems debate through a resilience lens. *Nature Food* 4:22-29.

⁵ Österblom, H., J. Bebbington, R. Blasiak, M. Sobkowiak, and C. Folke. 2022. Transnational Corporations, Biosphere Stewardship, and Sustainable Futures. *Annual Review of Environment and Resources* 47:609-635.



Inequality and the Biosphere project team at the annual project workshop in May 2023 on Askö, Sweden.

Patrik Henriksson, Tomas Chaigneau, Anne-Sophie Crépin, Andrew Tilman, Yolanda Lopez, Juan Rocha, Tracie Curry, Jiangxiao Qiu, Alon Shepon, Tong Wu, Emmy Iwarsson, Emilie Lindkvist, Caroline Schill, Maïke Hamann.

Beijer Fellow Brian Walker, describing work initiated at the Beijer Institute's annual Askö meeting. The authors use the ecological science concept of “response diversity”, which describes a system's variety of responses to disruptions of all kinds. In social systems, international trade provides spatial response diversity that buffers disruptions at national or local scale. Common examples of temporal responses in human societies include storage in granaries, reservoirs and banks.

A study in *Ecological Economics*³ proposes using the concept of resilience value, rather than insurance value, when valuing biodiversity and ecosystems, because insurance value is defined in a rather narrow economic sense. Thus it only captures the subjective risk preferences of individuals, and not the foundational work of biodiversity in buffering change and providing ecosystem services for wellbeing and prosperity.

Resilience thinking in relation to the significance of the global food systems of the Anthropocene is addressed in an article arguing that it is not possible to develop sustainable food systems by taking a local *or* global perspective⁴. These dichotomous perspectives are ineffective because they imply that the underlying driver of vulnerability is the scale at which a food system operates. Reframing food system stress points through a resilience lens shifts the focus from scale-oriented solutions to the capacities that need to be embedded at all scales within food systems to increase social, environmental and economic sustainability.

Studying long-term environmental change

Ongoing work co-led by Beijer Institute researcher Anna Tompsett, in partnership with researchers at the National Collection of Aerial Photography in Edinburgh, Stockholm University and the University of California Berkeley, aims to process and make accessible a remarkable archive of 1.6 million aerial photographs, dating back to the late 1940s, from across the developing world. This work is expanding the period for which data are available to study global long-term environmental change by 25-50 years, or over 50%. In 2022, robots developed especially

for the project completed scanning of most of the archive. The next step is to employ machine learning algorithms to stitch the individual images into composite mosaics and extract structured data on land use, population density, economic development and urbanisation.

Corporate biosphere stewardship

A major review paper on the role of businesses and large corporations in preventing or performing systemic transformation towards biosphere stewardship and sustainable futures makes novel suggestions for aligning corporate activities with the biosphere and argues that corporate biosphere stewardship requires more ambitious approaches by corporations, combined with new, formalised public governance approaches⁵. Read more on page 24.

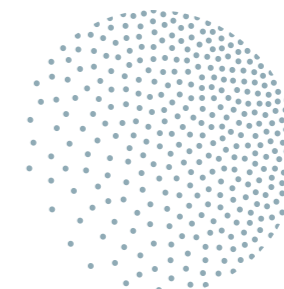
Biosphere economics

Biosphere economics, a recurring topic in Beijer Institute research, focuses on some of the essential interactions between social and ecological parts of social-ecological systems at the interface between the biosphere and the economy.

Exploring synergies between our two Arctic projects

Beijer researchers Anne-Sophie Crépin and Åsa Gren are currently participating in the project “Winners and losers in the climate casino: Arctic marine resources under climate change”, the objective of which is to examine climate change impacts on fish, shellfish and their fisheries in the Atlantic and Pacific Arctic Shelf seas, focusing on systemic interactions. The project is led by Sturla Kvamsdal from (SNF at the Norwegian School of Economics, and funded by the Norwegian research council. The first physical meeting of the project took place in Stockholm in October 2022.

The project “Marine Arctic Resilience Adaptation and Transformation” (MARAT) is now in its final year of tracking the





Jan Erik Stiansen, Anne-Sophie Crépin, Sturla Kvamsdal, Nils Arne Ekerhovd, Anne Britt Sandø, Xiurou Wu and Yuanming Ni gathered in Bergen, Norway for a workshop in the CASINO project studying Arctic marine resources under climate change.

main impacts of climate change on seascapes and society in the Arctic, and on the economic activities they support. It is led by former Beijer young scholar Juan Carlos Rocha (Stockholm Resilience Centre) and funded by the Belmont forum.

While involving different case studies, both projects have a systemic focus, aiming to develop methods to represent and investigate social-ecological connections in an Arctic context and hopefully provide decision support in situations of substantial uncertainty. Given these common objectives, efforts have begun to explore synergies between the projects. Anne-Sophie Crépin is leading these efforts, which aim to produce a synthesis of appropriate scientific methods that could be used, combined and refined in such work.

Regime shifts

The field of research at the interface between regime shifts and economics is more active than ever. Behavioural economics aspects of this are reported under the BEN programme, but other aspects are investigated in a study published in the *Journal of Economic Behaviour and Organisation*⁶. It examines how impatient decision makers might manage a renewable resource stock with uncertain growth and which could undergo rapid and significant change when stock falls below a threshold. Using a mathematical model, the authors showed that impatience inevitably leads to overharvesting of the resource under a very broad range of assumptions. Their analysis suggests that accounting for and appropriately dealing with the reasons for resource managers' impatience may be important in measures to improve resource use sustainability.

The latest advances in the economics of tipping points were reviewed in a study led Chuan-Zhong Li, together with Therese Lindahl and Anne-Sophie Crépin, which is reported in a paper submitted to a leading journal.

⁶ Arvaniti, M., C.K.B. Krishnamurthy, and A.-S. Crépin. 2023. Time-consistent renewable resource management with present bias and regime shifts. *Journal of Economic Behavior & Organization* 207:479–495.

⁷ Allakulov, U., S. Cocciolo, B. Das, M.A. Habib, L. Rambjer, and A. Tompsett. 2023. Transparency, governance, and water and sanitation: Experimental evidence from schools in rural Bangladesh. *Journal of Development Economics* 163:103082.

Towards safe drinking water

Since 2007, economist Anna Tompsett, who joined the Beijer Institute in 2022, has led a project on how to improve access to safe drinking water, in partnership with researchers at KTH and the Bangladeshi NGO Forum for Public Health. This is a huge problem around the world, e.g. more than half the 102 million population of Bangladesh lacks access to clean water. Recent project work has examined the unglamorous but essential topic of cleaning. Community wells by definition have many users and each additional user increases the risk of introducing contamination into the well, where moist and warm conditions mean that biofilms can thrive. Recent studies^{7,8} by the team show that improvements to cleaning practices are technically feasible and that training caretakers to adopt these approaches is a highly cost-effective way to reduce exposure to faecal contamination in drinking water and ultimately reduce child mortality⁷.

Economics of planetary boundaries

Work has continued in the project “The economics of planetary boundaries” to address the overarching research question: Which policies would keep humanity within the planet’s safe operating space without hindering progress on the Sustainable Development Goals? A core effort is to bring biodiversity into integrated assessment models like those used in the field of economics of climate change. This entails both theoretical and empirical work, and much effort has been devoted to gaining access to relevant data. Several Beijer Institute researchers are involved in the project, together with colleagues from the Global Economic Dynamics and the Biosphere programme, Stockholm Resilience Centre Uppsala University, The Wharton School at University of Pennsylvania, and Norwegian University of Science and Technology. On 23–24 May 2023, project participants gathered at the Academy for a workshop summarising the work so far and planning future work.



⁸ Habib, M. A., S. Cocciolo, M.A. Haque, M.M.A. Raihan, P. Bhattacharya, and A. Tompsett. 2023. How to clean a tubewell: the effectiveness of three approaches in reducing coliform bacteria. *Science of the Total Environment* 872:161932.

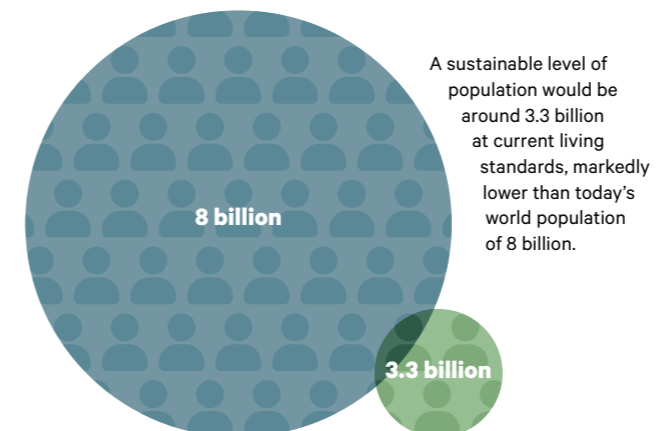
Spreading environmental economics worldwide

As a tribute to the legacy of environmental economist Professor Karl-Göran Mäler (1939–2020), co-founder and former director of the Beijer Institute, a special issue of the journal *Environmental & Resource Economics*¹ has been published.

During his time in office, Karl-Göran Mäler took on the challenge of bringing high-quality university education in environmental economics to low- and middle-income countries across the world. The idea was that by teaching the teachers, knowledge would spread to future university teachers and decision makers in those countries. Several of his former students, students of his students, and former Mäler scholars and colleagues contribute to the special issue, which was edited by Beijer Institute deputy Director Anne-Sophie Crépin, together with Ed Barbier (Colorado State University) and Thomas Sterner (Gothenburg University).

Only 3.3 billion can live sustainably at today's living standards

The first article in the special issue is written by two former directors of the Beijer Institute board, Partha Dasgupta and Scott Barrett, together with Aisha Dasgupta. The paper focuses on the problem that humanity's ecological footprint is substantially exceeding the biosphere's capacity to supply goods and services sustainably. The authors use economic models and estimates of the ecological gap between demand and supply of goods and services from the biosphere, global GDP and its growth, and the rate of decline in natural capital to investigate three questions: 1) How much more efficient does conversion of nature's services into GDP need to be in order to be sustainable? 2) What global population level could live sustainably at current living standards? and what living standards could be achieved if the world population reaches 9 billion by 2100? They show that: 1) efficiency must substantially increase to reach the sustainable development goals by 2030; 2) a sustainable level of population would be around 3.3 billion, markedly lower than today's world population of 8 billion; and 3) the highest sustainable living standard for a population of 9 billion would be around 11,800 USD at 2011 price levels.



Karl-Göran Mäler 2010. Photo: Agneta Sundin

Informing about regime shifts improves management

Another article describes work led by former Beijer Institute scholar Herbert Ntuli (University of Pretoria), together with Beijer colleagues Caroline Schill and Anne-Sophie Crépin and Edwin Muchapondwa (University of Cape Town), to design a new type of framed field experiment for assessing possible differences in outcome between policies for managing elephants and grasslands in Zimbabwe. These resources could suffer from regime shifts (abrupt change if some thresholds are passed). Despite the complexity of the problem, resource users were able to participate in the experiment, which resulted in clear and meaningful results. The authors found that informing resource users about the possibility of regime shifts led to a level of efficiency in management closely resembling that with other management options, such as harvest quotas with sanctions or a combination of harvest quotas and information about the threshold (see also page 11).

Case studies from around the world

The special issue also contains a review on valuation of ecosystem services across emerging markets and poor- and middle-income countries and several articles reporting on different case studies. These relate to: air pollution in Colombia; solid waste management in Nepal; payment for ecosystem services and rural poverty in Costa Rica; behavioural and policy aspects of wildlife conservation in Zimbabwe; fishing and household nutrition in Ghana; and mangrove protection in Thailand.

In their introductory article, the editors acknowledge the contribution of Karl-Göran Mäler to the profession, not only as a great scholar but also as a warm, generous and fun human being. Their narrative includes explanations about the fields of research to which he contributed, anecdotes about his life and descriptions of how the contributions in the special issue relate to his research.

¹ Sterner, T., E.B. Barbier, and A.S. Crépin (Eds.). 2023. Special issue in honour of Karl-Göran Mäler. *Environmental and Resource Economics* 84(3):649–876.

Using blue foods to meet UN goals

Fish, shellfish, algae and aquatic plants (referred to collectively as blue foods) are currently under-utilised in tackling global environmental and health challenges. A study in *Nature* gives policymakers access to new analysis and online tools which show the role that aquatic foods can play in combatting nutrient deficiencies and cardiovascular disease and in reducing the sector's climate and environmental footprint.

Blue foods are immensely diverse. More than 2,200 wild species of blue food organisms are caught and more than 600 are farmed, with tremendous variation in associated production and processing systems and practices. Consumption patterns also vary across the world, due to the types of blue foods accessible, but also to cultural and religious traditions.

This diversity holds the key to understanding the geographical contexts and conditions in which blue foods can contribute to achieving food system ambitions, such as improved

“Blue foods can contribute to achieving food system ambitions, such as improved nutrition, equity and lowered environmental impact”



nutrition, equity and lowered environmental impact, as articulated in the UN Sustainable Development Goals.

The Blue Food Assessment (BFA), involving several Beijing Institute researchers, recently evaluated nutritional, environmental, economic and justice dimensions of blue foods globally. As part of BFA, the study in *Nature* integrates these findings and translates them into four policy objectives to help realise the contributions that blue foods can make to national food systems around the world. These objectives are to:

- reduce vitamin B₁₂ and omega-3 deficiencies
- reduce non-communicable disease risks related to overconsumption of red meat, particularly cardiovascular disease
- reduce greenhouse gas consumption and production footprints
- safeguard blue food contributions to nutrition, just economies, livelihoods and cultures under climate change.

For instance, the researchers found that policymakers in countries with high environmental food footprint and high levels of cardiovascular disease – typified by developed countries in Europe and North America – should focus on improving production and access to blue foods, which can act as a substitute for consumption of more impactful red meats.

The results also suggested that many countries with severe nutrient deficiencies, mainly in Africa and South America, can address vitamin B₁₂ and omega-3 shortages, especially among nutritionally vulnerable parts of the population, by facilitating consumption of culturally relevant blue food, including bivalves or small pelagic fish.

The analytical framework was used to identify countries with high future risk for whom climate adaptation of blue food systems will be particularly important. The complex nature of food systems, including aquatic systems, means that any action to improve performance in some dimensions will involve a trade-off with performance in one or several other dimensions. Overall, the framework helps decision makers to assess the blue food policy objectives most relevant to their geographies, and to compare and contrast the benefits and trade-offs associated with pursuing these objectives.

Crona, B., E. Wassénius, M. Jonell, J.Z. Koehn, R. Short, M. Tigchelaar, T.M. Daw, C.D. Golden, J.A. Gephart, E.H. Allison, S.R. Bush, L. Cao, W.W.L. Cheung, F. DeClerck, J. Fanzo, S. Gelcich, A. Kishore, B.S. Halpern, C.C. Hicks, J. Leape, D.C. Little, F. Micheli, R.L. Naylor, M. Phillips, E.R. Selig, M. Springmann, U.R. Sumaila, M. Troell, S.H. Thilsted, and C. Wabnitz. 2023. Four ways blue foods can help achieve food system ambitions across nations. *Nature* 616:104–112.

EU fuel tax cut can benefit Russia

The Russian war on Ukraine demands action by EU leaders to dampen negative effects on its citizens. However, to avoid involuntarily favouring Russia, it is important to analyse the effects of response measures. For instance, an EU-wide fuel tax cut of €0.20 per litre could increase oil profits in Russia by more than €8 million per day in the first 1–3 years, according to a modelling study published in *Nature Energy*. These findings suggest that alternative policies to fuel tax cuts might be needed in order for the EU to support households without undermining its geopolitical goals.

The Russian invasion of Ukraine led Western nations to impose sanctions on Russia, including restrictions on EU imports of crude oil and gas. This, together with post-pandemic increases in demand, has led energy prices to rise dramatically. Many European countries have been considering fuel-tax reductions to help consumers manage increases in the cost of living. However, it is important to understand how these cuts might influence oil company revenues, particularly those of suppliers in Russia.

Beijing economist Johan Gars and colleagues Daniel Spiro and Henrik Wachtmeister at Uppsala University analysed the impact of an EU-wide fuel tax cut on Russian oil profits. In their analysis, they assumed a common tax cut across the EU of €0.20 per litre, based on different possible responses by EU member states. They then constructed a model that considered global oil markets, EU road transport fuel demand, and oil supply from Russia compared with the rest of the world. Model predictions showed that in the first year after introduction of the fuel tax cut, EU consumer prices would decrease by almost the full tax reduction, at a financial cost to the EU of €170 million per day. However, Russian oil companies were predicted to increase their profits by approximately €8.4 million per day during the same period.

“A fuel tax cut leads to increased demand for oil and, as a consequence, increased oil prices. This increases the profits of all oil producers, including Russia”, explains Johan Gars. “The effects will be largest in the very short run and then decline as the global oil market has time to adjust. We show that when the market has had time to adjust, a 20 Euro cent fuel tax decrease would still lead to an increase in Russian oil profits of around 8 million Euros per day.”

“A fuel tax cut leads to increased demand for oil and, as a consequence, increased oil prices. This increases the profits of all oil producers, including Russia”

The authors also considered an alternative policy involving direct transfer of cash to consumers, with the same total financial burden to the EU as the fuel tax cut. In this scenario, model predictions showed that fuel prices would increase very slightly, but profit gains in Russia would be around 15% of those under the fuel tax cut. Consumers would also have greater flexibility in their spending choices.

“To shield households from high fuel prices, policies increasing their disposable income directly, instead of helping them at the fuel pump, would give much smaller Russian oil profit increases, while arguably being better for households by giving them greater flexibility”, Johan Gars explained.

Oil refinery in Yaroslavl, Russia.



Gars, J., D. Spiro, and H. Wachtmeister. 2022. The effect of European fuel-tax cuts on the oil income of Russia. *Nature Energy* 7(10):989–997.

Can corporations be a force for good?

Transnational corporations (TNCs) are becoming increasingly powerful and thus critically important for ensuring that irreversible climate or ecosystem tipping points are not transgressed. National legislation often fails to prevent harmful impacts of TNCs on the climate system, ecosystems and people. An article in *Annual Review of Environment and Resources* calls for more transformative approaches by TNCs, together with stronger actions by governments and global organisations to safeguard the planetary systems on which TNCs themselves rely.

Negative impacts of TNCs include pollution of soils, freshwater and oceans, depletion of air quality, ecosystems and species, climate change emissions, and social effects such as unacceptable working conditions, erosion of traditional practices and increased inequalities.

National law falls short for international corporations

National legislation covers only activities taking place within a nation and expected standards of performance differ between countries. Therefore, TNCs operating in several countries are subject to different legal requirements and no single nation has a full overview of their operations. Moreover, TNCs are rarely forced to consider the full social and ecological costs of doing business. The author team, led by Henrik Österblom at the Beijer Institute (also affiliated with Stockholm Resilience Centre and Director of the Anthropocene Laboratory), claims that extensive lobbying and science denial have delayed establishment of adequate regulations.

“It is time for governments to ensure that company motives and purposes are aligned with political and societal interests and economic preconditions—namely to safeguard the resilience of the biosphere for future generations”, the authors write.

The inability of governments to agree on a set of global standards for TNCs, combined with limited transparency and knowledge of impacts, has resulted in a governance gap.

The rise of voluntary environmental programmes

Some TNCs, alone or in partnership with others, have started to take action and have established voluntary environmental programmes (VEPs) to clean up their act, prompted by the realisation that this is necessary for the future of their business and reputation or to avoid public shaming. VEPs unite companies behind voluntary commitments to go beyond complying with minimum legal regulations. Corporate engagement is emerging as a pathway to competitiveness, recruitment of talent and progress among companies and investors.

The international wheels move too slowly

International governance efforts have been made, e.g. the OECD has sought more general regulation of TNCs since in the 1970s. OECD guidelines cover topics such as human rights, employment practices and bribery, but also expectations on documenting and reducing negative environmental impacts. Many of these principles and practices are similar to those adopted by the United Nations Global Compact, a non-binding pact to encourage businesses and firms worldwide to adopt sustainable and socially responsible policies and report on implementation.

The article identifies several weaknesses with these efforts, e.g. they are non-binding and the OECD guidelines have not been updated since 2011, so do not consider recent scientific advances regarding the biosphere crises.

Call for a new convention

“International governance of environmental effects of corporations is rarely put in place proactively; instead, it is developed years after environmental problems have become evident”, says Henrik Österblom. “We can conclude that the combined effect of state-led and voluntary governance of corporations has been insufficient to meet the United Nations Sustainable Development Goals”.

Broader transformation is needed, where governments adopt a leadership role, through development of formal regulations. The authors claim that the time is ripe for a “Convention for Transnational Corporations in the Anthropocene Biosphere.” It could be modelled on an updated OECD framework and the UN Guiding Principles on Business and Human Rights, expanded to include the latest research on the state of natural systems, connections between systems and the different pressures they face.

“Corporations can be an instrumental force for reducing climate change impacts and achieving the Sustainable Development Goals. This requires corporate leaders to be willing to go far beyond compliance, and work together with science. Equally necessary are stronger and more ambitious policies and incentives from political leaders and financial institutions”, says Henrik Österblom.

Österblom, H., J. Bebbington, R. Blasiak, M. Sobkowiak, and C. Folke. 2022. Transnational corporations, biosphere stewardship, and sustainable futures. *Annual Review of Environment and Resources* 47:609–635.



Panel discussion at the Swedish Chef in Gastronomic Sustainability in October 2022. The Beijer Institute's Malin Jonell third from the left. Photo: Taste by Globe

Influencing influencers of the food system

At a ceremony in Stockholm on 25 October 2022 in which the awards for top Swedish Chef in Gastronomic Sustainability and Influencer of the Year in Sustainable Food were announced, Malin Jonell from the Beijer Institute held a presentation on defining a sustainable food system and strategies that can be used to achieve food sustainability targets. The jury for the chef award included world-class chefs and a sommelier. The day also offered seminars and panel debates. With over 300 visitors to the event, including chefs, food companies and influencers, it represented an important platform for science-based direct communication on sustainable food to an audience with strong influence on the Swedish food system.

“Dare to implement solutions even if they are not the most effective. We need to be active, but also dare to embrace complexity.”

–Malin Jonell

Policy advice for a sustainable seafood industry

The five-year Seawin project mapped Swedish production and consumption of seafood and increased understanding of its environmental sustainability through life cycle assessment. Nutrition and consumer preferences and behaviour were also studied. Several policy briefs and results produced in the project were presented to policymakers and other stakeholders at a hybrid seminar at the Royal Academy of Sciences on 24 November 2022. Seawin was a transdisciplinary project, with members from a range of academic institutions, food retailers, authorities and NGOs.

The event focused on the role of seafood in the future food system – in Sweden and the world. Short presentations were interspersed with discussions about sustainability, health and development potential with different actors in Sweden. The policy briefs provide clear guidance and advice to authorities, companies and consumers on actions that can increase sustainable and healthy seafood consumption, focusing largely on Swedish conditions. Seawin was funded by the Swedish research council Formas, with the Beijer Institute as a partner through its programme *Aquaculture and Sustainable Seafood*.

Max Troell at Seawin symposium in November 2022, at the Academy.



Seafood Business for Ocean Stewardship

SeaBOS is a unique collaboration between scientists and nine of the largest seafood companies operating in the wild capture, aquaculture and feed production sectors. Together, SeaBOS members have over USD 30 billion in annual turnover, corresponding to nearly 20% of global trade in fisheries and aquaculture products. The collaboration was initiated in 2016 by Stockholm Resilience Centre and the Beijer Institute has been a member of the scientific and organising team since the start.

In conjunction with the UN Ocean conference in July 2022, SeaBOS published its first public report, thereby taking an important step towards transparency and accountability regarding its commitments and time-bound goals (read more in last year's annual report). To further advance SeaBOS leadership, at the October 2022 dialogue in Sanpoort, CEOs agreed to take three key actions that will strengthen collaboration between the science team, SeaBOS secretariat and SeaBOS members.

The first key action is to establish one or more “keystone projects” in line with the SeaBOS vision and commitments, which could serve as flagships for the initiative to communicate its capacity to achieve rapid and meaningful impact.

To fulfil this goal, several activities were initiated in the period June 2022-December 2022. The first involves achieving greater clarity about the landscape of risk-based tools, approaches and technologies for addressing illegal activity in the seafood industry.

The second key action is creation of a dedicated SeaBOS monitoring and reporting framework. To fulfil this goal, the science team continues to monitor and track development of the SeaBOS collaboration, and to analyse and communicate its findings within the scientific literature. Several scientific articles have been produced, including “Transnational corporations, biosphere stewardship and sustainable futures” (featured on page 24).



Carl Folke and HRH Crown Princess Victoria of Sweden.
Photo: Pelle T Nilsson/SPA

A manuscript for a special issue of a scientific journal was prepared following the “2022 US-UK Scientific Forum on bringing nature into decision making”, a seminar led jointly by the British Royal Academy of Sciences and the National Academy of Sciences. At this seminar, SeaBOS was featured as a key example of how science and business could work together.

The third key action is creation of a unified science data collection process for member companies. This development is particularly relevant for ensuring that SeaBOS advances the frontiers of best industry practice.

In a SeaBOS working meeting that took place in Stockholm on 8–11 May, participating companies reported back on the commitments in their sustainability work. Issues such as Illegal, Unreported, Unregulated (IUU) Fishing, human rights, climate change, endangered species, plastic reduction in the oceans, and antibiotic use were discussed, and some planning was done for the next Keystone Dialogue taking place in Busan, South Korea, in October 2023.

Swedish Crown Princess Victoria, who was present for the first day of the meeting addressed the participants:

“I am excited to learn about the ambitious keystone projects in development – there is a chance to do something new, together. Something big with real world impacts. In that way we can show the world what happens when collaboration is focused on complex, but concrete challenges.”

The Crown Princess has been involved in SeaBOS since the start, providing consistent support and participation in events.

The scientific work is funded by the Walton Family Foundation, the David and Lucile Packard Foundation and the Gordon and Betty Moore Foundation.



Participants at the SeaBOS working meeting in Stockholm 8-11 May 2023.
Photo: Pelle T Nilsson/SPA

Shifting to healthier diets

The Beijer Institute, represented by Therese Lindahl, took part in a workshop for 150 Nordic food professionals arranged by Nordregio, the official research entity of the EU statistical office for regional development, policy and planning (Eurostat). During the workshop, participants discussed key possibilities and challenges in shifting towards healthy diets and sustainable consumption patterns in the Nordic countries, and existing interventions to stimulate consumers to eat healthier and more environmentally sustainable diets. These inputs were used in a policy brief.

“The workshop provided valuable insights, as we explored various intervention measures, such as nudging and economic instruments, that offer price incentives. This input will enable us to advise decision-makers on the next steps towards shaping a sustainable food future for Nordic citizens”, reported Nordregio Senior Research Fellow Leneisja Jungsborg.



Group discussion at Nordregio workshop for 150 food professionals. Beijer Institute's Therese Lindahl to the left.
Photo: Sofia Strömgård

Dialogue on antibiotic resistance

As part of its work on developing policy to decrease antibiotic use in food production, on 24 May 2023 the *Aquaculture and Sustainable Seafood* programme participated in a dialogue meeting on antibiotic resistance connected to seafood, organised by the Swedish Royal Agricultural Academy and AxFoundation. Through the umbrella organisation “Antibiotikapattformen”, these two organisations want to strengthen and coordinate efforts over different sectors to speed up work to combat antibiotic resistance. The event acted as a knowledge platform and forum for networking dialogues with quality managers within the Swedish food retail and food service industry. Programme director Max Troell gave a presentation on the latest research in the area and hosted one of the dialogues.



Panel discussion at policy seminar with Sir Partha Dasgupta, co-arranged by the Beijer Institute. Photo: Gabriela Gallen-Kallela-Sirén

The Economics of Biodiversity – Implications for policy and practice

On 2 May, 2023, the Beijer Institute, together with the Mistra Center for Sustainable Markets at the Stockholm School of Economics and the British Embassy, arranged a seminar with Beijer Fellow Sir Partha Dasgupta, author of *‘The Economics of Biodiversity: The Dasgupta Review’*. At the event, Professor Dasgupta shared key findings of the report, and their integration into policy and practice, with policymakers and representatives from environmental NGOs and academia. His talk was followed by a panel discussion, with Carl Folke as one of the participants.

Shifting financial flows

The Beijer Institute serves as a knowledge partner to the Taskforce for Nature-related Financial Disclosures (TNFD), the focus of which is to develop and deliver a risk management and disclosure framework for organisations to report and act on evolving nature-related risks. The ultimate aim is to support a shift in global financial flows away from nature-negative outcomes and towards nature-positive outcomes. The G7 Finance Ministers and G20 Sustainable Finance Roadmap, among others, have endorsed TNFD, while the G20 and G7 Environment and Climate Ministers have acknowledged its establishment. Version v1.0 of the TNFD framework for market adoption will be released in September 2023.

Art and science exhibition on antibiotic resistance

An annual interdisciplinary collaboration between researchers at the Beijer Institute, students in Visual Communication at Beckmans College of Design and design firm Svenskt Tenn was initiated in 2017. It aims to create new paths by which science and visual communication and design can meet and interact to visualise and convey knowledge, intellectually and emotionally.

In this year's collaboration, *Are we there yet?* students interpreted cutting-edge research on antibiotic resistance, one of the greatest threats to global health and food security, accelerated by antibiotic overuse in humans and animals. The results were presented at an exhibition at the Royal Swedish Academy of Sciences 18 April to 8 May, 2023 and at the Svenskt Tenn store in Stockholm 8 June to 17 June, 2023. Selected parts of the exhibition were also shown at a two-day dialogue meeting on antimicrobial resistance (AMR) at Uppsala University, within the Swedish EU presidency. The meeting gathered national and international experts, policy makers and representatives from civil society, from 25 countries on four continents. They discussed important steps and concrete goals for combatting AMR globally, in preparation for the UN high-level meeting on the subject in 2024.

The same works were also exhibited at the British Embassy in Stockholm.

The students wanted to highlight common misconceptions, encourage conversation and emphasise that action, at all levels of society, can reduce the impact of antibiotic resistance and limit its spread.

"The door between research and communication design is wide open in this collaboration between Beckmans College of Design, the Beijer Institute and Svenskt Tenn. The fact that the students can use current research as a starting point and investigate ways to communicate antibiotic resistance sparked a desire to experiment that arises from seriousness. This is valuable for all of us," said Sophia Wood, senior lecturer at Beckmans College of Design.



The exhibition piece "Facing our future" highlights that antibiotic resistance is a big factor behind child mortality.

A piece entitled *Muddy waters* highlighted that contamination of water bodies with antibiotics is invisible both to the naked eye and to public perception. When manufacturing antibiotics, nearby water sources can be contaminated by factory waste, disturbing ecosystems and affecting drinking water and water used in farming and aquaculture. This in turn contributes to bacteria becoming resistant to antibiotics.

In a piece entitled *Under your skin*, students compared antibiotic resistance to a nuclear arms race, with higher doses and broad-spectrum antibiotics being prescribed to kill resistant bacteria, an approach which risks making bacteria resistant to these too.

In the work *Misconception*, two students made giant blister packs blinking out misconceptions about antibiotics, with the correct facts in small letters on the other side. The piece illustrates how misinformation often speaks louder than the truth.

The exhibition also included pretty flower vases in the shape of medicine pills to inspire conversations and a sculptural heap of intestines visualising a disturbed (human) ecosystem, among other things.

Participating researchers were Patrik Henriksson and Max Troell from the Beijer Institute, Peter Sogaard Jørgensen and Tiscar Graells (GEDB), and Andrea Caputo Svensson (ReAct, Uppsala University).

"This year's collaboration with Beckmans students on antibiotic resistance was a very inspiring experience. Our first meeting revealed ignorance of the subject among the students, but at the same time great interest in learning more and understanding. The process meant that we as researchers were forced to concretise and clarify our research, which proved useful. As usual, it was amazing to see how the students approached the subject and how they transformed messages into different art forms – all very innovative and completely outside our frame of reference of what was possible," said Max Troell.

See a digital version of the exhibition at antibiotics.cargo.site

"Conversation pieces" from the exhibition *Are we there yet?*



Resilience of People and Ecosystems under Climate Stress

A new initiative by the Pontifical Academy of Sciences in Rome, Italy, entitled *Resilience of People and Ecosystems under Climate Stress*, aims to bring researchers, policymakers and faith leaders together to understand the scientific and societal challenges of climate change and to develop solutions for enabling resilient people and resilient ecosystems.

Through this, the Pontifical Academy acknowledges the multiple intersecting crises facing humanity, namely climate change, biodiversity and equity. At a workshop on 13–14 July 2023 at Vatican City, Beijer Institute programme leader Victor Galaz was invited to hold a presentation on the subject *Finance for People and Planet* and to engage in group discussions. After the event, the Pontifical Academy issued a final statement, agreed by all participants, that: "It is too late to rely just on mitigation. Adaptation to climate risks is overdue and must become a central theme of climate actions. A global effort to build climate resilience is needed." It also delivered recommended actions in key areas, with a call for these to be "placed on the agenda of COP27 and beyond". The final statement included a message from Pope Francis where he emphasised: "An interdependent world not only makes us more conscious of the negative effects of certain lifestyles and models of production and consumption which affect us all; more importantly, it motivates us to ensure that solutions are proposed from a global perspective, and not simply to defend the interests of a few countries. Interdependence obliges us to think of one world with a common plan."

Risks of automated mis- and disinformation

As part of the *Governance, technology and complexity* programme's work on identifying the risks of automated mis- and disinformation, a round table meeting was held at the Royal Swedish Academy of Sciences in November 2022 to explore what these risks could comprise and the most effective ways to mitigate them through new forms of governance. The meeting included scholars from other Swedish universities, AI experts from Sweden, journalists and public opinion experts. One conclusion from the conversations was the need to develop a portfolio of robust methods to better assess the real impacts of mis- and disinformation on public perceptions and opinions on climate and sustainability issues. Another conclusion was an increased need to focus on the ways in which security and climate misinformation are becoming increasingly aligned, for example through attempts by foreign actors to create and amplify false information about energy issues in the aftermath of Russia's war on Ukraine.

Discussions at the session co-arranged by the Beijer Institute at the Nobel Prize Summit in Washington. Photo: Marcus Lundstedt, Stockholm Resilience Centre



Participants of the Pontifical Academy of Sciences' workshop 'Resilience of people and Ecosystems under climate stress'. Photo: Gabriella C. Marino

Nobel Prize Summit: Truth, Trust and Hope

The international Nobel Prize Summit on 24–26 May brought together Nobel laureates and other experts to explore the problem of misinformation and measures that organisations, policymakers and citizens can take to combat misinformation, restore trust in science and create a hopeful future. The hybrid summit took place online and in Washington D.C. It was organised by the Nobel Foundation and the US National Academy of Sciences.

Misinformation is eroding people's trust in science and runs the risk of becoming one of the greatest threats to societies today. Sessions at the summit examined factors driving the spread of misinformation and disinformation, the impact they have on science and democracy, and possibilities for confronting them and fostering healthier information environments.

This subject is part of the research agenda for the Beijer Institute's *Governance, technology and complexity* programme, which was invited to co-organise a session on how to address health and climate misinformation. Programme director Victor Galaz presented the programme's work in a panel that included Dr. Anthony Fauci. In conjunction with the summit, the programme also compiled an online report, "*Climate Misinformation in a Climate of Misinformation*", that combines insights from various research strands, including computational social sciences, sustainability sciences and neurosciences. In addition, Carl Folke presented a reflection of the previous summit, *Our Planet Our Future*, the first of its kind, which was co-organised by the Beijer Institute.



The Anthropocene Laboratory

The Academy's Anthropocene Laboratory, which will act as both a think tank and meeting place for collaborations, gathering key researchers internationally on key topics of high relevance and involving younger scientists, is now taking shape. The Beijer Institute and our close collaborators Stockholm Resilience Centre (SRC) and the GEDB Academy Programme, along with other leading research groups and centres, will serve a critical asset for the Anthropocene Laboratory. Exciting collaborations have started, with Henrik Österblom as the director and with Beijer Institute researcher Caroline Schill, former Beijer Young Scholars Juan Rocha and Lan Wang Erlandsson and GEDB researcher Peter S. Jørgensen central in forming the research agenda. Postdocs, research assistants and administration staff are being employed and two major research efforts and workshops are in the pipeline. Carl Folke serves as chair of the scientific committee.

kva.se/en/the-anthropocene-laboratory/

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

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

The GEDB Academy Programme – *New approaches to the grand challenge: Global finance, global health and the biosphere* – focuses on two broad areas of research. The first, *Biosphere Finance*, studies finance and capital markets linked 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. GEDB researchers are working with research on green funds, how to inform corporate reporting and disclosure. They have developed a set of essential environmental impact variables and a new metric called Earth System Impact (ESI) for this purpose.

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

Presentation by Sasha Quahe at a shared staff meeting of the Beijer Institute and the GEDB Academy Programme. Photo: Agneta Sundin



Beijer Institute of Ecological Economics

production. New diseases and agricultural pest organisms, also known as emerging pests and pathogens (EPPs), have been a major focus of the Global Health and Biosphere Stewardship theme for several years. Chemicals and biotechnology is another target area. The role of biodiversity in human health is under investigation and the last articles from the Blue Food assessment have been published, including a major synthesis in the journal *Nature* in early 2023.

GEDB is a significant channel for research, synthesis and synergies between the Beijer Institute and Stockholm Resilience Centre. Beatrice Crona is executive director of GEDB and Peter S. Jørgensen is deputy executive director. GEDB is funded by the Erling-Persson Foundation. Last year's achievements are described in the GEDB Annual Report 2022, which can be found at the website.

gedb.se

Stockholm Resilience Centre

The close collaboration with 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. Beijer researchers Malin Jonell and Patrik Henriksson lead the Food for Resilience theme and Caroline Schill leads the Interacting Complexities theme together with former Beijer Young Scholars Juan Carlos Rocha and Emilie Lindkvist. Beijer researchers lead and 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 nicely in the form of collaboration between the Beijer Institute, SRC and Stanford University. A new five-year grant for further developing collaborations, for the project *Advancing the Research Frontier of Biosphere Stewardship*, has been secured from the Marianne and Marcus Wallenberg 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 wellbeing 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 fifth executive programme of SRC took place in autumn 2022 and spring 2023. Within the programme, carefully 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. Around 70 high-level participants have been part of the programme. Corporations represented in the fifth executive programme included Advania, Dagab, Gränges, Gullspång Invest,

Hemköp/Tempo, Industrivärden, Latour, OKQ8, Scania, Skanska. Conversations covered the pivotal role that businesses can play in sustainability transformations, informed by science and driven by purpose. The deeper meaning and challenge of 'corporate biosphere stewardship' is increasingly appreciated. Carl Folke is science director for the programme. An alumni gathering was held at SRC in April 2023. For more information, see www.executive.stockholmresilience.org/stockholmresilience.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 *Policy Options*, which includes papers that may be of interest to the wider policy community. 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 for 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.

HiG Urban Studio, University of Gävle

The *Urban social-ecological systems* programme at the Beijer Institute collaborates with *HiG Urban Studio* at the University of Gävle. Beijer Institute programme director 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 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. Henrik Österblom is currently on the advisory board and Beijer Institute programme leader Therese Lindahl is a SARAS associate.

saras-institute.org

Stanford Centre for Ocean Solutions

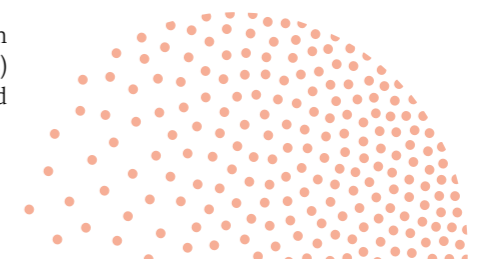
Through its research programme *Aquaculture and sustainable seafood*, the Beijer Institute is part of a two-year project evaluating the potential of blue foods in climate adaptation and mitigation strategies, led by Stanford Centre for Ocean Solutions, Stanford University. The project team, including partners from CARE, USA, the Environmental Defense Fund, 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. As climate change increasingly threatens food systems, with more powerful storms, frequent droughts, and shifting fish stocks, rapidly reducing emissions is key to protecting food and nutrition security while reducing environmental footprints on land and in water.

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 sustainable benefits of present and future generations of low-income users in developing 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 investigating equitable development of aquaculture in East Africa is led by Max Troell. Formal support from WorldFish also includes supporting activities within the Beijer Institute programme *Aquaculture and sustainable seafood* and co-funding a post-doc (Patrik Henriksson) for several years.

worldfishcenter.org



Will Steffen 1947–2023

Pioneering climate and Earth system scientist

Our dear friend and Beijer Fellow Will Steffen passed away from pancreatic cancer in Canberra on 29 January 2023. He was 75. Will was a remarkable human being and a visionary scientific giant.

Our journey with Will goes back to the 1990s, when he started as the new Director of the *International Geosphere and Biosphere Programme* (IGBP) and the Beijer Institute was in its infancy. Interacting with Will, such a humble, deeply knowledgeable, curious and creative human being, was a true privilege and pleasure.

Will was the father of Earth System science. At an early stage, he brought together leading scholars from diverse disciplines and backgrounds for new scientific syntheses. His 2004 book *Global Change and the Earth System: A Planet under Pressure* is a milestone and classic in this context, a systemic view of planet Earth and the human imprint altering its dynamics.

Will's work was instrumental in generating the Great Acceleration insights, showing the increasing rate of human activity and impact upon the Earth's biosphere and climate system. More recently, his work on the Anthropocene was critical in revealing its implications as a new geological epoch where humanity has become a global force shaping the dynamics of planet Earth. He achieved this not least by co-writing the first articles establishing the planetary boundaries concept in 2009 and then as first author in development of the planetary boundaries field in 2015. Will was also critical in advancing work on the risk of irreversible climate "tipping points" that could move the world into so-called



"hothouse conditions". His curiosity led him into new forms of collaboration across the sciences and humanities. Few can see the bigger picture as Will did, and dare jump into new explorations, generating amazing understandings and insights of profound significance.

"Will's work truly opened new paths of scientific inquiry and will have a lasting and deep imprint that reaches far beyond science"

Will's work truly opened new paths of scientific inquiry and will have a lasting and deep imprint that reaches far beyond science, since he was a gifted communicator and change maker. Actively and tirelessly, he brought the very best of scientific understanding of climate change and complex Earth system dynamics into policy, practice and business, highlighting the implications for sustainability and the future of civilisation in the fragile biosphere.

Will's commitments ranged from city development to national and international climate policy and from business leaders to central banks, to name but a few. Fairness, respect and appreciation were part of his humanism. He felt wonder and curiosity about life and being alive, and enjoyed being part of nature, revived by climbing mountains in Australia or skating on frozen lakes in Sweden.

Will's legacy and exceptional contributions shape the way we now think and act on world issues and will play a fundamental and profound role in efforts for transformation towards a sustainable future. It was hugely inspirational to interact with Will, to learn, discover and be revitalised. His humble personality, pleasant demeanour and great friendship will remain unforgettable in the hearts of his colleagues and friends at the Beijer Institute and around the world.



Carl Folke

Expanding horizons



Photo: Bumper DeJesus/Princeton University

August 2023

Four decades of research and six decades of living on our planet suggest that I have a strong interest in bridging competing or complementary entities, from cultures and continents (e.g. Europe and North America) to academic disciplines (e.g. psychology and economics), in order to create richer and more conscious ways of thinking and being.

Never and nowhere have I found so many like-minded scholars from so many different disciplines as in the Beijer Institute. Being part of this intellectual family since 2019 has been a great privilege and joy. Those four years of attending the annual Askö meetings—unfortunately only two of them in person with the pandemic interruption in 2020 and 2021—and serving on the Scientific Advisory Board (SAB) have expanded my horizon in directions I aspired to and shown me new needs and opportunities for coordination and cooperation across disciplines.

The Beijer Institute has extended its initial mission to bridge the dysfunctional gap between economics and ecology in ways that would fill a paragraph if they were to become incorporated into its name. While ecologists and economists still make

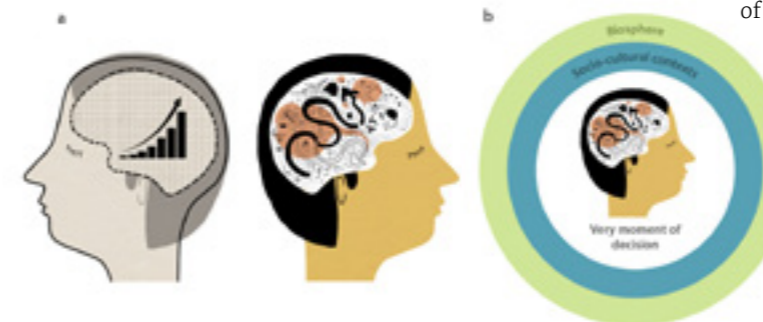


Figure 1 from Schill et al. 2019. A more dynamic understanding of human behaviour for the Anthropocene. *Nature Sustainability* 2:1075–1082. Illustration by Elsa Wikander/Azote

up most researchers on its staff and in its associated research community, many other neighboring disciplines are also represented, from a far broader range of social scientists (with a psychologist, namely me, chairing the SAB) to a wide range of modelers who come from mathematics, physics, evolutionary biology and elsewhere.

In thus expanding its expertise across theories and tools of academic disciplines to better understand and beneficially support the social-ecological systems that shape life on our planet, the Beijer Institute has been a pioneer. It took the UN Intergovernmental Panel on Climate Change (IPCC), for example, until its fifth assessment report (AR5) in 2014 to even mention non-rational choice processes ("smuggled" by some behavioral economists and me into a chapter on risk management) and until the sixth assessment report (AR6) in 2022 to create a chapter on demand-side and social aspects of mitigation. In contrast, researchers at the Beijer Institute have long examined human actors in the full complexity of their choice processes—making deliberative analytical decisions but also responding to emotional signals and following social norms and other rules of conduct—to assess their impacts on other people, flora and fauna, and the physical environment. A compelling illustration of this conceptualization is Figure 1 from the 2019 *Nature Sustainability* paper by a long list of Beijer authors, led by Caroline Schill. The growing impact of this perspective is illustrated by the large number of times in which I have seen this figure reproduced in recent papers, talks and dissertations.

So thank you, Beijer Institute scholars, for welcoming me into your family. I hope to contribute to your valiant efforts for many years to come!

Elke U. Weber
Gerhard R. Andlinger Professor in Energy and the Environment
Professor of Psychology and Public Affairs
Princeton University

Scientific advisory board

The 32nd annual scientific advisory board meeting was held at Royal Swedish Academy of Sciences on 9 September 2022. This meeting was the first for Professor Eli Fenichel, Yale University, USA, and Associate Professor Malin Pinsky, Rutgers University, USA, who were welcomed as new members of the 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. Kathleen Segerson, Joern Fischer and Elena Bennett reached the end of their term. The Beijer Institute wishes to express its warmest gratitude for their great efforts on behalf of 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

Elena Bennett

Professor, McGill University, Canada

Reinette (Oonsie) Biggs

Professor, Stellenbosch University, South Africa

Juan Camilo Cárdenas

Professor, Universidad de los Andes, Colombia

Eli Fenichel

Professor, Yale University, USA

Joern Fischer

Professor, Leuphana University, Germany

Claire Kremen

Professor, University of British Columbia, Canada

Malin Pinsky

Associate Professor, Rutgers University, USA

Kathleen Segerson

Professor, University of Connecticut, USA

Karen Seto

Professor, Yale University, USA

Rashid Sumaila

Professor, University of British Columbia, Canada



Beijer Scientific Advisory Board. Back row from left: Malin Pinsky, Carl Folke, Joern Fischer, Alessandro Tavoni, Juan Camilo Cardenas. Front row: Elke Weber, Claire Kremen, Elena Bennett, Kathleen Segerson, Rashid Sumaila, Eli Fenichel. Photo: Cecilia Nordstrand

Alessandro Tavoni

Associate Professor, University of Bologna, Italy

Board member **Rashid Sumaila** was awarded the 2023 Tyler Prize for Environmental Achievement, together with his colleague at the Institute for the Oceans and Fisheries at University of Columbia, Professor Daniel Pauly. They received the prize “for their rigorous scientific work to end overfishing and restore equity to our oceans”.

“Our lives and livelihoods depend on the ocean, which covers more than 70 percent of Earth. The Tyler Prize Executive Committee recognizes Professors Pauly’s and Sumaila’s outstanding individual and complementary achievements towards the conservation of this global life-source.”

“By pioneering analytical approaches and knowledge platforms to assess the global state of world fisheries, they have discovered viable solutions,



Photo: Tyler Prize

offering policymakers a realistic pathway towards the sustainable management of ocean fisheries.” *Chair of the Tyler Prize for Environmental Achievement, Julia Marton-Lefèvre*

In addition, in October 2022, the American Association for the Advancement of Science (AAAS) elected **Rashid Sumaila**, fellow board member **Malin Pinsky** and Beijer Fellow **Roz Naylor** as AAAS Fellows. This election is one of the greatest honours within the global scientific community and recognises members whose efforts in advancement of science or its applications in the service of society have distinguished them among their peers and colleagues. In September 2022, at an award ceremony in Amsterdam, Carl Folke received the Dr. A.H. Heineken Prize for Environmental Sciences (as reported on in last year’s Annual Report).

Staff members

Carl Folke

Professor, Director

Anne-Sophie Crépin

Associate Professor, Deputy Director

Johan Colding

Professor, Researcher, Programme Director

Gustav Engström,

Associate Professor, Researcher

Johan Gars

PhD, Researcher

Johanna Gulliksen

Research Assistant

Åsa Gren

Associate Professor, Researcher

Marie Huss

Operations Manager

Emmy Iwarsson

Research Assistant

Krisztina Jónás

Research Assistant

Malin Jonell

PhD, Researcher

Sofia-Kristin Kokinelis

MSc, Finance and HR Administrator

Therese Lindahl

PhD, Researcher, Programme Director

Arvid Marklund

Research Assistant

Henrik Österblom

Professor, Researcher

Rostya Septiana Putri

Intern

Caroline Schill

PhD, Researcher

Agneta Sundin

Communications Officer

Anna Tompsett

PhD, Researcher

Max Troell

Associate Professor, Researcher, Programme Director

Affiliated researchers

John M. (Marty) Anderies

Professor, Programme Director (Arizona State University, USA)

Stefan Daume

PhD, Researcher (Stockholm Resilience Centre, Stockholm University)

Victor Galaz

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

Patrik Henriksson

PhD, Researcher (Stockholm Resilience Centre, Stockholm University and WorldFish, Malaysia)

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

During the past year we welcomed two new colleagues:

Research assistant **Arvid Marklund** works within the *Governance, Technology and Complexity* programme. His work ranges from broadly studying the risks and opportunities associated with AI-powered emotion recognition and responsiveness in the context of sustainability to more specific applications, such as the use of Natural Language Processing (NLP) in social bot-mediated climate disinformation on social media. Arvid holds a MSc in Psychology and a psychologist licence and has a background in computer programming.

Anna Tompsett was originally trained as a Civil and Environment Engineer at Imperial College London and the University of Cambridge, before moving on to complete a PhD in Sustainable Development at Columbia University in 2014. Anna’s research focuses primarily on public goods whose presence or absence affect many people simultaneously, like a stable climate, an effective treatment for a disease or a source of safe drinking water. Her research leverages novel sources of data, combined with natural and field experiments. One strand of her research asks how public goods shape the trajectories of human development. A second strand examines the circumstances under which people and communities provide public goods effectively, for example does community participation in decision-making improve impact? A third strand of her research focuses on providing public goods.

Three colleagues have moved on to other positions: Research assistant **Johanna Gulliksen** left to work as a sustainability consultant. **Emmy Iwarsson**, research assistant within the *Inequality and the Biosphere* project, will start a PhD position at Uppsala University, Sweden, in autumn 2023. **Krisztina Jónás**, research assistant within the BEN programme, left the Beijer Institute in December 2022 to take a PhD position at Tromsø University, Norway. We are grateful for their work and wish them all the best in their new positions.



In addition, **Åsa Gren**, researcher within the *Urban social-ecological systems* programme, has taken up a position as lecturer at Gävle University, Sweden, but remains affiliated with the Beijer Institute. Åsa Gren has been working at the Beijer Institute for more than a quarter of a century. She has been a pioneer in quantifying all kinds of ecosystem services. After completing her Master’s thesis, Åsa started as a research assistant in 1995,

working with Carl Folke on the worldwide ecosystem appropriation by large cities. This work, published in *Ambio* in 1997, is now a classic within the field of urban ecology. During her PhD studies at the Department of Systems Ecology, Stockholm University, Carl Folke was her supervisor, so she continued to spend time at the institute. She successfully defended her PhD-thesis ‘Quantifying Ecosystem Services from Regional to Local Scales: Examples from the Baltic Sea Drainage Basin’ in 2002. The thesis included inspirational work on nitrogen retention by wetlands across Baltic Europe, the role of freshwater in the generation of ecosystem services, and the significance of green areas in carbon sequestering and for air quality. In 2004, she rejoined the Beijer Institute in a project with Karl-Göran Måler on assessing and quantifying measures of inclusive wealth. During the many years to follow, she was part of numerous different projects and publications, mostly with focus on urban social-ecological systems and urban ecosystem services and their values. She has participated in several Arctic projects, such as the EU funded Arctic Climate Change, Economy and Society (ACCCESS), and more recently the CASINO project (see page 19-20) in which she will continue to be active. Åsa received her associate professorship in 2021, and has this year taken on a permanent position as lecturer at the University of Gävle, Sweden. There, her work continuous to focus on how to create fair, healthy, sustainable, and resilient cities for everyone, in an urban planning and design context. Having Åsa at the Beijer Institute for all these years has been just great. Her drive, engagement, positive and wonderful personality, and her beautiful laugh echoing in the corridors, has enriched us again and again. We are grateful to Åsa for all her contributions to the Beijer Institute.

We congratulate **Carl Folke** and co-authors from Stockholm Resilience Centre (SRC) and from the Netherlands and Japan, who were selected as recipients of the Ecological Society of America’s Sustainability Science Award 2023 for a paper led by Thomas Elmqvist (SRC), entitled “Sustainability and resilience for transformation in the urban century”, which was published in *Nature Sustainability* in 2019. The paper looked at how urban sustainability and urban resilience are related and can be connected. The jury pointed out that the paper has already impacted sustainability and gained broad citation across diverse academic disciplines, from urban planning and engineering to health and life sciences.

“By acknowledging the tensions and contradictions between resilience and sustainability goals, the framework supports practice and policies toward transforming urban areas to be more resilient and sustainable,” the jury wrote in its motivation.

Beijer Fellows

John M. (Marty) Anderies

Professor, Arizona State University, USA

Scott Barrett

Professor, Columbia University, USA

Elena Bennett (new)

Professor, McGill University, Canada

Fikret Berkes

Professor, University of Manitoba, Canada

William “Buz” Brock

Professor Emeritus, University of Wisconsin, Madison, USA

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 (new)

Professor, Leuphana University, Germany

Lance Gunderson

Professor, Emory University, USA

Michael Hoel

University of Oslo, Norway

Terry Hughes

Professor, 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

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

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 2 km 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.

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 to support research and education, as well as supporting culture, especially design and interior decoration, and also 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 2022 and 30 June 2023 was also provided by:

- Formas, Swedish government research council for sustainable development
- Mistra
- Samfunns- og naeringslivsforskning, SNF, Norway
- Swedish Environmental Protection Agency
- Stichting IKEA Foundation
- The Crafoord Foundation
- The Marianne and Marcus Wallenberg Foundation
- 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).

Governance and management of social-ecological systems: Economic perspectives

The module “Economic perspectives” is part of the course “Governance and management of social-ecological systems”, which, in turn, is a part of the Master’s programme “Social-Ecological Resilience for Sustainable Development” at Stockholm Resilience Centre (SRC), Stockholm University. The module leader in spring 2023 was Johan Gars

and participating lecturers were Beijer Institute researchers Gustav Engström and Therese Lindahl and David Collste (SRC). The overall aim of the course is to introduce students to the concepts and methods of economics and how they can be used to analyse 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. The students have diverse backgrounds, ranging from not having studied economics previously to holding a degree in economics, making it challenging to put together material that suits all students. A common theme of the discussions in class are the various problems that the students have identified in the current economic system.

The Askö meetings

Since 1993, the Beijer Institute has organised an annual meeting in 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. The 2022 meeting was held 10-12 September and Rashid Sumaila, with the support of Kathleen Segerson and Marten Scheffer, led the discussions on the topic *Anthropocene Subsidies – Extinction or Prosperity*.

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 Ferdinanda Wijermans (SRC).



Participants of the Askö meeting in September 2022. Back row: Emmy Wassénus, Stephen Polasky, Juan Camilo Cárdenas, Aart de Zeeuw, Carl Folke, Malin Pinsky, Joern Fischer, Nils Kautsky, Marten Scheffer, Scott Barrett. Middle row: Stephen Carpenter, Marie Huss, Elke Weber, Claire Kremen, Elena Bennett, Brian Walker, Therese Lindahl, John M. (Marty) Anderies, Kathleen Segerson, Agneta Sundin. Front row: Karine Nyborg, Beatrice Crona, Eli Fenischel, Henrik Österblom, Alessandro Tavoni, Rashid Sumaila.

Beijer Young Scholars

The Beijer Young Scholars (BYS) Programme was started in 2012 with the aim of creating an international network of early-career researchers and stimulating 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. The process of selecting participants for a fourth cohort of Beijer Young Scholars, who will gather in spring 2024, is underway.

Stockholm Seminars - Frontiers in Sustainability Science and Policy

The Stockholm Seminars are arranged by Albaeco, the Beijer Institute, Future Earth and 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 in 2000. No seminars were held during the Covid-19 pandemic, but on 13 March 2023 the series resumed with the seminar “*Gross ecosystem product: An attractor for social innovation and transformation*”. Speakers were Beijer Fellows Gretchen Daily (Stanford University) and Stephen Polasky (University of Minnesota) and former Beijer Young Scholar Tong Wu (Stanford University).

Staff members’ publications and activities



John M. (Marty) Anderies
Professor, Programme director and affiliated researcher

Research focus

Institutions and institutional change in social-ecological systems, robustness and resilience, human behaviour and decision making, world-earth system dynamics.

Publications

Journal articles

- Aggarwal, R.M., and J.M. Anderies. 2023. Understanding how governance emerges in social-ecological systems: Insights from archetype analysis. *Ecology and Society* 28(2):2.
- Anderies, J.M., G.S. Cumming, H.S. Clements, S.J. Lade, R. Seppelt, S. Chawla, and B. Müller. 2022. A framework for conceptualizing and modeling social-ecological systems for conservation research. *Biological Conservation* 275:109769.
- Baggio, J.A., J. Freeman, T.R. Coyle, and J.M. Anderies. 2022. Harnessing the benefits of diversity to address socio-environmental governance challenges. *PLOS ONE* 17(8):e0263399.
- Deslatte, A., L. Helmke-Long, J.M. Anderies,

- M. Garcia, G.M. Hornberger, and E.A. Koebele. 2022. Assessing sustainability through the institutional grammar of urban water systems. *Policy Studies Journal* 50(2):387-406.
- Eppinga, M.B., H.J. de Boer, M.O. Reader, J.M. Anderies, and M.J. Santos. 2023. Environmental change and ecosystem functioning drive transitions in social-ecological systems: A stylized modelling approach. *Ecological Economics* 211:107861.
 - Freeman, J., J.A. Baggio, L. Miranda, and J.M. Anderies. 2023. Infrastructure and the energy use of human polities. *Cross-Cultural Research* 57(2-3):294-322.
 - Freeman, J., R.P. Mauldin, R.J. Hard, K. Solis, M. Whisenhunt, and J.M. Anderies. 2023. Hunter-gatherer population expansion and intensification: Malthusian and boserupian dynamics. *Journal of Archaeological Method and Theory*, in press.
 - Homayounfar, M., R. Muneeppeerakul, and J.M. Anderies. 2022. Resilience-performance trade-offs in managing social-ecological systems. *Ecology and Society* 27(1):7.
 - Walker, B., A.-S. Crepin, M. Nyström, J.M. Anderies, E. Andersson, T. Elmqvist, C. Queiroz, S. Barrett, E. Bennett, J.C. Cardenas, S.R. Carpenter, F.S. Chapin III, A. de Zeeuw, J. Fischer, C. Folke, S. Levin, K. Nyborg, S. Polasky, K. Segerson, K. Seto, M. Scheffer, J.F. Shogren, A. Tavoni, J. van den Bergh, E.U. Weber, and J.R. Vincent. 2023. Response diversity as a sustainability strategy. *Nature Sustainability* 6:621-629.

Book chapters

- Anderies, J.M. and S.A. Levin. 2023. Conservation of fragility and the collapse of social orders. In: Centeno, M., P. Callahan, P. Larcey, and T. Patterson (eds.). *How Worlds Collapse: What History, Systems, and Complexity Can Teach Us About Our Modern World and Fragile Future*. Routledge, New York, U.S., pp. 282-295.
- Deslatte, A., M. Garcia, E.A. Koebele, and J.M. Anderies. 2022. Sustainability transitions in urban water management: Assessing the robustness of institutional arrangements. In: Bolognesi, T., F.S. Pinto, and M. Farelli (eds.). *Routledge Handbook of Urban Water Governance*. Taylor & Francis, Oxon, U.K., pp. 284-296.

Working papers

- Anderies, J.M., W. Barfuss, J.F. Donges, I. Fetzer, J. Heitzig, and J. Rockström. 2022. Conceptualizing world-earth system resilience: Exploring transformation pathways towards a safe and just operating space for humanity. arXiv preprint arXiv:2204.04471.

Conferences, workshops and presentations

- Leveraging intrinsic tribal behaviours for planetary stewardship. Workshop within the Behaviour, economics and nature (BEN) programme, Royal Swedish Academy of Sciences, Stockholm, Sweden, May 2023. Participant and co-organiser.



Johan Colding
Professor, Programme director
and Senior Research Fellow

Research focus

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

Publications

Journal articles

- Berghauer Pont, M., S. Barthel, J. Colding, Å. Gren, A. Legeby, and L. Marcus. 2022. Social-ecological urbanism: Developing discourse, institutions and urban form for the design of resilient social-ecological systems in cities. *Frontiers in Built Environment* 8:982681.
- Hsu, A., K. Logan, M. Qadir, M.J. Booyesen, A.M. Montero, K. Tong, G. Broadbent, T. Wiedmann, V.K. Sin Woon, C. Good, J. Colding, G. Foliente, and Ş. Kilkış. 2022. Opportunities and barriers to net-zero cities. *One Earth* 5(7):739-744.
- Pan, H., J. Page, R. Shi, C. Cong, Z. Cai, S. Barthel, P. Thollander, J. Colding, and Z. Kalantari. 2023. Potential contribution of prioritized spatial allocation of nature-based solutions to climate neutrality in major EU cities. *Nature Climate Change*, in press.

Reports and briefs

- Alfredsson, E., M. Malmæus, D. Lindvall, M. Karlsson, T. Hahn, S. Barthel, and J. Colding. 2023. *Investeringar för en rättvis klimatomställning*. Policyslutsatser 2. (Investments for a fair climate transition. Policy conclusions 2). FAIRTRANS.
- Colding, J., S. Sjöberg, S. Barthel, M. Svensson-Wiklander, A. Rex, P. Andersson, and K. Nordin. Kunskapsunderlag 1. *Rättviseperspektiv på digitaliseringens roll för omställning mot ett fossilfritt Sverige* (Justice perspectives on the role of digitalisation in the transition towards a fossil-free Sweden). FAIRTRANS.
- Hahn, T., I. Fetzer, M. Karlsson, J. Ergon, E. Alfredsson, M. Malmæus, S. Barthel, and J. Colding. 2022. *FAIRTRANS Rapport 1: Rättvisa koldioxidbudgetar för Sverige* (FAIRTRANS Report 1: Fair Carbon Budgets for Sweden). FAIRTRANS.
- Hahn, T., M. Karlsson, I. Fetzer, A. Linell, E. Alfredsson, S. Barthel, and J. Colding. 2023. *Fairtrans Policyslutsatser 1: Rättvisa koldioxidbudgetar för Sverige* (FAIRTRANS Policy Conclusions 1: Fair Carbon Budgets for Sweden). FAIRTRANS.

Conferences, workshops and presentations

- Yearly Academic Research Conference, University of Gävle, Tällberg, Sweden, August 2022. Participant.
- FAIRTRANS WP-leadership workshop, Sigtuna, Sweden, September 2022. Participant.
- Sustainability Science Research Retreat 2022, University of Gävle, Gimo, Sweden, September 2022. Presenter.
- FAIRTRANS workshop no. 2, on Carbon Budget and Economic Investments, Stockholm Resilience Centre, Stockholm, Sweden, October

2022. Participant.

- Two-day autumn seminar for Swedish Knowledge Foundation's Research School 'Företagsforskarskolan Future-Proof Cities'. Mälardalens högskola, Västerås, Sweden, November 2022. Presentation: *Resilience Thinking*.
- 3rd Social-Ecological Urbanism Symposium. University of Gävle, Gävle, Sweden, December 2022.
- FAIRTRANS workshop among work-package leaders, Stockholm Resilience Centre, Stockholm, Sweden, January 2023. Presenter.
- FAIRTRANS workshop no. 3: Coworking as potential arenas to accelerate Sweden's climate transformation, Östersund, Sweden, March 2023. Co-organiser, presenter.
- Two-day spring seminar for Swedish Knowledge Foundation's Research School *Företagsforskarskolan Future-Proof Cities*, Gävle Central Konferens, Gävle, Sweden, March 2023. Co-organiser, presentation: *Urban Commons*.
- Samhällsarbete och kollektiv mobilisering för hållbar stadsutveckling (Community work and collective mobilisation for sustainable urban development). Urban Commons workshop, University of Gävle, Gävle, Sweden, March 2023. Co-organiser, presenter.
- Resiliens och Hållbar Stadsutveckling* (Resilience and Sustainable Urban Development), DoSpace, Gävle, May 2023. Presentation.

Teaching and training

- Main supervisor of PhD student Caroline Nilsson (University of Gävle).
- Main supervisor of Master's student Iva Mihaylova (University of Gävle).
- Main supervisor of Master's students Daniela Larsson and Dharshini Krishnaraj (University of Gävle).
- Supervisor at undergraduate level for Mathias Klar, Viktor Vagfalvi and Anna Holm Ek (University of Gävle).
- Lecturer, Master's level course *The biodiversity crisis* (Sustainability Science), University of Gävle, autumn 2022.
- Lecturer, undergraduate course *Environmental technology/environmental strategy*, University of Gävle, autumn 2022.
- Lecturer, Master's level course *Fördjupad miljöpsykologi* (Advanced environmental psychology), University of Gävle, autumn 2022.
- Lecturer, Master's level course *History of social-ecological systems* (Sustainability Science), University of Gävle, autumn 2022.
- Lecturer, Master's level course *Resilience management of natural resources and ecosystems* (Sustainability Science), University of Gävle, autumn 2022.
- Lecturer, Master's level course *Institutions and property rights* (Sustainability Science), University of Gävle, autumn 2022.
- Lecturer, undergraduate course *Environmental technology/environmental strategy*, University of Gävle, spring 2023.
- Lecturer, Master's level course, Chalmers University of Technology, Department of Architecture and Civil Engineering, spring 2023.

Commissions

- Chair, PhD-disputation of Noah Linder, Univer-

sity of Gävle, autumn 2022.

- Co-director, SFO-program on Urban Commons, University of Gävle, Gävle, Sweden.
- Steering board member, Swedish Knowledge Foundation's Research School 'Företagsforskarskolan Future-Proof Cities'.
- Course evaluation board member, University of Gävle, Gävle, Sweden.
- Working group member, 'Smarta hållbara städer och samhällen' (Smart sustainable cities and societies), Region Gävleborg, Sweden.
- Founding member, the research consortium Social-Ecological Urbanism. Stockholm, Sweden, 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

- Arvaniti, M., C.K.B. Krishnamurthy, and A.-S. Crépin. 2023. Time-consistent renewable resource management with present bias and regime shifts. *Journal of Economic Behavior & Organization* 207:479-495.
- Ntuli, H., A.-S. Crépin, C. Schill, and E. Muchapondwa. 2023. Sanctioned quotas versus information provisioning for community wildlife conservation in Zimbabwe: A framed field experiment approach. *Environmental and Resource Economics* 84(3):775-823.
- Sterner, T., E.B. Barbier, and A.-S. Crépin. 2023. Spreading environmental economics world-wide. *Environmental and Resource Economics* 84(3):649-657.
- Sterner, T., E.B. Barbier, and A.-S. Crépin, 2023. Special issue in honour of Karl-Göran Mäler. *Environmental and Resource Economics* 84(3):649-876.
- Walker, B., A.-S. Crepin, M. Nyström, J.M. Anderies, E. Andersson, T. Elmqvist, C. Queiroz, S. Barrett, E. Bennett, J.C. Cardenas, S.R. Carpenter, F.S. Chapin III, A. de Zeeuw, J. Fischer, C. Folke, S. Levin, K. Nyborg, S. Polasky, K. Segerson, K. Seto, M. Scheffer, J.F. Shogren, A. Tavoni, J. van den Bergh, E.U. Weber, and J.R. Vincent. 2023. Response diversity as a sustainability strategy. *Nature Sustainability* 6:621-629.

Conferences, workshops and presentations

- 30th Askö Meeting: Anthropocene subsidies: Extinction or prosperity? Royal Swedish Academy of Sciences, Askö and Stockholm, Sweden, September 2022. Organiser, participant.
- Winners and losers in the climate casino: Arctic marine resources under climate change. Workshop, Royal Swedish Academy of Sciences, Stockholm, Sweden, October 2022. Organiser.

- Marine Arctic Resilience and Transformation (MARAT). Workshop, Stockholm Resilience Centre, Stockholm, Sweden, November 2022. Participant.
- Resilience Metrics. Workshop, Stockholm Resilience Centre, Stockholm, Sweden, February 2023. Participant.
- Seminar, Umeå School of Economics, Umeå, Sweden, February 2023. Presentation: *Cascading regime shifts in pollution recipients and resource systems*.
- Seminar, Swedish University of Agricultural Sciences, Ultuna, Sweden, March 2023. Presentation: *Cascading regime shifts in pollution recipients and resource systems*.
- Winners and losers in the climate casino: Arctic marine resources under climate change. Workshop, Bergen School of Economics, Bergen, Norway, April 2023. Participant.
- Leveraging intrinsic tribal behaviours for planetary stewardship. Workshop within the Behaviour, economics and nature (BEN) programme, Royal Swedish Academy of Sciences, Stockholm, Sweden, May 2023. Participant and co-organiser.
- Inequality and the Biosphere project consortium meeting, Beijer Young Scholars II, Askö and Royal Swedish Academy of Sciences, Sweden, May/June 2023. Resource person and participant.
- 2023 World Conference on Natural Resource Modeling. University of Amsterdam, Amsterdam, The Netherlands, June 2023. Invited plenary speaker.

Commissions

- Member, National Committee for Global Environmental Change, 2018 until autumn 2022.
- Member, Council for evidence-based environmental analysis, FORMAS. Since 2020.
- Member, Environmental Research Council of the Swedish Environmental Protection Agency (Miljöförskningsrådet för Naturvårdsverket). Since 2018.
- Member of advisory board, Global Challenges Initiative, Stockholm School of Economics, Stockholm, Sweden. Since 2016.
- Co-opted Member, Committee for Environment, Climate and Energy of the Royal Swedish Academy of Sciences. Since 2016.
- Journal Editor for *Ecological Economics*. Since 2019.



Stefan Daume
PhD, affiliated researcher

Research focus

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

Publications

Journal articles

- Daume, S., V. Galaz, and P. Bjersér. 2023. Automated framing of climate change? The role of social bots in the Twitter climate change discourse during the 2019/2020 Australia bushfires. *Social Media + Society* 9(2).

Reports and briefs

- Galaz, V., H. Metzler, S. Daume, A. Olsson, B. Lindström, and A. Markström. 2023. *Climate misinformation in a climate of misinformation*. Online research brief. Stockholm Resilience Centre (Stockholm University) and Beijer Institute of Ecological Economics (Royal Swedish Academy of Sciences).

Conferences, workshops and presentations

- Automated climate mis- and disinformation? Round table event, Royal Swedish Academy of Sciences, Stockholm, Sweden, November 2022. Co-organiser and contributor.

Teaching and training

- Co-supervisor of Master's student Kate Björklund (Stockholm Resilience Centre, Stockholm University, Social-Ecological Resilience for Sustainable Development).
- Co-organiser, PhD course, R programming, Stockholm Resilience Centre, Stockholm, Sweden, since 2022.

New funding

- Sustainability, Emotions, and Intelligent Machines: The mechanisms, diffusion and effects of technology-mediated emotions on sustainability*, Marianne and Marcus Wallenberg Foundation, SEK 5.6 million, 2023-2026. Project participants: Victor Galaz (project lead), Therese Lindahl, Stefan Daume and Andreas Olsson.



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 economy and environment interaction.

Teaching and training

- Lecturer, Master's level course *Governance and management of social-ecological systems: Economic perspectives*, Stockholm Resilience Centre, Stockholm University, spring 2023.



Carl Folke
Professor, Director

Research focus

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

Publications

Journal articles

- Hahn, T., G. Sioen, A. Gasparatos, T. Elmqvist, E. Brondizio, E. Gómez-Baggethun, C. Folke, M.

- Jarzebski, K. Takeuchi, K. Fukushi, M. Setiawati, E. Arini, and T. Atmaja. 2023. Insurance value of biodiversity in the Anthropocene is the resilience value? *Ecological Economics* 208:107799.
- Norström, A.V., B. Agarwal, P. Balvanera, B. Baptiste, E.M. Bennett, E. Brondizio, R. Biggs, B. Campbell, S.R. Carpenter, J.C. Castilla, A. Castro, W. Cramer, G. Cumming, M. Felipe-Lucia, J. Fischer, C. Folke, R. DeFries, P. Eyzaguirre, S. Gelcich, J. Groth, L. Schultz, C. Ifejika Speranza, S. Jacobs, J. Hofmann, T.P. Hughes, D. Lam, J. Loos, A. Manyani, B. Martin-Lopez, M. Meacham, H. Moersberger, H. Nagendra, L. Pereira, S. Polasky, M. Schoon, O. Selomane, and M. Spierenburg. 2022. The Programme on Ecosystem Change and Society (PECS) – A decade of deepening social-ecological research. *People and Ecosystems* 18(1):598-608.
 - Österblom, H., J. Bebbington, R. Blasiak, M. Sobkowiak, and C. Folke. 2022. Transnational corporations, biosphere stewardship, and sustainable futures. *Annual Review of Environment and Resources* 47:609-635.
 - Rockström, J., A.V. Norström, N. Matthews, R. Biggs, C. Folke, A. Harikishun, S. Huq, N. Krishnan, L. Warszawski, and D. Nel. 2023. Reshaping a resilient future in response to COVID-19. *Nature Sustainability* 6:897–907.
 - Walker, B., A.-S. Crepin, M. Nyström, J.M. Anderies, E. Andersson, T. Elmqvist, C. Queiroz, S. Barrett, E. Bennett, J.C. Cardenas, S.R. Carpenter, F.S. Chapin III, A. de Zeeuw, J. Fischer, C. Folke, S. Levin, K. Nyborg, S. Polasky, K. Segerson, K. Seto, M. Scheffer, J.F. Shogren, A. Tavoni, J. van den Bergh, E.U. Weber, and J.R. Vincent. 2023. Response diversity as a sustainability strategy. *Nature Sustainability* 6:621-629.

Book chapters

- Folke, C. 2023. Foreword. In: Damania, R., S. Polasky, M. Ruckelshaus, J. Russ, R. Chaplin-Kramer, J. Gerber, P. Hawthorne, M.P. Heger, S. Mamun, G. Ruta, R. Schmitt, J. Smith, A. Vogl, and F. Wagner (eds.). *Nature's Frontiers: Achieving Sustainability, Efficiency, and Prosperity with Natural Capital*. World Bank Publications, The World Bank, Washington DC., USA.

Conferences, workshops and presentations

- Meeting of the International Scientific Advisory Council (ISAC). Stockholm Resilience Centre, Stockholm, Sweden, September 2022. Science director, participant.
- 30th Askö Meeting: Anthropocene subsidies: Extinction or prosperity? Royal Swedish Academy of Sciences, Askö and Stockholm, Sweden, September 2022. Organiser, participant.
- Tipping Points: From Climate Crisis to Positive Transformation. Conference, virtual panel, Exeter University, U.K., September 2022. Speaker.
- Copernicus Institute of Sustainable Development, Utrecht Science Park, the Netherlands. September 2022. Invited speaker.
- The Anthropocene biosphere - transforming for sustainable futures. Symposium, Wageningen University, Wageningen, the Netherlands, September 2022. Invited speaker.
- PhD/Postdoc Dialogue, Wageningen University, the Netherlands, September 2022. Keynote

speaker.

- Great Minds Exposed: Heineken Prize, Leiden, the Netherlands, September 2022. Speaker.
- Naturalis Biodiversity Center, Leiden, the Netherlands, September 2022. Presentation: *Biodiversity, social-ecological systems, and biosphere resilience*.
- Ceremony Heineken Prizes, Amsterdam, the Netherlands, September 2022. Laureate.
- NatCap-SRC Workshops, Stockholm, Sweden, January 2023, March 2023, May 2023. Organiser.
- SeaBOS CEO Annual Meeting, Reflection on SeaBOS, virtual, October 2022. Speaker.
- Transition in numbers, SEB Sustainability Conference. November 2022. Keynote speaker.
- NatCap-SRC Workshops, Stockholm, Sweden, January 2023, March 2023, May 2023. Organiser.
- Wallenberg Initiative Material Science for Sustainability (WISE) Dialogue, Royal Swedish Academy of Sciences, Stockholm, Sweden, March 2023. Invited speaker.
- Conceptualizing and Navigating Earth Resilience in the Anthropocene, LOOPS-5 Workshop, ERA (Earth Resilience in the Anthropocene) project, Högberga Gärd, Lidingö, Sweden, March 2023. Speaker, participant.
- Executive course alumni gathering, Stockholm Resilience Centre, Stockholm, Sweden, April 2023. Speaker.
- The Economics of Biodiversity: Implications for policy and practice. Partha Dasgupta seminar and panel discussion, Stockholm School of Economics, Stockholm, Sweden, May 2023. Panel participant.
- Meeting with the Taskforce for Nature-based Financial Disclosure (TNFD), Beijer Institute, Royal Swedish Academy of Sciences, Stockholm, Sweden, May 2023. Organizer, advisor.
- Reflection on why SeaBOS, SeaBOS 6th Working Meeting, Skeppsholmen, Stockholm, Sweden, May 2023. Speaker, participant.
- Leveraging intrinsic tribal behaviours for planetary stewardship. Workshop within the Behaviour, economics and nature (BEN) programme, Royal Swedish Academy of Sciences, Stockholm, Sweden, May 2023. Participant, advisor.
- Nobel Prize Summit – Truth, Trust, and Hope. Washington, USA, May 2023. Speaker.
- Inequality and the Biosphere project consortium meeting, Beijer Young Scholars II, Askö and Royal Swedish Academy of Sciences, May/June 2023. Participant.

Teaching and training

- Lecturer, undergraduate, Master's and PhD courses, Stockholm University, autumn 2022.
- Lecturer, CEO Executive Programme in Resilience Thinking: Transformative Business Leadership for a Prosperous Planet, Stockholm Resilience Centre, Stockholm University, autumn 2022 and spring 2023.
- Lecturer, Master's level course *Resilience and Sustainable Development*, LUMES, Lund University, autumn 2022 and spring 2023.
- Lecturer, Master's level course on scientific advocacy, Wageningen University, Wageningen, the Netherlands, spring 2023.

Commissions (a selection)

- Member, International McKinsey Sustainability Advisory Council. Since 2023.
- Founder, Chair of the Scientific Committee, The Anthropocene Laboratory, Royal Swedish Academy of Science, Stockholm, Sweden. Since 2022.
- Core knowledge partner, Taskforce on Nature-related Financial Disclosures (TNFD). Since 2022.
- Member, Ethics Advisory Council, Axel Johnson, Stockholm, Sweden. Since 2022.
- Advisor, Biosphere Intelligence (start-up), Stockholm, Sweden. Since 2022.
- Jury member, Frontiers Planet Prize. Since 2022.
- Member, Misum Center Board, Stockholm School of Economics, Stockholm, Sweden. Since 2022.
- Member, High Council of Trustees of the Nobel Foundation (Nobelfullmäktige). Since 2021.
- Member, SEB External Sustainability Advisory Board (SESAB), Stockholm, Sweden. Since 2021.
- Partnership Committee member, the Natural Capital Project, Stanford University, Stanford, U.S. Since 2020.
- Member, Academic Advisory Board of STIAS, Stellenbosch Institute for Advanced Study, Stellenbosch, South Africa. Since 2019.
- Member, Temasek Sustainability Advisory Panel (TSAP), Singapore. Since 2019.
- Member, Monaco Ocean Science Federation, Monaco. Since 2019.
- Scientific Director, CEO Executive Programme in Resilience Thinking: Transformative Business Leadership for a Prosperous Planet, Stockholm Resilience Centre, Stockholm, Sweden. Since 2018.
- Member, International Scientific Advisory Board, Helsinki Institute of Sustainability Science, HELSUS, University of Helsinki, Helsinki, Finland. Since 2018.
- 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. Since 2018.
- Member, SeaBOS Steering Committee and Board of the SeaBOS Foundation. Since 2016.
- Member, Advisory board of EAT and EAT Forum, Oslo, Norway. Since 2014.
- Selection committee, Kenneth Boulding Award, International Society for Ecological Economics. Since 2013.
- Co-director (with Beatrice Crona), Erling-Person Family Academy Programmes, New Approaches to the Grand Challenge: Global Finance, Global Health and the Biosphere, Royal Swedish Academy of Sciences, Stockholm, Sweden. Since 2013.
- Chair, Scientific committee of the Volvo Environment Prize. Since 2012.
- Founding Director, Chair of the Board, Stockholm Resilience Centre, Stockholm, Sweden. Since 2007, 2023.
- Advisory and editorial board member for *Ambio*, *the Anthropocene Review*, *Anthropocene Science*, *Ecological Economics*, *Ecology*

and *Society*, *Environment and Development Economics*, *Environmental Innovation and Societal Transitions*, *Geography and Sustainability*, *Global Sustainability*, *One Earth*, *Proceeding of the National Academy of Sciences USA* (PNAS), and *Sustainability Science*.

Other

- The 2023 Sustainability Science Award of the Ecological Society of America.
- Organiser (with Henrik Österblom) of dialogues on the ocean and forestry for HRH Crown Princess Victoria, Haga Castle, October 2022 and May 2023.
- Recognised as Highly Cited Researcher by Thompson Reuters. 2014-2022.



Victor Galaz
Associate Professor,
Programme director

Research focus

Political and governance challenges created by rapid global change, including globally networked risks, governance dimensions of “planetary boundaries”, the interplay between financial systems and Earth system dynamics, and the sustainability implications of novel technologies.

Publications

Journal articles

- Daume, S., V. Galaz, and P. Bjersér. 2023. Automated framing of climate change? The role of social bots in the Twitter climate change discourse during the 2019/2020 Australia bushfires. *Social Media + Society* 9(2).

Reports and briefs

- Galaz, V., H. Metzler, S. Daume, A. Olsson, B. Lindström, and A. Marklund. 2023. *Climate misinformation in a climate of misinformation*. Online research brief. Stockholm Resilience Centre (Stockholm University) and the Beijer Institute of Ecological Economics (Royal Swedish Academy of Sciences).

Conferences, workshops and presentations

- Pontifical Academy of Sciences. Vatican City, Vatican, July 2022. Invited speaker: *Finance for People and Planet*.
- Requirements Engineering '22 Conference. Melbourne, Australia/online, August 2022. Keynote speaker: *AI and Systems Design for People and Planet*.
- XV Asociación Española de Ecología Terrestre (AEET) National Congress. Plasencia, Spain, October 2022. Keynote speaker: *AI for People and Planet?*
- Automated climate mis- and disinformation? Round table event, Royal Swedish Academy of Sciences, Stockholm, Sweden, November 2022. Organiser and contributor.
- CEREAL postdoc network. Princeton's Environmental Institute, Princeton University, online, November 2022. Invited speaker: *AI, Emotions and Sustainability*.
- Austrian Academy of Sciences. Vienna, Austria, December 2022. Invited speaker: *AI, Emotions*

and *Sustainability*.

- Illusion of Control. Symposium, Royal Swedish Academy of Sciences (in collaboration with Para Limes, Arizona State University, Princeton University and Stockholm Resilience Centre), Stockholm Sweden, May 2023. Co-organiser.
- Nobel Prize Summit – Truth, Trust and Hope. Washington D.C., USA, May 2023. Co-organiser and contributor: *Nature and Society: Combating climate and health misinformation: finding common ground*.

Teaching and training

- Lecturer, Master's program, Stockholm Resilience Centre, Stockholm University.

New funding

- Sustainability, Emotions, and Intelligent Machines: The mechanisms, diffusion and effects of technology-mediated emotions on sustainability*, Marianne and Marcus Wallenberg Foundation, SEK 5.6 million, 2023-2026. Project participants: Victor Galaz (project lead), Therese Lindahl, Stefan Daume and Andreas Olsson.

Other

- Popular science article: Lyxkommunism hägrar när naturen blir digital (Luxury communism could be our digitalised future), Galaz, V. *Svenska Dagbladet*, Kultur, 19 August 2022.
- Popular science article: Maskinernas styrkor kan vändas mot dem (The strengths of machines can be turned against them). Galaz, V. *Svenska Dagbladet*, Kultur, 6 December 2022.
- Popular science article: Akademin får inte gå vilse i kulturkriget (We cannot let the academy get lost in the culture wars). Galaz, V. *Svenska Dagbladet*, Kultur, 9 March 2023.
- Popular science article: Recension: Norrskén – drömmen om den gröna industrin (Book review: Norrskén – the dream of a green industry). Galaz, V. *Svenska Dagbladet*, Kultur, 23 May 2023.
- Popular science article: Privata företag utmanar med ny klimatteknik (Climate technology? Private corporations are stepping up). Galaz, V. *Forskning & Framsteg*, 15 June 2023.



Johan Gars
PhD, Researcher

Research focus

Economic aspects of environmental issues, energy, and natural resources.

Publications

Journal articles

- Gars, J., D. Spiro, and H. Wachtmeister. 2022. The effect of European fuel-tax cuts on the oil income of Russia. *Nature Energy* 7(10):989-997.
- Hart, R., and J. Gars. 2022. The black paradox. *European Economic Review* 148:104211.
- Gars, J., and D. Spiro. 2023. Approximately optimal forest rotation in a nonstationary environment. *Natural Resource Modeling* e12372.

Reports and briefs

- Gars, J., D. Spiro, and H. Wachtmeister. 2022. European fuel tax cuts increase Russian oil profits. *Nature Energy* 7(10): 912-913.

Conferences, workshops and presentations

- Fourth Nordic Annual Environmental and Resource Economics (NAERE) Workshop. Swedish University of Agricultural Sciences (SLU), Uppsala, October 2022. Participant and presenter: *International business cycles: quantifying the effects of a world market for oil*.
- Research Group Meeting, Nordeuropeiska energiperspektiv (Nepp, Northern European energy perspectives). Stockholm, Sweden, April 2023. Participant.

Teaching and training

- Lecturer and module leader, Master's level course *Governance and management of social-ecological systems: Economic perspectives*, Stockholm Resilience Centre, Stockholm University, spring 2023.

Commissions

- Journal reviewer for *Environmental and Resource Economics*.



Patrik J.G. Henriksson
PhD, Affiliated researcher

Research focus

Aquaculture and seafood, identifying and promoting more sustainable aquaculture practices, modelling life cycle assessments (LCA) of food commodities, understanding inequalities role for the biosphere, and detailing antimicrobial use in aquaculture.

Publications

Journal articles

- Lambraki, I.A., M.V. Chadag, M. Cousins, T. Graells, A. Léger, P.J.G. Henriksson, M.F. Troell, S. Harbarth, D. Wernli, P.S. Jørgensen, C.A. Carson, E.J. Parmley, and S.E. Majowicz. 2023. Factors impacting antimicrobial resistance in the South East Asian food system and potential places to intervene: A participatory, one health study. *Frontiers in Microbiology* 13:1-17.
- Lambraki, I.A., M. Cousins, T. Graells, A. Léger, S. Abdelrahman, A.P. Desbois, R. Gallagher, B. Staaf Larsson, B. Mattson, P. Henriksson, M. Troell, P. Søgaard Jørgensen, D. Wernli, C.A. Carson, E.J. Parmley, and S.E. Majowicz. 2022. Governing antimicrobial resistance (AMR) in a changing climate: A participatory scenario planning approach applied to Sweden in 2050. *Frontiers in Public Health* 10:1-17.
- Wiloso, E.I., M. Romli, B.A. Nugraha, A.R. Wiloso, A. A.R. Setiawan, and P.J.G. Henriksson. 2022. Life cycle assessment of Indonesian canned crab (*Portunus pelagicus*). *Journal of Industrial Ecology* 26(6):1947-1960.
- Zaman, A.U., P.J.G. Henriksson, and A. Al Mamun. 2023. Fuel use intensity of hilsa fisheries in the lower Meghna River estuary of Bangladesh. *Fisheries Research* 263:106684.

Reports and briefs

- Henriksson, P.J.G., M. Troell, M. Jonell, F. Ziegler, S. Hornborg, and K. Bergman. 2023. *Sjömatslandet Sverige – Vart är vi på väg?* (Seafood Sweden – Where are we going?). SeaWin Policy Brief no. 7, SeaWin.
- Ziegler, F., S. Hornborg, M. Troell, P.J.G. Henriksson, and M. Jonell. 2023. *Lax – Hållbart och hälsosamt?* (Salmon – Healthy and sustainable?). SeaWin Policy Brief no. 6, SeaWin.

Working papers

- Henriksson, P.J.G., K. Bergman, V. Caldart, S. Curcurachi, J. B. Guinée, R. Heijungs, S. Hornborg, M. Jonell, N. Pelletier, M. Troell, P. Tyedmers, and F. Ziegler. 2022. Comparing apples and oysters – A review of dietary footprints. In: Vázquez-Rowe, I., R.K. Abedrabbo, and E.M. Sovero (eds.). *Proceedings of the 13th International Conference on Life Cycle Assessments of Foods (LCA Foods 2022)*. Pontificia Universidad Católica del Perú, Lima, Peru. p. 912.

Conferences, workshops and presentations

- LCAFood 2023. Conference, Lima, Peru, October 2022. Presenter.
- Hållbar blå mat 2030: Framtidens sjömat i Sverige (Sustainable Blue Food 2030: The future of aquatic foods in Sweden). Final seminar of SeaWin project, Royal Swedish Academy of Sciences, Stockholm, Sweden, November 2022. Organiser and speaker.
- IKAN-F3 x Inequality and the Biosphere Workshop. Yogyakarta, Indonesia, January 2023. Co-organiser and presenter.
- HESTIA Workshop. Oxford University, UK, March 2023. Participant.
- AMR Workshop. London, UK, March 2023. Participant.
- Inequality and the Biosphere project consortium meeting, Beijer Young Scholars II, Askö and Royal Swedish Academy of Sciences, May/June 2023. Co-organiser and participant.

Teaching and training

- Co-supervisor of PhD student Oskar Nyberg (DEEP, Stockholm University, Marine Ecotoxicology).
- Co-supervisor of PhD student Alena Goebel (Department of Biology, University of Oxford, Biology).

Commissions

- Journal Editor for *Sustainability Science*. Since 2021.
- Scientific advisor, SeaBOS. Since 2018.
- Scientific advisor, HESTIA. Since 2019.

Other

- Transdisciplinary collaboration: Scientific advisor to the collaboration between the Beijer Institute, Svenskt Tenn, and Beckmans School of Design: *Are we there yet?* Focus theme: Antibiotic resistance. Spring 2023.



Marie Huss
Operations manager

Co-ordinates 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. During the year, Marie was responsible for the move of the Beijer Institute and GEDB office back to its newly renovated premises in the main building. She managed the administrative part of the Board and the Askö meeting in September 2022 and Behaviour, economics and nature (BEN) workshop in May 2023 at the Academy. Also in May she co-organized a three-day "Illusion of Control" conference in the Beijer Hall at the Academy in collaboration with colleagues at the Beijer Institute and Para Limes.



Emmy Iwarsson
MSc, Research assistant

Research focus
Issues at the intersection between social justice/inequality and the environment, with a particular interest in food systems. Works as a research assistant within the Inequality and the Biosphere project, contributing to research on trade-offs and synergies between reducing social inequality and safeguarding the biosphere, as well as to the wider project coordination.

Conferences, workshops and presentations

- Scoping review workshop, Inequality and the Biosphere project, St Martin Lars en Sainte-Hermine, France, November 2022. Participant.
- IKAN-F3 x Inequality and the Biosphere Workshop. Yogyakarta, Indonesia, January 2023. Participant.
- Inequality and the Biosphere project consortium meeting, Beijer Young Scholars II, Askö and Royal Swedish Academy of Sciences, May/June 2023. Co-organiser and participant.



Krisztina Jónás
MSc, Research assistant

Research focus

Human behaviour, governance, biosphere (Behaviour, economics and nature programme), inequality and the biosphere (Inequality and the Biosphere project), anticipatory governance, aquatic ecosystems, just sustainability transitions.

Conferences, workshops and presentations

- Inner Development Goals Summit. Conference, Stockholm, Sweden, April 2022. Participant.
- Nor-Fishing. Conference and fair, Trondheim, Norway, August 2022. Participant.



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**

- Crona, B.I., E. Wassénius, M. Jonell, J.Z. Koehn, R. Short, M. Tigchelaar, T.M. Daw, C.D. Golden, J.A. Gephart, E.H. Allison, S.R. Bush, L. Cao, W.W.L. Cheung, F. DeClerck, J. Fanzo, S. Gelcich, A. Kishore, B.S. Halpern, C.C. Hicks, J.P. Leape, D.C. Little, F. Micheli, R.L. Naylor, M. Phillips, E.R. Selig, M. Springmann, U.R. Sumaila, M. Troell, S.H. Thilsted, and C. Wabnitz. 2023. Four ways blue foods can help achieve food system ambitions across nations. *Nature* 616:104-112.
- Wood, A., C. Queiroz, L. Deutsch, B. González-Mon, M. Jonell, L. Pereira, H. Sinare, U. Svedin, and E. Wassénius. 2023. Reframing the local-global food systems debate through a resilience lens. *Nature Food* 4:22-29.

Reports and briefs

- Gordon, L., H. Hansson, P.-A. Hansson, M. Jonell, M. Hellström, T. Lindahl, and U. Sonesson. 2023. *En tryggare och godare värld. Ett inspel till Livsmedelsstrategi 2.0*. (A safer and tastier world. A contribution to Sweden's National Food Strategy 2.0). Mistra Food Futures Policy Brief. Mistra Food Futures.
- Henriksson, P.J.G., M. Troell, M. Jonell, F. Ziegler, S. Hornborg, and K. Bergman. 2023. *Sjömatslandet Sverige – Vart är vi på väg?* (Seafood Sweden – Where are we going?). SeaWin Policy Brief no. 7, SeaWin.
- Ziegler, F., S. Hornborg, M. Troell, P.J.G. Henriksson, and M. Jonell. 2023. *Lax – Hållbart och hälsosamt?* (Salmon – Healthy and sustainable?). SeaWin Policy Brief no. 6, SeaWin.

Conferences, workshops and presentations

- Seminar at the Sustainable Society Design Center Graduate School of Frontier Science, University of Tokyo. Tokyo, Japan, September 2022. Presentation: *Sustainable seafood in the Anthropocene* (with Abigail Blandon).
- Mistra Food Futures Conference. Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden, October 2022. Presentation: *Matsveriges hållbarhetsmål – siktar de högt nog?* (Food Sweden's sustainability goals – are they aiming high enough?).
- Svenska Kockpriset i Gastronomisk Hållbarhet (Taste by Globe). Public event. Stockholm, Sweden, October 2022. Presentation: *Hälsosam och hållbar mat - vad är det och hur nå dit?* (Healthy and sustainable food – what is it and how do we get there?).
- Hållbar blå mat 2030: Framtidens sjömat i Sverige (Sustainable Blue Food 2030: The future of aquatic foods in Sweden). Final seminar of SeaWin project, Royal Swedish Academy of Sciences, Stockholm, Sweden, November 2022.

Presentation: *Hur styr vi mot hållbar sjömat-skonsumtion?* (How do we set course towards sustainable seafood consumption?).

- Påverkans dagligvaruhandelns hållbarhetsambitioner när konsumenten håller hårdare i plånboken? (Do consumers' limited budgets affect the sustainability ambitions of food retailers?). Webinar, online, Svensk Dagligvaruhandel (Swedish Food Retailers Foundation), March 2023. Presentation: *Hälsosam och hållbar mat - vilken roll kan handeln spela?* (Healthy and sustainable food – what is the role of supermarkets?).
- Sustainable Science Days. Conference, Helsinki University, Helsinki, Finland, May 2023. Seminar organiser: *Leverage points for food system transformation*.
- Hur kan producenter och dagligvaruhandelns samarbete för fler hållbara produkter på hyllan? (How can producers and the retail sector collaborate towards more sustainable products on the shelves?). Webinar, online, Matlust & Royal Swedish Academy of Sciences, June 2023. Organizer.

Teaching and training

- Lecturer, undergraduate course, *Sustainability perspectives on contemporary fisheries – Where have all the fishes gone?* Swedish University of Agricultural Sciences (SLU), October 2022.
- Main supervisor of PhD student Abigail Blandon (Stockholm Resilience Centre, Stockholm University).

Other

- Popular science article: Mat är mycket mer än näring (Food is much more than nutrition). Gordon, L., H. Hansson, P.-A. Hansson, M. Jonell, M. Hellström, T. Lindahl, and U. Sonesson. Land *Lantbruk & Skogsbruk*, debate article, May 30 2023.



Sofia-Kristin Kokinelis
MSc, Finance and HR Administrator

Works for both the Beijer Institute and the Global Economic Dynamics and the Biosphere Programme (GEDB) at the Royal Swedish Academy of Sciences. Deals with accounting, financial reporting and budgeting, and also 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 the Beijer Institute and Stockholm Resilience Centre (SRC), her work 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 articles**

- Wei, C., Y. Xu, and C.Z. Li. 2022. Recent advances in China's sustainable transition studies. *Letters in Spatial and Resource Sciences* 15:279-286.
- Wei, C., C.Z. Li, A. Löschel, S. Managi, and T. Lundgren. 2023. Digital technology and energy sustainability: Recent advances, challenges, and opportunities. *Resources, Conservation and Recycling* 190:106803.

Conferences, workshops and presentations

- PACE Annual Conference on Environmental and Resource Economics. Hangzhou, China, July 2022. Presentation: *The economics of tipping points*.



Therese Lindahl
PhD, Programme director

Research focus

Human behaviour in social-ecological systems, including how ecosystem dynamics (e.g. threshold effects, uncertainty and resource variability) influence resource users' exploitation and cooperation behaviour and implications for natural resource management. Attitudes and perceptions towards the environment and towards environmental policy. Methods for changing behaviour.

Publications**Journal articles**

- Lindahl, T., and R. Jarungrattanapong. 2023. Avoiding catastrophic collapse in small-scale fisheries through inefficient cooperation: Evidence from a framed field experiment. *Environment and Development Economics* 28(2):111-129.

Reports and briefs

- Gordon, L., H. Hansson, P.-A. Hansson, M. Jonell, M. Hellström, T. Lindahl, and U. Sonesson. 2023. *En tryggare och godare värld. Ett inspel till Livsmedelsstrategi 2.0*. (A safer and tastier world. A contribution to Sweden's National Food Strategy 2.0). Mistra Food Futures Policy Brief. Mistra Food Futures.

Working papers

- Lindahl, T., and N. Linder. 2023. Beijer Discussion Paper 279: What factors influence the choice between fish and meat among grocery shoppers? Insights from an unsuccessful nudge intervention. *Beijer Discussion Paper Series*.

Conferences, workshops and presentations

- I tider av kris – hur håller vi kursen mot hållbar mat, vatten och skog?* (In times of crisis – how do we keep on course towards sustainable food, water and forestry?). Open seminar organised by Mistra during Almedalen 2022, Visby, Sweden, July 2022. Panel participant.

- 30th Askö Meeting: Anthropocene subsidies: Extinction or prosperity? Royal Swedish Academy of Sciences, Askö and Stockholm, Sweden, September 2022. Participant.
- Hållbara livsmedelssystem i en föränderlig värld (Sustainable food systems in a changing world). Conference organised by Mistra Food Futures, Uppsala, Sweden, October 2022. Participant, presenter and co-organiser.
- Hållbart Näringsliv 2022. Conference, Stockholm, Sweden, November 2022. Panel participant: *Scope 3 – så tar du kontroll över utsläppen i konsumentledet* (Scope 3 – how you take control of the emissions on the consumer side of the value chain).
- Hur får vi mer hållbar svensk mat? – Inspel till Svensk Livsmedelsstrategi (How do we get more sustainable Swedish food? – a contribution to Sweden's National Food Strategy). Seminar, Kungliga Skogs och Lantbruksakademien (KSLA), Stockholm, Sweden, February 2023. Presenter and panel participant.
- Mistra Sustainable Consumption/Centre for Collective Action Research (CeCAR) Workshop. Nääs, Sweden, February 2023. Presenter and participant.
- Nordic Food Environments and Behavior Change for Better Diet. Workshop organised by Nordregio, Stockholm, Sweden, March 2023. Presenter and participant.
- Leveraging intrinsic tribal behaviours for planetary stewardship. Workshop within the Behaviour, economics and nature (BEN) programme, Royal Swedish Academy of Sciences, Stockholm, Sweden, May 2023. Organiser and chair.

Teaching and training

- Co-supervisor of PhD candidate Krisztina Jonnas (The Norwegian College of Fishery Science, Arctic University of Norway, Tromsø).
- Co-supervisor of PhD candidate Noah Linder (Department of Building, Energy, and Environmental Engineering, University of Gävle, Gävle). Examination: 9 September 2022.
- Lecturer, Master's level course *Governance and management of social-ecological systems: Economic perspectives*, Stockholm Resilience Centre, Stockholm University, spring 2023.
- Lecturer, undergraduate level course *Ekologisk ekonomi* (Ecological economics), Department of Physical Geography and Stockholm Resilience Centre, Stockholm University, autumn 2022.
- Lecturer, undergraduate level course *Environmental management in planning*, Department of Physical Geography, Stockholm University, autumn 2022.
- Lecturer, undergraduate level course *Världens eko* (The world's eco), Stockholm University, autumn 2022.

Commissions

- Grading PhD examination committee member for Sebastian Tebbe, Institute for International Economic Studies (IIES), Stockholm University, Stockholm, Sweden, June 2023.
- Member of the board, Master's programme in Sustainability: Environment and Decision Making, University of Gävle, Gävle, Sweden.

- Member of the board, Centre for Evolutionary Cultural Research, Stockholm University, Stockholm, Sweden.
- Associate, South American Institute for Resilience and Sustainability Studies (SARAS).
- Journal reviewer for *Nature Sustainability*, *Ecological Economics*, *Environmental and Resource Economics*.

Other

- Blog post: I tider av kris – hur håller vi kursen mot hållbar mat? (In times of crisis – how do we keep on course towards sustainable food?), *Mistra Food Futures Blog* (<https://mistrafood-futures.se/sv/blog/i-tider-av-kris-hur-haller-vi-kursen-mot-hallbar-mat/>), 27 June 2022.
- Blog post: Acceptans för politisk styrning med syfte att påverka matkonsumtion kan bero på så mycket (Acceptance for political steering with the purpose to change food consumption can depend on so many things), *Mistra Food Futures Blog* (<https://mistrafoodfutures.se/sv/blog/acceptans-for-politisk-styrning-med-syfte-att-paverka-matkonsumtion-kan-beropa-sa-mycket/>), 9 January 2023.
- Popular science article: Mat är mycket mer än näring (Food is much more than nutrition). Gordon, L., H. Hansson, P-A. Hansson, M. Jonell, M. Hellström, T. Lindahl, and U. Sonesson. *Land Lantbruk & Skogsbruk*, debate article, 30 May 2023.

New funding

- *Sustainability, Emotions, and Intelligent Machines: The mechanisms, diffusion and effects of technology-mediated emotions on sustainability*, Marianne and Marcus Wallenberg Foundation, SEK 5.6 million, 2023-2026. Project participants: Victor Galaz (project lead), Therese Lindahl, Stefan Daume, and Andreas Olsson.



Arvid Marklund
MSc, Research assistant

Research focus

Risks and opportunities associated with emotionally responsive AI models in the context of sustainability, the use of Large Language Models in social bot-mediated climate disinformation on social media, and how technology can be leveraged to inherently facilitate pro-social activities, such as cooperation, trust and sharing of resources.

Publications

Reports and briefs

- Galaz, V., H. Metzler, S. Daume, A. Olsson, B. Lindström, and A. Marklund. 2023. *Climate misinformation in a climate of misinformation*. Online research brief. Stockholm Resilience Centre (Stockholm University) and the Beijer Institute of Ecological Economics (Royal Swedish Academy of Sciences).

Conferences, workshops and presentations

- Automated climate mis- and disinformation? Round table event, Royal Swedish Academy of

Sciences, Stockholm, Sweden, November 2022. Co-organiser and presentation: *Dynamically GPT-3 generated climate disinformation*.

- Illusion of Control. Symposium, Royal Swedish Academy of Sciences (in collaboration with Para Limes, Arizona State University, Princeton University and Stockholm Resilience Centre), Stockholm Sweden, May 2023. Co-organiser and manager of the conference tech-team.

Other

- Paternal leave: 50% from February 2023.



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 data science, 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, related to the Beijer Institute

Journal articles

- Ghermandi, A., J. Langemeyer, D. Van Berkel, F. Calcagni, Y. Depietri, L. Egarter Vigl, N. Fox, I. Havinga, H. Jäger, N. Kaiser, O. Karasov, T. McPhearson, S. Podschun, A. Ruiz-Frau, M. Sinclair, M. Venohr, and S.A. Wood. 2023. Social media data for environmental sustainability: A critical review of opportunities, threats, and ethical use. *One Earth* 6(3):236-250.
- Wang, J., T. McPhearson, W. Zhou, E.M. Cook, P. Herreros-Cantis, and J. Liu. 2023. Comparing relationships between urban heat exposure, ecological structure, and socio-economic patterns in Beijing and New York City. *Landscape and Urban Planning* 235:104750.

Conferences, workshops and presentations related to the Beijer Institute

- Ocellus XR: Visualizing Climate Risk, Vulnerability, and Equity in NYC. Public seminar, online, 10 October, 2022. <https://publicseminar.org/2022/10/ocellus-xr-visualizing-climate-risk/>
- Ecological Society of America Meeting. Montreal, Canada, August 2022. Presentation (with Grimm, N.B., M. Berbé-Blázquez, E. Cook, S. Markolf, D. Iwaniec, and T. Munoz-Erickson): *Urban social-ecological-technological resilience for the Anthropocene*.

New funding

- *Climate!Q*. Google.org Climate Innovation Impact Challenge. Pending: USD 5M. Lead: Timon McPhearson



Belinda Reyers
Professor, Senior Research Fellow

Research focus

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

Publications

Journal articles

- Bennett, E., and B. Reyers. Reimagining human-environment interactions for the Anthropocene. *People and Nature*, in press.
- Biggs, R., H.S. Clements, G.S. Cumming, G. Cundill, A. de Vos, M. Hamann, L. Luvuno, D. J. Roux, O. Selomane, R. Blanchard, J. Cockburn, L. Dziba, K. J. Esler, C. Fabricius, R. Henriksson, K. Kotschy, R. Lindborg, V.A. Masterson, J.L. Nel, P. O'Farrell, C.G. Palmer, L. Pereira, S. Pollard, R. Preiser, R.J. Scholes, C. Shackleton, S. Shackleton, N. Sitas, J.A. Slingsby, M. Spierenburg, M. Tengö, and B. Reyers. 2022. Social-ecological change: insights from the Southern African Program on Ecosystem Change and Society. *Ecosystems and People* 18(1):447-468.
- Biggs, R., B. Reyers, R. Blanchard, H. Clements, J. Cockburn, G.S. Cumming, G. Cundill, A. de Vos, L. Dziba, K.J. Esler, and C. Fabricius. 2023. The Southern African Program on Ecosystem Change and Society: An emergent community of practice. *Ecosystems and People* 19(1).

Reports and briefs

- Reyers, B. 2022. SPOTLIGHT 1.4 People-planet relationships in an uncertain, unsettled world. In: UNDP (United Nations Development Programme). *Human Development Report 2021-22: Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World*. New York, US.

Conferences, workshops and presentations

- IIASA 50th Anniversary Conference. IIASA and Austrian Academy of Sciences, Vienna, Austria, November 2022. Opening plenary address: *Navigating the dynamics of people-planet relationships - a social-ecological systems perspective: Systems analysis for reducing footprints and enhancing resilience*.
- Natural Capital Conversations Webinar. Stanford University, USA (online), November 2022. Session lead and speaker: *Is the science and practice of resilience changing the way we do development?*
- 150th Anniversary of the International Law Association (ILA): SDGs BEYOND 2030. Online, 14 February 2023. Panellist.
- Africa Week 2023: Open Africa, Open Science. Future Africa, Pretoria, South Africa, May 2023. Plenary speaker: Opening pathways to action: Unlocking the science-policy-practice interface.

Teaching and training

- Main supervisor of postdocs R. Davids and V. Mokoka (University of Pretoria, in collaboration with Stanford University and the Beijer Institute).

- Lecturer, Swedish Institute Catalysing Change Faculty (Africa public sector focus).

Commissions

- Advisory board member, United National Development Program – Human development report 2022 and 2023, New York, U.S.
- Review Editor, Intergovernmental Science Policy Platform for Biodiversity and Ecosystem Services, Transformative change assessment, 2022.
- Member, the Scientific Council of Montpellier University's Advanced Knowledge Institute on Transitions (MAK'IT), Montpellier, France, since 2019.
- Subject Editor: Current opinion in environmental sustainability, since 2019.
- Assembly member, Future Earth.

Other

- Faculty member, Cambridge Institute for Sustainability Leadership Programme (Business Leaders Africa).
- Advisor, Inequality and the Biosphere project, Beijer Institute.



Caroline Schill
PhD, Researcher

Research focus

Human behaviour in complex and 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, uncertainty and inequalities.

Publications

Journal articles

- Ntuli, H., A.-S. Crépin, C. Schill, and E. Muchapondwa. 2023. Sanctioned quotas versus information provisioning for community wildlife conservation in Zimbabwe: A framed field experiment approach. *Environmental and Resource Economics* 84(3):775-823.
- Schill, C., and J.C. Rocha. 2023. Sustaining local commons in the face of uncertain ecological thresholds: Evidence from a framed field experiment with Colombian small-scale fishers. *Ecological Economics* 207:107695.
- West, S., and C. Schill. 2022. Negotiating the ethical-political dimensions of research methods: A key competency in mixed methods, inter- and transdisciplinary, and co-production research. *Humanities and Social Sciences Communications* 9(1):1-13.

Conferences, workshops and presentations

- Conducting Research Together: Methods and Methodologies in Cross-Cutting Research Endeavours, CIRCUS (Centre for Integrated Research on Culture and Society at Uppsala University) Symposium 2022, Humanities Theatre, Uppsala University, Uppsala, Sweden, October 2022. Invited talk (together with Simon West): *Negotiating the ethical-political aspects of methods in inter- and transdisciplinary research*.

- Scoping review workshop, Inequality and the Biosphere project, St Martin Lars en Sainte-Hermine, France, November 2022. Co-organiser and participant.
- Conceptualizing and Navigating Earth Resilience in the Anthropocene, LOOPS-5 Workshop, ERA (Earth Resilience in the Anthropocene) project, Högberga Gård, Lidingö, Sweden, March 2023. Participant.
- Leveraging intrinsic tribal behaviours for planetary stewardship. Workshop within the Behaviour, economics and nature programme (BEN), Royal Swedish Academy of Sciences, Stockholm, May 2023. Co-organiser and participant.
- Inequality and the Biosphere project consortium meeting, Beijer Young Scholars II, Askö and Royal Swedish Academy of Sciences, May/June 2023. Co-organiser and participant.
- Stockholm Resilience Centre Science Retreat, Långholmen, Stockholm, Sweden, June 2023. Participant.

Teaching and training

- Module leader, lecturer and examiner, Master's level course *Governance and management of social-ecological systems: Theories and methods for governance of the commons*, Stockholm Resilience Centre, Stockholm University, spring 2023.
- Main supervisor of Master's students Ylva Skoogh and Sophia Queckenberg (Social-Ecological Resilience for Sustainable Development, Stockholm Resilience Centre, Stockholm University).
- Main supervisor of Master's student Jesús Manuel Jiménez Torres (Sustainable Territorial Development, University of Magdalena, Santa Marta, Colombia).
- Co-supervisor of Interacting Complexities theme intern Erwan Gardies (Stockholm Resilience Centre, Stockholm University).
- External reviewer of Individual Study Plan for PhD students Agnes Pranindita, Carolin Seiferth and Emmy Wassénus (Sustainability Science, Stockholm Resilience Centre, Stockholm University).

Commissions

- Post doc mentor, Anthropocene Laboratory, Royal Swedish Academy of Sciences, Stockholm, Sweden. Since March 2023.
- Theme Leader, Interacting Complexities research theme (together with Emilie Lindqvist and Juan C. Rocha), Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden. Since August 2020.
- Member of the Careoperative (leadership collective experiment for sustainability transformations). Since 2019.
- Journal reviewer for *Data in Brief*, *Ecological Economics*, *Global Sustainability*, *Nature Sustainability*, and *Philosophical Transaction of the Royal Society B*.

Other

- Fieldwork: San Antero and Bahía Solano, Colombia. In collaboration with Lina M. Saavedra-Díaz and her team from University of Magdalena, Santa Marta. Framed field

- experiments, interviews and focus groups with small-scale fishers within the VR-funded (Swedish Science Council) project "Improving strategies for dealing with increasing resource scarcity and variability in small-scale fisheries" and Formas-funded (Government Research Council for Sustainable Development) project "Climate change - from the small-scale fisher's point of view", August and December 2022.
- Fieldwork: Wainwright, Alaska, USA. In collaboration with Kinga Psiuk (Stockholm Resilience Centre) and Tracie Curry (NorthernSER, Alaska). Photovoice study within the Formas-funded project "Living with the 'new normal': Exploring human responses to abrupt environmental change in the Arctic using behavioural and interpretive social science", June 2023.
- Parental leave: September–December 2022 (15%); January–April 2023 (10%).



Agneta Sundin
Communications officer

Tasks include 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. 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

- Allakulov, U., S. Cocciolo, B. Das, M.A. Habib, L. Rambjer, and A. Tompsett. 2023. Transparency, governance, and water and sanitation: Experimental evidence from schools in rural Bangladesh. *Journal of Development Economics* 163:103082.
- Habib, M.A., S. Cocciolo, M.A. Haque, M.M.A. Raihan, P. Bhattacharya, and A. Tompsett. 2023. How to clean a tubewell: The effectiveness of three approaches in reducing coliform bacteria. *Science of the Total Environment* 872:161932.

Working papers

- Habib, M.A., M. Madajewicz, and A. Tompsett, 2023. *When does community participation in decision-making improve outcomes? Evidence from a field experiment in Bangladesh*. Asian Development Bank Working Paper, in press.

Conferences, workshops and presentations

- Seminar at University of Munich, Germany, November 2022. 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 2022. Presenter: *Understanding institutional persistence: Exposure to community-driven development and the value of autonomy and democracy*.
- WASH Economics Conference. London School of Tropical Medicine and Hygiene, London, England, March 2023. Presenter: *When does community participation in decision-making improve outcomes? Evidence from a field experiment in Bangladesh*.
- Energy Policy Institute at the University of Chicago Junior Workshop. Chicago, USA, March 2023. Presenter: *Participation can increase sustainability*.

Teaching and training

- Main supervisor of PhD student Tillmann von Carnap (Institute of International Economic Studies, Stockholm University) Defense: 1 June 2023.
- Main supervisor of PhD student Chiara Latour (Stockholm University).
- Co-supervisor of PhD student Md. Ahasan Habib (KTH Royal Institute of Technology).
- Co-supervisor of PhD student Stephan Schneider (ETH Zurich).
- Main supervisor of PhD student Nicklas Nordfors (Stockholm University).
- Co-supervisor of PhD student Evelina Linnros (Institute of International Economic Studies, Stockholm University).
- Co-supervisor of PhD student Merve Demirel (Institute of International Economic Studies, Stockholm University).
- Co-lecturer, Master's level course *Environment and local communities*, Stockholm University, autumn 2022.
- Co-lecturer, Master's level course *Environment, markets and politics*, Stockholm University, autumn 2022.
- Co-lecturer, PhD level course *From idea to paper: Writing a paper in development and experimental economics*, spring 2023.
- Course leader, PhD level course *Towards clarity and grace in academic writing*, spring 2023.
- Course leader, PhD level course *Development Economics I*, Stockholm University, autumn 2022.

Commissions

- External reviewer for PhD student Linn Mattisson (Lund University), March 2023.
- Journal reviewer for *British Journal of Political Science*, *Environmental Science and Technology*, *Journal of Development Economics*, *Journal of Health Economics* and *Journal of Political Economy Microeconomics*.

New funding

- The Marketplace Activity Index: Towards real-time economic monitoring in remote and conflict-affected regions using satellite imagery*, Riksbankens Jubileumsfond Research Infrastructure Grant, SEK 7 563 000, 2023-2025. Project participants: Anna Tompsett (project lead), Tillmann von Carnap and Jakob Svensson (International Institute for Economic Studies, Stockholm University).

- Mobilizing private resources for public services: The transition to private water sources in rural Bangladesh*, International Growth Centre Research Grant, GBP 40,000, 2023-2024. Project participants: Anna Tompsett (project lead) and Md. Ahasan Habib (NGO Forum for Public Health, Bangladesh, and KTH, Sweden).
- The last mile: The impacts of market access improvements in remote rural Mozambique*, International Growth Centre Research Grant GBP 70,000, 2023-2026. Project participants: Anna Tompsett (project lead), Tillmann von Carnap (International Institute for Economic Studies, Stockholm University) and Paul Christian, Stephen Glover, Dahyeon Jeong and Astrid Zwager (World Bank, Washington D.C.).



Max Troell
Associate Professor,
Programme Director

Research focus

Sustainability of the global seafood system, aquaculture, capture fisheries, governance of coastal and marine ecosystems, coastal livelihoods, ecosystem functions and services, mangroves, biodiversity, resilience, regime shifts, food systems, nutrition and food security, ocean acidification, integrated aquaculture, food/seafood trade dynamics, sustainability metrics, circular economy, life-cycle analysis, eco-certification, antibiotics.

Publications

Journal articles

- Cao, L., B.S. Halpern, M. Troell, M., R. Short, C. Zeng, Z. Jiang, Y. Liu, C. Zou, S. Liu, C. Liu, X. Liu, W.W.L. Cheung, R. Cottrell, F. Declerk, S. Gelcich, J.A. Gephart, C.D. Golden, D. Godo-Solo, J.I. Kaulf, F. Micheli, R.L. Naylor, H.J. Payne, E.R. Selig, U.R. Sumaila, and M. Tigchelaar. 2023. Vulnerability of blue foods to human-induced environmental change. *Nature Sustainability*.
- Crona, B., E. Wassénius, M. Jonell, J.Z. Koehn, R. Short, M. Tigchelaar, T.M. Daw, C.D. Golden, J.A. Gephart, E.H. Allison, S.R. Bush, L. Cao, W.W.L. Cheung, F. DeClerck, J. Fanzo, S. Gelcich, A. Kishore, B.S. Halpern, C.C. Hicks, J. Leape, D.C. Little, F. Micheli, R.L. Naylor, M. Phillips, E.R. Selig, M. Springmann, U.R. Sumaila, M. Troell, S.H. Thilsted, and C. Wabnitz. 2023. Four ways blue foods can help achieve food system ambitions across nations. *Nature* 616:104-112.
- Diedrich, A., S. Duce, H. Eriksson, H. Govan, D. Harohau, G. Koczberski, J. Lau, D. Mills, T. Minter, D. Steenbergen, and M. Troell. 2022. An applied research agenda for navigating diverse livelihood challenges in rural coastal communities in the tropics. *One Earth* 5(11):1205-1215.
- Lambraki, I.A., M.V. Chadag, M. Cousins, T. Graells, A. Léger, P.J.G. Henriksson, M.F. Troell, S. Harbarth, D. Wernli, P.S. Jørgensen, C.A. Carson, E.J. Parmley, and S.E. Majowicz. 2023. Factors impacting antimicrobial resistance in the South East Asian food system and potential places to intervene: A participatory, one health study. *Frontiers in Microbiology* 13:1-17.
- Leape, J., F. Micheli, M. Tigchelaar, E.H. Allison, X. Basurto, A. Bennett, S. Bush, L. Cao, B. Crona, F. Declerk, J. Fanzo, S. Gelcich, J.A. Gephart,

- C.D. Golden, C.C. Hicks, A. Kishore, J.Z. Koehn, D.C. Little, R.L. Naylor, E.R. Selig, R.E. Short, U.R. Sumaila, S.H. Thilsted, M. Troell, and C. Wabnitz. 2023. The vital roles of blue foods in the global food system. In: von Braun, J., Afsana, K., Fresco, L.O., Hassan, M.H.A. (eds.) *Science and Innovations for Food Systems Transformation*. Springer, Cham, Switzerland, pp. 401-420.
- Sandström, V., A. Chrysafi, M. Lamminen, M. Troell, M. Jalava, J. Piipponen, J. Siebert, O. van Hal, V. Virkki, and M. Kumm. 2022. Food system by-products upcycled in livestock and aquaculture feeds can increase global food supply. *Nature Food* 3(9):729-740.
- Troell, M., B. Costa-Pierce, C. Stead, R.S. Cottrell, C. Brugere, A.K. Farmery, D. Little, Å. Strand, R. Pullin, D. Soto, M. Beveridge, K. Salie, J. Dresdner, P. Moraes-Valenti, J. Blanchard, P. James, R. Yossa, E. Allison, C. Devaney, and U. Barg. 2023. Perspectives on aquaculture's contribution to the Sustainable Development Goals for improved human and planetary health. *Journal of the World Aquaculture Society* 54(2):251-342.

Reports and briefs

- Henriksson, P.J.G., M. Troell, M. Jonell, F. Ziegler, S. Hornborg, and K. Bergman. 2023. *Sjömatssländet Sverige – Vart är vi på väg?* (Seafood Sweden – Where are we going?). SeaWin Policy Brief no. 7, SeaWin.
- Majowicz, S.E., I.A. Lambraki, M. Cousins, E.J. Parmley, P. Søgaard Jørgensen, T. Graells, M. Troell, and D. Wernli. 2022. Factors influencing antimicrobial resistance in food systems & recommendations for long-term governance under a changing climate - Research brief. University of Waterloo, Waterloo, Canada.
- O'Dell, A., A. Adrian, M. Canvin, F. de Bettignies, K. Filbee-Dexter, R. Grisenthwaite, A. Hughes, K. Hancke, D. Krause Jensen, A. Macleod, P. Moore, A. Ricart, J. Rostan, C. Smeaton, M. Stanley, D. Smale, J.-B. Thomas, M. Troell, and M. Burrows. 2023. *Blue Forests – A review of carbon offset strategies with seaweed aquaculture – feasibility, current knowledge, and suggestions for future research*. Report number: 20230202. Scottish Association for Marine Science (SAMS) and Scottish Government.
- Ziegler, F., S. Hornborg, M. Troell, P.J.G. Henriksson, and M. Jonell. 2023. *Lax – Hållbart och hälsosamt?* (Salmon – Healthy and sustainable?). SeaWin Policy Brief no. 6, SeaWin.

Working papers

- Gephart, J., R.A. Bejarano, K. Gorospe, A. Godwin, C.D. Golden, R.L. Naylor, K.L. Nash, M.L. Pace, and M. Troell. 2023. Globalization of wild capture and farmed aquatic foods. Authorea Preprints, Authorea, ESS Open Archive . February 09, 2023. DOI: 10.22541/essoar.167590829.99780929/v1.

Conferences, workshops and presentations

- Blue Carbon International Policy Challenge. Scottish Blue Carbon Forum, Oban, Scotland (online), September 2022. Invited expert and speaker.
- APEC workshop, online, September 2022. Pres-

entation: *Strategies to Reduce Antimicrobial Use: Seafood Business for Ocean Stewardship (SeaBOS)*.

- SEABOS CEO Workshop, Amsterdam, the Netherlands, October 2022. Speaker.
- Hållbar blå mat 2030: Framtidens sjömat i Sverige (Sustainable Blue Food 2030: The future of aquatic foods in Sweden). Final seminar of SeaWin project, Royal Swedish Academy of Sciences, Stockholm, Sweden, November 2022. Organiser and speaker.
- Sjömatens utmaningar och möjligheter* (Aquatic foods – challenges and opportunities) Ax-foundation Innovation Hub, Sweden. December 2022. Presentation.
- MOORE Project workshop (with Stanford University). Online, January 2023. Participant.
- Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa (FASA). Webinar, WorldFish and SLU, March 2023. Speaker.
- Workshop on Antibiotic Resistance. Stirling University, London, U.K, March 2023. Speaker.
- SeaBOS Technical Working Group meeting. Stockholm, Sweden, May 2023. Speaker.
- Antibiotic dialogue for food retailers Sweden (Theme: Seafood). Axfoundation, Sweden, May 2023. Presenter.

Teaching and training

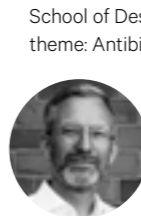
- Co-supervisor of PhD student Ola Luthman (Södertörn University).
- Supervisor of Master's student Christopher Frånberg (DEEP, Stockholm University).
- Moderator of PhD defence of Blanca González-Mon (Stockholm Resilience Centre, Stockholm University), September 2022.
- Supervisor, Independent work 15 p Biology, Stockholm University, Beata Wolgers, *Aquaculture in Bangladesh: Its contribution to the global Sustainable Development Goals*, Spring semester 2023.
- Lecturer, Belmont Forum Project, *Anthropocene and oceans* and *Aquaculture*, February 2023.

Commissions

- Marine and Coastal Science for Management (MASMA) Program. Committee member and research reviews and programme support. Western Indian Ocean Marine Science Association, since 2007-2023.
- Reviewer on Communication research call, FORMAS, 2022-2023.
- Scientific Advisor, Dutch Research Council project 2022-2025: Regional innovation for circular low trophic aquaculture production in the Dutch North Sea (CIRCAQUA).
- Researcher responsible for joint work on antibiotics, SeaBOS.
- Review editor for *Journal of Aquaculture Environment Interactions (AEI)* and *Frontiers in Marine Science*.
- Editorial board member, Western Indian Ocean Journal of Marine Science.
- Member, Blue/Aquatic Food Action Coalition.

Other

- Transdisciplinary collaboration: Organiser and supervisor of the collaboration between the Beijer Institute, Svenskt Tenn, and Beckmans



Henrik Österblom
Professor, Senior Research Fellow

Research focus

Collaboration for biosphere stewardship.

Publications

Journal articles

- Österblom, H., J. Bebbington, R. Blasiak, M. Sobkowiak, C. Folke. 2022. Transnational Corporations, Biosphere Stewardship, and Sustainable Futures. *Annual Review of Environment and Resources* 47:609-635.
- Österblom, H., and R. Blasiak. 2022. Credibility at stake in Sweden. *Science* 378:337.
- Blasiak, R., J.-B. Jouffray, D.J. Amon, F. Moberg, J. Claudet, P. Jørgensen, A. Pranindita, C. Wabnitz, H. Österblom. 2022. A forgotten element of the blue economy: Marine biomimetics and inspiration from the deep sea. *PNAS Nexus* 1(4).
- Blasiak, R., J.-B. Jouffray, D.J. Amon, J. Claudet, P. Dunshirn, P. Søgaard Jørgensen, A. Pranindita, C. Wabnitz, E. Zhivkopljas, H. Österblom. 2023. Making marine biotechnology work for people and nature. *Nature Ecology and Evolution*, in press.

Books

- Österblom, H. 2023. *The Sounds of Science – Orchestrating Stewardship in the Seafood Industry*. Academic Press, in press.

Conferences, workshops and presentations

- SeaBOS CEO Workshop, Amsterdam, the Netherlands, October 2022. Co-organizer.
- SeaBOS Technical Working Group meeting, Stockholm, Sweden, May 2023. Co-organizer.

Teaching and training

- Main Supervisor of PhD student Frida Bengtsson (Stockholm Resilience Centre, Stockholm University)

Commissions

- Director, The Anthropocene Laboratory, Royal Swedish Academy of Science, Stockholm, Sweden. Since 2022.
- Chair, Natural Capital Partnership Committee, Stanford University, Stanford, U.S. Since 2022.
- Chairman, SeaBOS Fundraising Foundation. Since 2019.
- Board Member, Race for the Baltic Fundraising Foundation. Since 2018.

Other

- TV interview: Interviewed in Swedish TV4, regarding the High Seas Treaty, March 2023.

All publications

Journal articles

- Aggarwal, R.M., and J.M. Anderies. 2023. Understanding how governance emerges in social-

ecological systems: Insights from archetype analysis. *Ecology and Society* 28(2):2.

- Allakulov, U., S. Cocciolo, B. Das, M.A. Habib, L. Rambjer, and A. Tompsett. 2023. Transparency, governance, and water and sanitation: Experimental evidence from schools in rural Bangladesh. *Journal of Development Economics* 163:103082.
- Anderies, J.M., G.S. Cumming, H.S. Clements, S.J. Lade, R. Seppelt, S. Chawla, and B. Müller. 2022. A framework for conceptualizing and modeling social-ecological systems for conservation research. *Biological Conservation* 275:109769.
- Arvaniti, M., C.K.B. Krishnamurthy, and A.-S. Crépin. 2023. Time-consistent renewable resource management with present bias and regime shifts. *Journal of Economic Behavior & Organization* 207:479-495.
- Baggio, J.A., J. Freeman, T.R. Coyle, and J.M. Anderies. 2022. Harnessing the benefits of diversity to address socio-environmental governance challenges. *PLOS ONE* 17(8):e0263399.
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