



GLOBAL ECONOMIC DYNAMICS
AND THE BIOSPHERE

THE ROYAL SWEDISH ACADEMY OF SCIENCES

The Erling-Persson Family Academy Programme



Global Economic
Dynamics and the
Biosphere
Annual Report 2023

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Directors' note

The year 2023 saw a sad record, with 63 major weather-related disasters hitting the world, each resulting in billions of dollars in damage. In fact, according to Yale Climate Connections, seven nations had their most expensive weather disaster ever in this past year. It is becoming increasingly clear that the costs of these events are being exacerbated by reduced capacity of natural ecosystems to buffer the rapid fluctuations and extremes appearing in the wake of a changing climate.

The strong interconnections between the biosphere, the climate and global economic dynamics are at the very heart of research conducted at the GEDB Academy programme. As in previous years, in 2023 our team worked hard to deliver new scientific insights that can inspire real change in practice and policy. Our research has shown how global health, biodiversity and antibiotic resistance can be approached from a systems perspective. The insights gained have been fed into dialogues with policy makers and practitioners in Sweden and internationally.

“The demand for our research is greater than ever and we see this as a sign of increasing awareness among decision makers...”

The demand for our research is greater than ever and we see this as a sign of increasing awareness among decision makers that a sustainable future will require a reinforcing relationship between the economy, societal development and the living planet. GEDB is happy and proud to be one of the science organisations to whom leading institutions can turn for knowledge on a complex but urgent topic.

As directors, we feel great pride in our researchers, but also gratitude, as they work hard to break new terrain and produce high-quality science of relevance for human and biosphere health and economic prosperity. Naturally, this gratitude extends to the Erling-Persson Family Foundation, whose generous support and commitment allow us to continue do science for change while building the next generation of transdisciplinary sustainability scholars.

Carl Folke
Director

Beatrice Crona
Executive Director

Aims and visions

To create a platform for interdisciplinary collaboration on the challenges of global change and sustainability, with specific focus on how local-to-global, cross-scale interactions affect human wellbeing and sustainable use of natural resources and ecosystems.

To facilitate and promote collaboration between early-career academics from diverse backgrounds focusing on sustainability science.

To combine diverse knowledge systems and experiences and conduct research for a broader understanding about the preconditions and opportunities for sustainable societal development in the new global context of the Anthropocene.

Research achievements and activities

PHOTO: ISTOCK

Biosphere Finance

The overarching ambition with research within this theme is to uncover and examine various links between corporate and financial actors and the biosphere, and to develop research that can enhance the ability to improve practices and promote biosphere stewardship in corporate and financial spheres.

A testimony to our scientific impact with our novel take on sustainable finance is that in 2023 we were contacted by One Earth, a relatively new interdisciplinary journal that has rapidly gained a high impact factor (16.2), to write a synthetic review. Specifically, we were asked to synthesise some of the key insights from applying a sustainability and systems science lens to sustainable finance. The review was submitted in December 2023 and we await publication in 2024.

Bringing nature into corporate and financial risk monitoring

At a time of both large-scale corporate environmental impact and ambitious corporate goals to reduce and reverse degradation, there is an urgent need to understand, monitor and assess the impacts of economic activities. There is currently a blind spot in corporate and financial risk monitoring, since by and large it does not account for nature-based or climate-related risks beyond what is

directly financially material to the firm. As a result, risks to businesses, investors, society and nature at large, which build up over time due to cumulative environmental harm, are likely to be unaccounted for. This situation is partly driven by current corporate accounting practices and the structure of emerging corporate sustainability reporting frameworks, and the resulting data (corporate disclosures).

Focusing on the structures that guide how and what companies report is therefore one important and tangible way to address this blind spot in corporate and financial risk monitoring and management.

During the past two years, GEDB has conducted a rigorous process to identify and propose a set of Essential Environmental Impact Variables (EEIVs), grounded in scientific review and evidence. The 15 EEIVs offer a method for companies to systematically assess their environmental footprint from a planetary perspective.

For investors, EEIVs serve as a tool to assess and mitigate environmental risks within their portfolios by investing in companies that measure and improve their EEIVs. EEIVs provide a science-backed framework that shifts the focus from self-determined environmental priorities to a comprehensive evaluation based on Planetary Materiality. As a first step, many organisations already have existing data that can give valuable insights once structured according to the EEIVs. This will also help companies stay ahead of coming regulations and demands for more transparent reporting.

Corporate disclosures on emissions have become commonplace, if not mainstream, yet disclosure of other forms of environmental and social impact remains patchy at best and non-existent for large parts of the world. In response, several corporate sustainability

reporting frameworks are emerging and gaining traction, such as the Taskforce on Nature-related Financial Risk (TNFD) and the European Union’s European Sustainability Reporting Standards (ESRS). However, most sustainability accounting frameworks still fail to fully capture the connections between corporate activities and impacts, as they depart from what is important for the companies (materiality assessments) and often rely on relative metrics.

The essential environmental impact variables are a direct attempt by GEDB at producing scholarly, yet practically useful and relevant, scientific outputs by bridging disciplines – in this case accounting and sustainability science. A scientific paper on this work was accepted for publication in December 2023 and published in February 2024.



SHRUTI KASHYAP is a postdoctoral researcher with GEDB and the Sustainable Finance Lab. Her work focuses on how sustainability risks are understood, identified, assessed, and handled in the context of policy, regulation, financial flows, and corporate activities. Specifically, she considers the alignment, tensions, and gaps between regulation and practice in the context of sustainability risk reporting, governance, and management. Her approach combines methods and perspectives from the fields of law, accounting, corporate governance, and management control. In the past year, Shruti focused on understanding how sustainability disclosure and assurance are being approached under emerging EU regulations such as the EU Taxonomy for

“I want to bridge perspectives to reach societal sustainability goals”

sustainable activities and the Corporate Sustainable Reporting Directive (CSRD).

“That work shows clearly that while professionals within accounting, auditing and compliance are indeed progressing in the generally right direction, sustainability risks are still being approached in a fragmented way. In particular, there is a tendency for industry professionals and academic experts alike to adopt relatively silo-based mentalities when it comes to how sustainability risks are or should be conceptualized, assessed, and managed”, Shruti says.

Having recognized this issue, Shruti spearheaded one step to bridge such silos by bringing together an interdisciplinary expert group of researchers across the domains of law, accounting and environmental sciences. The group convened for an inaugural workshop and round-table event at the Academy in May, organised by Shruti and colleagues. Read more about this at page 7.

“GEDB is one of those rare environments that nurtures true interdisciplinary and transdisciplinary work. It has inhouse experts across different fields. It has a unique culture that fosters creative spaces of exchange and collaboration between different disciplines and industries.” Shruti reflects, and then points out:

“If we as a collective society are to achieve the goals set for a sustainable green transition, we need to coordinate and align across disciplines and professions and geographic borders in a meaningful and effective way. It’s not enough to say we are all on the same boat and headed towards the same destination. We actually should try to understand how we are interacting and how we can coordinate our movements.”

PHOTO: ALUXUM/ISTOCK PHOTO



Joining forces to mitigate systemic risks

Research within GEDB also addresses risk from various perspectives, aiming to bridge and promote communication between previously siloed disciplines, between the domains of environmental sciences and sustainability reporting, corporate management, and law, to identify and mitigate systemic risks. For example, during 2023 Shruti Kashyap worked to determine how complex sustainability issues can be conceptualised and operationalised in the context of corporate and financial risk.

During 2023, GEDB made an explicit effort to begin to address these issues by convening series of workshops with scholars from corporate accounting, corporate and financial law, and environmental science. The aim was to develop a joint vocabulary of the challenges and use this to develop research that integrates frontier thinking in accounting, assurance, law, and risks and sustainability. GEDB believes this is one of the more fundamental but understudied aspects of achieving sustainable transformation driven by, and in concert with, business and finance. The reason is that while science-based targets have been important for placing key environmental challenges on the corporate and financial radar and for developing science-based targets

to strive for, these targets alone do not suffice. There is an urgent need for methods of assessing how well companies and investors are managing to progress towards these targets, and how and whether the emerging sustainability reporting frameworks are fit for the task. In other words, some form of ‘alignment assessment system’, is needed, particularly for nature-related risk. A first tangible output from the workshops is a draft proposal on how a scientifically informed alignment assessment system could be developed to map the fit and potential gaps between policy targets, reporting frameworks and corporate practices. Our long-term ambition is to develop such science-informed assessment methodology.

Discussions sparked within the interdisciplinary expert group also led to an invitation to Executive Director Beatrice Crona to make a keynote address at the 19th interdisciplinary conference on “Intangibles, sustainability and value creation” organised by the European Institute for Advanced Studies in Management (EIASM). EIASM is an international network for management research and teaching that includes more than 70,000 management scientists from all over the world.

Showing investors how they impact the Earth system

Over the past few years, the Biosphere Finance theme has developed a tool that allows investors to assess how their operations and investments impact the stability of the Earth's climate system. We call this tool the Earth System Impact (ESI) score and have described it in previous annual reports. The ESI tool accounts for Earth system components other than climate (generally measured through CO₂), such as water and land use, as well as interactions between these three components which lead to potentially large, amplified effects on the climate. This is a major scientific innovation to which the Erling-Persson Family Foundation has contributed and which we hope can significantly enhance the capacity of corporate and financial actors to address nature-related risks and act to reduce them. By including assessments of impacts on climate, water and land, the tool also begins to address some of the key drivers of biodiversity loss and change. More information about the tool is available [here](#). A key scientific achievement in this project during the year was completion and publication of the first test of the tool on the mining industry. This demonstration of feasibility of use on a significant economic sector has sparked interest from a range of actors and paved the way for further engagement and pilot testing with non-academic stakeholders.



The Earth System Impact score (ESI) tool developed by GEDB was tested in the mining industry.



Global Health and Biosphere Stewardship

The overarching ambition within this theme is to make visible how human health and wellbeing depends on and can be promoted by stewardship of the living planet.

Examples of activities during 2023:

GEDB organised and hosted an inaugural interdisciplinary workshop to explore links between sustainability risks and corporate governance, management and reporting in Stockholm, Sweden on 15–16 May.

Shruti Kashyap presented her work at the 13th European Network for Research in Organizational and Accounting Change (ENROAC) Conference in June. Presentation title: *The Curtains are Blue – Risk and Accountability Challenges under Converging Sustainability Reporting Frameworks*.

Kashyap also made a presentation entitled *Risky Decisions – Understanding and Handling Risk in Complex Accountability Systems* at the Research Conference Platform for a Sustainable Future in Örebro, Sweden, on 21 November.

Beatrice Crona presented a synthesising overview of GEDB's work on connecting Earth system science and finance at a workshop on Critical Transitions, hosted under the Earth Resilience and Sustainability Initiative at the Potsdam Institute for Climate Impact Research, on 19 December.

Biodiversity and polycrisis were two important focal areas within the theme in 2023.

Biodiversity and human health

The multiple ways in which biodiversity supports human health are becoming clearer, but there have still not been any unifying systematic assessments of the evidence on how this support occurs. GEDB Postdoc Honghong Li is leading our work to develop a methodology for systematically mapping this evidence base. The mapping results will be important in informing, broadening and concretising debates, policy and action around biodiversity and health. The protocol for the study was submitted for publication in 2023 and publication is awaited in 2024.

Evolutionary traps for humanity

There is also growing recognition that global human health and environmental sustainability issues interact with the growing set of crises that are facing world economies. Conflict, climate change, inequality, new technologies and biodiversity loss are examples of global challenges that all combine to affect global health. In November, GEDB concluded a three-year research process to identify the core structure of this “global

polycrisis”. This culminated in identification of 14 so-called ‘Anthropocene traps’, representing trajectories in which modern societies appear to be caught and which produce a set of interacting global challenges. The traps are divided into four groups: global, technology, temporal and spatial, with each trap type characterised by unique trap-generating dynamics. This research has already gained significant interest and the academic paper was downloaded more than 20 000 times by the end of 2023.

Infectious diseases, pests and pathogens

Another manifestation of polycrisis is the increasing risk of emerging infectious diseases, pests and pathogens of production systems. GEDB continues to build a growing research portfolio in this area.

Major shocks from outbreaks of pests and pathogens cascade to influence the broader sustainability agenda. An article with participation of Director Carl Folke analysed the way in which central development actors responded to the Covid-19 crisis, revealing that the shock was not used to accelerate building a more resilient future, but mainly focused on bouncing back to the ‘status quo’.

GEDB participates in the European Research Council project INFLUX, which aims to understand the multiple ways in which emerging pest and pathogens can affect society. Importantly, this understanding is sought based not only on the recent example of Covid-19, but in a much more comprehensive manner on thousands of existing emerging pests and pathogens. In 2023, an MSc student linked to the theme (Kate Bjorklund) defended her thesis, which improved understanding of the multiple impacts of the Fall Armyworm moth that have been observed across Africa and Asia in the past decade.

Food security and sustainable diets

Food-related global health research continues to be a strong area of activity within the Global Health and Biosphere Stewardship theme. In light of the growing polycrisis, there has been renewed interest in food security and the ability of countries to feed their own populations

when faced with supply chain disruptions. In a paper led by PhD candidate Emmy Wassénius, GEDB showed that only 41 countries, representing about 30% of the world's population, can potentially be fully self-sufficient when it comes to both macro- and micronutrients, while 66 nations (often smaller territories, representing 6% of the world's population) have low levels of self-sufficiency. The assessment highlights the varying risk profiles of countries when it comes to likely future supply chain disruptions.

The Blue Foods Assessment, to which GEDB researchers have contributed significantly, published its final synthesis study showing four ways that blue foods can help meet country-specific aspirations for sustainable development around the world. This publication has been downloaded more than 21,000 times since its publication. In 2023, GEDB researchers were also engaged in EAT-Lancet 2.0.,

a follow-up of the original EAT-Lancet Commission, an international effort to review the evidence on how to define and quantify a healthy and sustainable reference diet. Building on this work, EAT-Lancet 2.0 will accelerate progress and contribute to the 2030 agenda by including several new elements such as a greater focus on diversity and the adaptation of regional and local diets, strengthened diversity in the composition of the Commission, and a new focus on food justice and social food system goals.

Connecting health, biosphere stewardship and finance

During the year, a paper was published in *Lancet Planetary Health* highlighting the interaction between GEDB's health and finance work, with the participation of Peter Søgaard Jørgensen. Building on the sleeping financial giant methodology established by GEDB, the study was the first to link ownership of financial giants to risk of new emerging infectious diseases.

Through their ownership of companies with large impacts on land use, financial actors are shown to have a major role in preventing future pandemics in two ways. Firstly, by lowering the risk of emergence of zoonosis by not condoning developments in high-risk areas, and secondly, by investing in community capacity for monitoring and health systems. Although commodity supply chains and financial markets are highly globalised, a small number of investors and countries appear to be disproportionately influential in sectors that increase emerging infectious disease (EID) risks. The influence of such financial actors could be used to develop and implement effective policies to reduce ecological degradation and mitigate infectious disease risks and their effects on population health.

Linking antibiotic resistance with sustainable development

One of the major obstacles to collective action on the urgent challenge of antimicrobial resistance (AMR) is the lack of integration between general policy agendas on sustainable development and the more focused global and national action plans on AMR. To bridge this gap, a PhD student at GEDB, Luong Nguyen Thanh, has led research that provides the foundation for such integration. Together with a team, Luong has provided the first systematic assessment of the network of diverse causal factors that contribute to AMR. This work provides a scientific base for linking the implications of AMR to overall development strategies and can facilitate formulation of policies that specifically target AMR.

Multiple papers from the AMResilience project, housed and supported by GEDB, were produced in 2023. The project, funding for which formally ended in 2022, aimed to provide a framework for building societal resilience to antibiotic resistance. The papers published in 2023 included work led by former GEDB post-doc Tiscar Graells, who compared barriers and success factors for interventions seeking to reduce AMR in low-, middle- and high-income countries. There is a stark contrast between practitioners in these contexts regarding the perceived importance of success factors. Funding and technological capacity for surveillance are perceived as the major barrier to successful reduction of AMR in low- and middle-income countries, whereas high-income country practitioners perceive factors related to corporate practice and management as the most important.



“I want to understand and help overcome psychological barriers to change”

Noah Linder

Noah Linder is a postdoctoral researcher with a PhD in Sustainability. Departing from environmental psychology and behavioural economics, his research at GEDB focuses on exploring how behavioural insights can help understand motivations and barriers to sustainable transformation within the Swedish food system.

Within the project “Retail for Sustainability - Mid-value chain engagement for food system transformation (ReSus)”, Noah and colleague Malin Jonell are investigating the role food retailers play in a sustainable transformation of the Swedish food system. With the three main food retailers (Ica, Coop and Axfood) as partners, they aim to identify the types of methods or interventions that can help these actors live up to their own ambitious sustainability goals.

“We have just initiated a survey study to explore the attitude Swedish consumers have towards different initiatives that food retailers can introduce to encourage customers to choose more sustainable protein”, reports Noah. “This can involve for example identifying products that are environmentally friendly and lowering the price of those, or more extreme methods such as rationing the amount of meat products a household may purchase, or even removing non- environmentally friendly products from their range.”

“The latter are not realistic options for food retailers at the present time, but are interesting from a research perspective”, says Noah.

Consumer surveys have shown that many Swedish consumers may be willing to pay more for sustainable goods and that 20-40% describe themselves as flexitarians. At the same time, meat consumption in Sweden has remained static since 2016 and there is even a trend for a slight increase. This is interesting, according to Noah, since: “It indicates that there is a gap between intention and behaviour. A positive aspect is that there is already a foundation for change in many consumers and they do not need to be convinced. That can act as a good starting point for sustainability work by food retailers, to help consumers realise their intentions”.

Examples of activities during 2023:

On numerous occasions, Malin Jonell presented her work on the role of food retailers in increasing consumption of more sustainable and healthy food. Examples include webinars arranged by the Swedish Food Retailers Federation in March, by GEDB and NGO Matlust in June, and by WWF in August.

Max Troell was invited to a workshop organised by the Aspen Global Change Institute in August, to present research related to the role of aquaculture in reaching Net Zero Emissions Food Systems.

Bridging Science, Policy and Practice

PHOTO: LUCAS SUNSPLEASH

GEDB continues to deliver science to a range of prominent public and private sector decision-makers. Together, the active engagement of GEDB researchers in seminars, dialogues with policy makers and educational efforts, including for the private sector, is testament to the demand for the science we deliver and is a measure of the impact of the science generously funded by the Erling-Persson Family Foundation.

Below, we outline a selection of activities that showcase the diversity in our engagement.

PUBLICATION The publication on Anthropocene traps led by Peter Sogaard Jørgensen, mentioned above, has attracted interest from a wide array of non-academic actors. For example, the terminology used to describe the traps has been included in the wide-reaching and impactful visualization of the Anthropocene by the NGO Globaia, along with planetary boundaries and the great acceleration. The research was also featured in diverse media such as Dagens Nyheter, El Pais and Fox Business.

POLICY DIALOGUE As representatives of the world's governments prepare to meet for the second UN High-Level Panel meeting on antimicrobial resistance in 2024, GEDB has been engaging in key stakeholder dialogues and delivering new science that aims to shape the meeting and this year of action. Peter Sogaard Jørgensen and Luong Nguyen Thanh presented GEDB research and participated in a dialogue entitled "The Global Need for Effective Antibiotics – Unlocking Barriers for Collective Action", organised by ReAct (Action for Antibiotic Resistance) and Uppsala University in Uppsala on 10–11 May. The dialogue convened the global ambassadors for antimicrobial resistance (AMR), as well as funders and heads of AMR policy in international organisations such as the World Health Organization.



PHOTO: ANNICA ALVEN, UPPSALA UNIVERSITY

Conversation pieces by Andreas Rehnberg and Mauritz Larsson from Beckmans College of Design. Part of the exhibition on antimicrobial resistance shown at the EU dialogue on AMR in Uppsala.

Participants from more than 20 countries gathered for collective actions on antibiotic resistance at the dialogue meeting organised by ReAct and Uppsala University within the framework of the Swedish Presidency of the Council of the EU.



PHOTO: TERESE HOLM, REACT

AMR OUTREACH GEDB continues to engage in several additional initiatives seeking to bridge science, policy and practice relating to antimicrobial resistance. Max Troell represented GEDB work at the Antibiotic Dialogue for food retailers in Sweden, organised by Axfoundation on 24 May, on the theme of seafood. Max Troell and Peter Sogaard Jørgensen collaborated with students at Beckmans College of Design in a project where the 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 from 18 April to 8 May, 2023 and at the design firm Svenskt Tenn store in Stockholm from 8 June to 17 June, 2023. Selected parts of the exhibition were also shown at the two-day dialogue meeting on antimicrobial resistance at Uppsala University, within the framework of the Swedish Presidency of the Council of the EU.

DIALOGUES GEDB Executive Director Beatrice Crona developed and curated Klimatkapitalet, a research-based dialogue series on key sustainability challenges and how pension funds and institutional investors can address transformation. It was initiated by the four Swedish signatories of the UN Net-Zero Asset Owner Alliance (Alecta, AMF, Folksam, and Nordea Life & Pension) with the aim of broadening knowledge about the science that can inform financial decision-makers in different spheres of society. Klimatkapitalet continued during 2023 with two dialogues, in March and August, with participation of representatives from politics, the energy sector, the financial sector, unions, academia, the real estate sector and other key real economy sectors.

SeaBOS The ongoing collaboration with nine of the world's largest global seafood companies within the SeaBOS project has now moved to a new phase, through the development of a Keystone Project aimed at increasing knowledge about antibiotic use and development of antimicrobial resistance (AMR) within aquaculture. Specific focus is on developing methodologies for detecting and mapping AMR genes in bacteria and the work concentrates initially on shrimp farms in Thailand. Leading industry partners in the work are CP Food and Thai Union Group. Involved are also Chulalongkorn University in Bangkok and Australia's Cooperative Research Centre for Solving Antimicrobial Resistance in Agribusiness, Food and Environments (CRC-SAAFE), that provides analytic expertise and broader one-health insights. The Keystone Project will continue until 2025.



PHOTO: JONAS HEMLIN AND GRETA GUSTAFSSON

Facing Our Future, piece by Gabriel Ankar, Rebecca Lagersted (Beckmans College of Design) to highlight child death caused by antibiotic resistance. From the exhibition 'Are we there yet'.



PHOTO: RUSLAN KALIN/ISTOCK PHOTO

Within the SeaBOS project GEDB researchers study antimicrobial resistance (AMR) within aquaculture, initially focused on shrimp farms in Thailand.

SCIENCE PRACTICE In April, Beatrice Crona was invited to talk at the UN PRI Nordics signatory event, hosted by Alecta, on the topic of Biodiversity, Nature-related risks & Investor Voice. During the year, GEDB has been invited to multiple such events and to present our work to individual interested parties from the insurance, pension and investment sectors, among others.

POLICY DIALOGUE GEDB has also participated in dialogues with policy makers and industry, both in Sweden and internationally. Beatrice Crona participated, as the sole representative from academia, at the round table discussion hosted jointly by the Swedish ministers of Climate and the Environment, and of Financial Markets. This dialogue included representatives from all major institutional and private investors in Sweden and focused on how and what Sweden needs to do to ensure that capital markets can promote sustainable transition.

POLICY OUTREACH An example of international events related to sustainable finance is the invitation to Beatrice Crona to participate in the panel discussion on “Standards and regulations of sustainable finance in the EU and China and where further interoperability should be sought to boost green investments”. This was arranged by the Swedish Embassy in Beijing and the Asian Infrastructure Investment Bank, in April. In another example, Carl Folke was invited as a keynote speaker at the European Bank for Reconstruction and Development in September.

ROUNDTABLE GEDB has also convened its own events, such as the round table on Corporate Sustainability Reporting: Risks and Opportunities Under Emerging Frameworks, co-hosted with Stockholm Resilience Centre and the Sustainable Finance Lab Sweden on 16 May. Participants included academics, private sector representatives such as ESG data providers and asset managers, and policy makers such as Finansinspektionen, the Swedish government authority tasked with monitoring the financial market.

PRACTITIONER OUTREACH 2023 also saw the publication of the pilot test of the Earth System Impact (ESI) score on the mining sector. The ESI is one of our first tools aimed at practitioners in the corporate and financial sector (read more under the Sustainable Finance theme). Publication of results of the mining pilot test led to engagements such as presentations at a side event at Stockholm Norrsken Impact week in September, organised by Gullspång Re:Food, on the theme of Transformative Investing. This sparked further interest by non-academic stakeholders. 2023 therefore became the year when we began to build a network of interested investors and companies willing to perform testing. We have now developed relations with several practitioners with whom we will be testing the tool in different settings to hopefully develop a set of use-cases in 2024.

DIALOGUE In May, Director Carl Folke organised a dialogue on forestry at Haga Castle for HRH Crown Princess Victoria of Sweden. This included the participation of Executive Director Beatrice Crona and of former CEO of Stora Enso, Annica Bresky.

POLICY OUTREACH The final summary paper of the *Blue Food Assessment* presented a framework and an interactive tool, specifically aimed at national policy makers. Its publication in *Nature* in February 2023 led to several outreach activities and engagements, such as seminars and lectures on what aquatic foods can bring to sustainable and healthy food systems. Among other things, GEDB was invited to present the findings to the Head of the Marine Stewardship Council (MSC), who was visiting Sweden in March, and was commissioned to write an article for the *FAO Magazine*, entitled ‘Blue foods, a cornerstone of achieving sustainable food systems’, as well as an open editorial in *Euronews*.



PHOTO: GUY ACKERMAN

Beatrice Crona holding the plenary lecture at the 105th birthday celebrations of Wageningen University, for an audience of 700 academic staff, NGOs, industry and national and EU policy makers.

Round table on Corporate Sustainability Reporting, co-hosted with Stockholm Resilience Centre and the Sustainable Finance Lab Sweden on 16 May and led by Shruti Kashyap (to the right).



PHOTO: GIORGIO PARLATO

Our Team



Daniel Avila Ortega
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Beatrice Crona
Professor, Executive Director



Louis Delannoy
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Max Troell
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Emmy Wassénus
PhD Candidate

PHOTO: CECILIA NORDSTRAND AND AGNETA SUNDIN

Team news

In April, **Noah Linder** joined GEDB as a postdoctoral researcher. His research focuses on exploring how insights about behaviour can help understand motivations and barriers to sustainable transformation within the Swedish food system. Noah received his PhD in Sustainability Science from Gävle University in 2022. He also holds an MSc in Social-Ecological Resilience for Sustainable Development from Stockholm Resilience Centre, Stockholm University. Read more about Noah's research on page 10.

Louis Delannoy joined GEDB as a postdoctoral researcher in September 2023, to work on the Entangled Shocks and Crises in the Anthropocene Production Ecosystem (ESCAPE) project. A transdisciplinary scholar, Louis combines various research fields to evaluate how multiple environmental and social shocks combine to create systemic crises, with a focus on the role of the global production ecosystem. More specifically, he examines how shocks are transferred, absorbed and linked together across space, time, and sectors of society, and develops empirical methods to answer these questions. Other research interests range from political ecology to economic anthropology. Louis's academic credentials include a BSc in

Civil Engineering and MSc in Energy Management and Sustainability, both from the Swiss Federal Institute of Technology in Lausanne (EPFL), and a PhD in Applied Mathematics from the Université of Grenoble Alpes.

During the year, GEDB took on two new research assistants, **Isabel Baudish** and **Amanda Jonsson**. Isabel has a BSc (Hons) in Renewable Engineering and BA in Development Studies from the University of New South Wales, Australia. She has several years of experience working with education for sustainable development at universities. She is concurrently studying for an MSc in Entrepreneurship at Uppsala University. Amanda holds an MSc in Sustainable Development from Uppsala University, where the focus of her work was on sensory aspects of ancient cereals and terroir in Sweden and how they can play a part in sustainable food production. She holds a BSc in Meal Ecology from Örebro University (School of Hospitality, Culinary Arts, and Meal Science). She has previously worked as a research assistant in sensory science.

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. This award was 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.

Both **Carl Folke** and **Max Troell** are listed on the exclusive 2023 Clarivate Analytics overview of the world's most cited researchers. The list recognises world-class researchers selected for their exceptional research performance, demonstrated by production of multiple highly cited papers that rank in the top 1% by citations for field and year in Web of Science.

Sofia Kjäll, who defended her PhD thesis in November 2022, worked in spring 2023 to finish some research projects and to help develop the new GEDB website. She left GEDB in April to work for the NGO Swedwatch which works to safeguard human rights and environment in business and supply chains. Her research on the sustainable fishing practises are highlighted at page 20.

TEN YEARS OF *Science for Change*

Through the generous support of the Erling-Persson Foundation, the GEDB Academy programme has been able to develop a truly transdisciplinary research environment.

GEDB is an academic programme involving many different disciplines, which has led to the creation and development of a number of entirely new research fields, at the nexus of existing disciplines. By developing these frontiers, GEDB has delivered research insights of significance, not just for related academic fields, but also for practitioners working to promote sustainable and healthy societies, economies, business practices and investments.

Below, we briefly summarise what we see as some of our broadest and most impactful research areas and show how these research achievements have created, formed or fed major international policy efforts, business collaborations and investment practices.

330

peer reviewed publications

8

PhD students

32

policy reports

Fifty shades of blue – marine biosphere stewardship at multiple scales

Since its inception, GEDB has centred on developing research to support stewardship of the living planet (the biosphere) to promote human prosperity, now and in the future. This stewardship has ranged from governance of natural resources, with marine resources being a strong focus at the very start of the programme, to increasingly focusing on research to support development of corporate stewardship of the biosphere more generally.

In its early days, GEDB conducted research to map and characterise transnational corporations involved in seafood trade globally and show how these key actors in the marine trade system can be thought of as “keystone actors” through their substantial influence on marine ecosystems globally. This work laid the scientific foundation for the development of the SeaBOS initiative (Seafood Business for Ocean Stewardship) and the associated Keystone Dialogues, under the patronage of HRH Crown Princess Victoria of Sweden, where nine of the world’s largest seafood companies issued a 10-point statement committing to action on ocean stewardship. Points of action on which SeaBOS companies have already committed to act include reducing climate change emissions and combatting illegal and unregulated fishing (IUU), slave labour, ocean plastics and antimicrobial resistance. The high concentration of global fishing operations to a small number of multinational companies means that the CEOs represent potentially significant leverage points for transforming the entire seafood sector towards more sustainable practices. This initiative has received worldwide recognition and has served as a model for multiple subsequent initiatives in other sectors. GEDB continues to play a key role in the initiative, contributing expertise and staff to support the first interim SeaBOS secretariat.

While SeaBOS companies may control many large commercial fish stocks, the vast majority of the world’s wild-caught seafood comes from small-scale trade. Improving the sustainability of this segment is therefore key for ocean health. GEDB has delivered scientific results

that can inform improvement of fishing practices through long-term collaboration with the Sustainable Fisheries Partnership (SFP), a business NGO working to re-shape corporate responsibility, transparency and traceability in the fisheries sector through Fishery Improvement Projects (FIPs). A systematic evaluation by GEDB of over 100 FIPs globally has led to recommendations on how FIP strategies can be better evaluated and has been used to promote learning across fisheries around the world.



The collaboration between Sustainable Fisheries Partnership (SFP) and GEDB began in early 2015, focusing on Fishery Improvement Projects (FIPs). GEDB’s contribution was instrumental in helping us better understand the diverse actors involved in FIPs and how their actions influence outcomes, including policy and practice changes leading to improved fisheries performance.

GEDB’s input also enabled us to gain a comprehensive understanding of factors influencing FIP success, such as the roles of different stakeholders and the traits specific to FIPs.

Overall, GEDB’s collaboration has been invaluable to SFP, further enriching our understanding of FIP dynamics and contributing to our efforts to promote sustainable fisheries management and practices. We are grateful for their partnership and the insights they have provided.

PEDRO VEIGA
Sustainable Fisheries Partnership

PHOTO: SHEFAZ SHAMMOON/UNSPLASH

In 2020, the ‘Blue Food Assessment’ (BFA) was officially launched by GEDB together with Stockholm Resilience Centre and the Stanford Center for Ocean Solutions. The initiative brought together more than 100 world-leading researchers with the aim of demonstrating the specific role that aquatic foods can play in transforming future food systems to better serve human and planetary health. It was co-chaired by Executive Director Beatrice Crona and Stanford Professor Roz Naylor, and several GEDB researchers made prominent contributions. The seed for this assessment was the scoping report developed by GEDB in 2018 to unpack the aquatic food component of the EAT-Lancet Commission. The BFA consists of eight high-profile, peer-reviewed papers in the internationally recognised *Nature* family of journals and a report that summarises key findings for decision makers. The publications examine health, nutrition and sustainability of blue foods. This was groundbreaking work because it succeeded in bringing aquatic foods firmly into the global debate on human health and food system sustainability. The BFA was instrumental in placing aquatic foods on the agenda at the first ever UN Food System Summit, triggering a host of research and practical collaborations, such as the Aquatic Blue Food Coalition, to advance and act on the knowledge of how blue foods can improve sustainability while improving human nutrition. The BFA research and its translation into policy recommendations has provided a firm foundation for decision-makers to make decisions about how blue foods can best form part of improved food systems and of improving human health in different nations.

As a testament to the broad contribution of GEDB research to many different aspects of marine science, Beatrice Crona was invited as the plenary lecturer at the 105th birthday celebrations at Wageningen University, to speak about GEDB’s spectrum of marine research and the transdisciplinary research approach behind it to an audience of 700 academic staff, NGOs, industry and national and EU policy makers. Another reflection of the influence of GEDB’s transdisciplinary research on marine science is the awarding of the Grande Médaille Albert Ier in Science to Carl Folke in 2021 by the prestigious Institut Océanographique de Monaco.

1223

scientific citations for the *Nature* article “A 20-year retrospective review of global aquaculture”

A pro-microbial planet: systemic approaches to antibiotic resistance

One of the key contributions of the GEDB academy programme is providing insights on how to deal with growing resistance to antibiotics and pesticides through systemic approaches. The foundation for this work was the convening by GEDB and Deputy Director Peter Søgaard Jørgensen of a two-year international synthesis effort, entitled 'Living with Resistance', funded by the US National Science Foundation synthesis centre SESYNC. The project gathered leaders from science and industry. By combining evolutionary science with knowledge on social-ecological interconnectivity, work pioneered by Director Carl Folke, GEDB has been able to formalise socially and ecologically grounded strategies to address one of the most serious issues facing humanity in the 21st century: sustainable governance of growing antibiotic and pesticide resistance in health and production systems.

The pursuit led to several pivotal contributions, including a comment in *Nature* ahead of the UN General Assembly High-Level meeting on antimicrobial resistance 2016. The piece set forth science-based policy recommendations for the world's governments in dealing with evolution of resistance. Other research insights have been published in several top-ranking journals, including *PNAS*, *Annual Reviews in Ecology and Evolution*, *Nature Sustainability* and *Trends in Ecology & Evolution*. As a testament to the recognition of this work by both the ground-level and applied science community, Peter Søgaard Jørgensen was invited to provide a keynote presentation at the European Conference of Clinical Microbiology and Infectious Diseases, a conference with more than 10,000 attendees. The work also helped attract funding for a large international consortium to study the resilience of high-, middle- and low-income countries to antibiotic resistance, convened by the Joint Programming Initiative on Antimicrobial Resistance (JPIAMR), a global collaborative organisation and platform engaging 29 nations to curb antimicrobial resistance with a One Health approach.

This work led to growing interest among the policy and practice community. Through consistent engagement with stakeholders within networks such as ReAct, a global network of microbiology and healthcare professionals, scientists, journalists and communication experts, and the Public Health Agency of Sweden, our work has gained traction. As a result, GEDB has initiated collaborations to implement biosphere-literate approaches for dealing with antibiotic resistance.



"Through the past 10 years GEDB has produced important work to address the complex interlinkages between antibiotic resistance and a sustainable development. This includes work on identifying a safe and just operating space for antibiotic resistance; pathways for transforming to a society where we have a more sustainable relationship between our personal microbiome and the microbiome of the planet; identification of barriers and enablers for successful implementation of policy interventions; and most recently, linking drivers of antibiotic resistance with the sustainable development goals. As demonstrated by their Nature commentary in 2016 at the UN High Level Panel on Antimicrobial Resistance, GEDB also has the capacity to convene experts to communicate these insights. As governments in 2024 again meet at the UN general assembly to set out the next steps in the work on AMR, there is a large need for the types of work that GEDB has led."

ANNA KARIN SJÖBLÖM
Director of ReAct Europe

PHOTO: SHOTA, ISTOCK PHOTO

Concrete examples include participation in the round table hosted by the Swedish Ambassador for anti-microbial resistance (AMR), which will provide input to international negotiations, and commissions by the World Bank to produce a list of priority interventions to control AMR for implementation in low- and middle-income countries. The World Bank Group is also evaluating how GEDB's scientific findings can be applied in training World Bank staff in concrete projects.

Through its involvement in the SeaBOS initiative, GEDB has contributed to mobilising action to address antimicrobial use in the world's largest seafood companies. This has involved mapping their use of antibiotics and

identifying approaches for transparent reporting, as part of a broader SeaBOS reporting and monitoring framework. It has also involved development of a Code of Conduct for reducing antibiotic use and AMR in the seafood industry more generally.

GEDB's pioneering and successful work in this field has attracted prestigious funding from the European Research Council to broaden the work to study the cascading societal impacts of emerging infectious diseases and agricultural pests.

182 400

people have downloaded the article
"Outside the Safe Operating Space of the
Planetary Boundary for Novel Entities"

Promoting an Earth system-savvy investment community

PHOTO: HECTOR J. RIVAS/UNSPLASH

A major scientific achievement and contribution of GEDB has been our work to bridge the academic fields of environmental sustainability, finance and corporate accounting.

This started with early efforts to map the connections between institutional investors and regions of the planet of particular importance for maintaining climate stability. We identified the important role of large asset managers and owners in steering away from irreversible large-scale environmental change and escalated global warming. Since they appeared unaware of the power they have at their fingertips, we called these influential institutions Sleeping Financial Giants. Through their holdings (or claims, in the case of debt), these financial giants have great power to influence the resilience of several large ecoregions that play a fundamental role as carbon sinks by storing carbon in

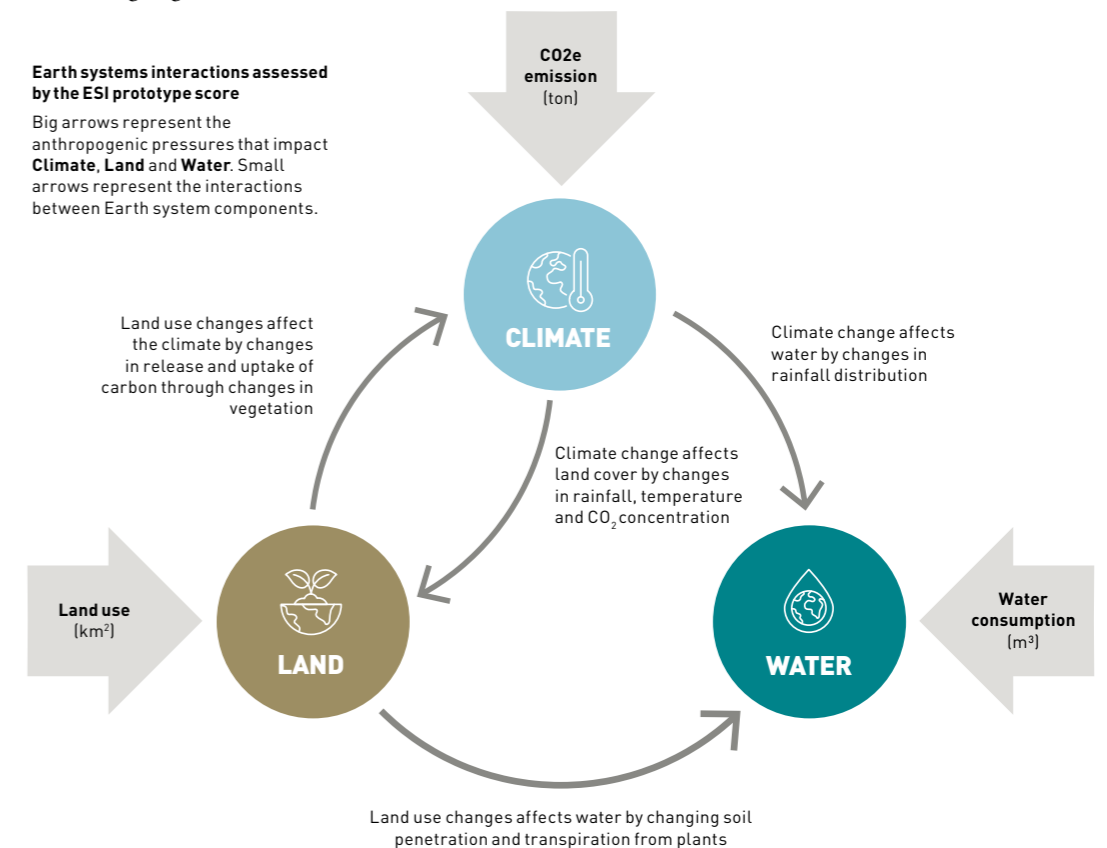
vegetation biomass. The Amazon and the large boreal forests of the Northern hemisphere are concrete examples. These findings laid the foundation for a series of science-industry dialogues, variously co-produced with the UN Principles for Responsible Investments, the ethical council of the Swedish pensions funds (AP-fonderna), Temasek/Ecosperity and Future Earth. The impact of this engagement can be exemplified with a communication brief, developed in collaboration with UN PRI on the Amazon region, listing six principles for responsible investments. This inspired 230 investors (including several major Swedish pension funds), together managing USD 16.2 trillion of assets, to call for corporate actions on deforestation and signalling support for the Amazon as a centre for sustainable development.

As interest and commitment to changing practices has grown in the financial community, GEDB has responded by designing research to deliver scientific insights to support this change. Our most prominent achievement thus far is the Earth System Impact (ESI) metric developed to allow impact assessments of corporate activities and financial investments on the Earth system. This prototype tool has pioneered research at the interface of Earth system science and corporate environmental impact assessment. It is the first known metric to capture Earth system processes beyond greenhouse gases only, by including water and land use change and capturing their mutual interactions. By also accounting for differing impacts of land use change depending on where on the planet it happens, the tool provides a first step towards incorporating Earth system tipping points in corporate sustainability strategies. Application of this tool to the mining industry represented another turning point in our impact beyond academia, as the tool has sparked unprecedented interest and is now being piloted with multiple corporate and financial actors.

The Sleeping Financial Giants principles and the Earth System Impact tool have both become important means for our science to promote change. The research behind these would not have been possible without the research funding provided by the Erling-Persson Foundation to the GEDB Academy programme. It has allowed us the flexibility to respond to serendipitous research opportunities, which have resulted in significant scientific breakthroughs. Two examples can serve to highlight this.

“Analysing the interaction between nature and economic activities is a complex undertaking. At Pictet Asset Management, we recognise this complexity. This is why we find it valuable to work with scientists and partners such as scholars from GEDB. At Pictet AM, we have developed a proprietary biodiversity impact measurement tool, designed to provide estimates of species loss that a company risks causing for every dollar of revenue it generates. But it is constantly evolving – and we will look to draw on the research undertaken by our partners at the GEDB programme. We find that the ESI model has great potential. It is an integrated tool that considers multiple environmental dimensions and their interactions. It can incorporate regional factors and illustrates how a certain corporate activity disrupts the environment in relation to the current state of the planet. We can envisage using an ESI score to estimate and compare the impacts of potential new energy transition projects and make sure such investments are made in the way that best minimises the biodiversity impact. Site-specific information from the ESI could guide shareholder engagement conversations to identify problematic assets and projects.

NATSUKO WAKI
Coordinator of science-business interaction, Pictet Asset Management, UK



The first is our work to uncover the links between deterioration in global environmental commons and capital routed via tax havens. This work was based on central bank data discovered while collecting empirical evidence for the Sleeping Financial Giants project. The freedom to devote resources to further investigate this empirical trace was instrumental and the results showed how offshore jurisdictions subsidise environmental degradation and reduce transparency at a scale that has implications for the resilience of the Earth system. This multidisciplinary work was published in the highly regarded journal of *Nature Ecology and Evolution* in 2018 and sparked extensive global media attention.

Another example is the work that combined our expertise on the seafood industry with our growing expertise on capital markets and investments. The combination of these domains led to research that identified several leverage points in the financial sector for promoting seafood sustainability. The resulting scientific paper won the European FIR-PRI Finance and Sustainability award for Best Published Article in 2020. The Finance and Sustainability award is given by the French Sustainable Investment Forum (FIR), a non-profit and multistakeholder organisation, and the UN Principles for Responsible Investment Initiative (PRI).

Together, GEDB's research on sustainable finance has created a multifaceted scientific base and transdisciplinary scientific expertise which is unique. It has resulted in invitations by several leading academic and non-academic institutions or initiatives for GEDB to contribute with our science to their respective remit and processes. As such, GEDB staff have contributed to two of the groups providing expert advice to the Technical Expert Group on Sustainable Finance, tasked with developing the European Union Sustainable Finance Taxonomy. We have provided scientific advice in production of the corporate reporting standards developed by the Taskforce on Nature-related Financial Disclosures (TNFD), and several staff are now involved in TNFD working groups. Our Director Carl Folke has served as scientific advisor to the Temasek Ecosperity Advisory Group, while Executive Director Beatrice Crona has been invited to contribute to the IPBES (International Panel on Biodiversity and Ecosystem Services) Assessment on Business and Biodiversity.

Launched in 2021, the Taskforce on Nature-related Financial Disclosures (TNFD) is a global, market-led, science-based and government-supported initiative. Research within the GEDB programme has contributed important dimensions to the TNFD's work in developing a risk management and disclosure framework that captures nature-related financial risks and opportunities, based on Earth systems and ecology. Notably, TNFD has drawn on GEDB research for insights on risk (including systemic risks), resilience, measurement and target setting (including the importance of connection between the two, and the importance of spatially explicit measurement), the role of corporate and investor stewardship, the implications of planetary boundaries, thresholds and tipping points, and ocean examples. TNFD is grateful to the GEDB team for their valuable contributions.

EMILY MCKENZIE,
Technical Director, TFND.

An example of the growing recognition of our expertise and convening power is the invitation to develop a research-based dialogue series on the theme of transformation, initiated by the four Swedish signatories of the UN Net-Zero Asset Owner Alliance (Alecta, AMF, Folksam, Nordea Life & Pension). This series of four dialogues, called Klimatkapitalet (Climate Capital), ran for one year and brought together representatives from politics, the energy sector, the financial sector, unions, academia, the real estate sector and other key real economy sectors.

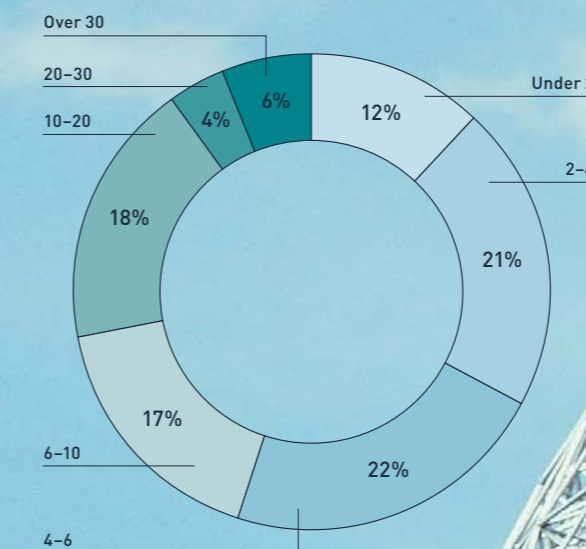
Enhancing the capacity of the next generation

During its 10 years of existence, GEDB has supported eight PhD students, 15 postdoctoral researchers and 24 research assistants. Our young scientists are an integral part of all the research we do. We take explicit care to include our research assistants in the academic publication process, since we see this as an important way for them to build their scientific merits. So far, nine of our research assistants have acquired PhD positions, while others have gone to use the academic training they received at GEDB in professional work at bodies such as the World Health Organization, the Public Health Agency of Sweden and Stockholm Environment Institute, to mention a few.

Total number of publications per year



Distribution of Journal Impact Factors for GEDB publications



We hope that this brief account of some of our scientific contributions demonstrates the significance of GEDB's interdisciplinary basic science for understanding contemporary sustainability challenges and opportunities, and the importance of work such as this for testing and further developing transdisciplinary science for positive change. True to its mission, GEDB is also working to continuously enhance the capacity of the next generation of scientists to acquire the skills of working in transdisciplinary ways to tackle the grand sustainability challenges of our time.

Appendix for 2023

Staff:

Director

Carl Folke

Executive Director

Beatrice Crona

Deputy Executive Director

Peter Sogaard Jørgensen

Senior Academy Researcher

Max Troell

Research Fellows

Malin Jonell

Shruti Kashyap

Post-Doctoral Researchers

Louis Delannoy

Honghong Li

Noah Linder

PhD Candidates

Abigayil Blandon

Daniel Izamna Avila Ortega

Luong Nguyen Thanh

Emmy Wassénius

Research Assistants

Isabel Baudish

Raf Jansen

Amanda Jonsson

Giorgio Parlato

Ege Pehlivanoglu

Sasha Quahe

Communications Officer

Agneta Sundin

Finance and HR Administration

Sofia-Kristin Kokinelis

Operations Manager

Marie Huss

Funding:

Core funding by the Erling-Persson Family Foundation. Additional funding was also received in 2023 from the Swedish Research Council Formas, the Swedish Foundation for Strategic Environmental Research Mistra, Sweden's innovation agency Vinnova, The David and Lucile Packard Foundation, IKEA Foundation, the Walton Family Foundation.

New funding:

IKEA-Food. IKEA Foundation, SEK 852 000 for 2023–2024.

INFLUX, European Research Council, SEK 9 583 430 for 2024–2027.

'Seafood Business for Ocean Stewardship – SeaBOS'. The Walton Family Foundation, The David and Lucile Packard Foundation, SEK 203 300 for 2023–2024.

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Selected activities featuring GEDB research

Project launch: Swedish Launch of the WorldFish Project: Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa. Swedish University of Agricultural Sciences, Uppsala, Sweden, 7 March. Presentation (Troell).

Symposium: Dies Natalis (Illustrum), celebrating 105th birthday of Wageningen University – Marine theme. Wageningen, the Netherlands, 9 March. Plenary lecture: *The value of an ecosystem approach for a prosperous and sustainable Ocean future* (Crona).

Workshop: Antibiotic resistance and NAP. Stirling University, Stirling, UK, 14–16 March. Presentation (Troell).

Webinar: Are the sustainability ambitions of the grocery store affected when the consumer holds tighter to the wallet? Organised by the Swedish Food Retailers Federation, 16 March. Presentation: *Healthy and sustainable food – what role can food retail play?* (Jonell).

Workshop: Conceptualizing and navigating Earth resilience in the Anthropocene, Loops 5, Organised by Potsdam Institute for Climate Impact Research. Stockholm, Sweden, 27–29 March. Invited speaker: *Navigating Anthropocene traps* (Sogaard Jørgensen).

Conference: Japanese Society of Fisheries Science Spring Conference, Shinagawa, Japan, 28–31 March. Participant (Blandon).

Symposium: Investing in a sustainable future. Arranged by Swedish Embassy in Beijing and the Asian Infrastructure Investment

Bank. Beijing, China, 4 April. Panel member: *Standards and regulations of sustainable finance in the EU and China and where further interoperability should be sought to boost green investments* (Crona).

Symposium: Generation Ocean Event – Sustainable seafood and traceability. Zushi, Japan, 9 April. Participant (Blandon).

Workshop: Evolutionary theories for social-ecological change: Third meeting. Konrad Lorenz Institute, Vienna, Austria, 17–21 April. Participants (Jansen, Sogaard Jørgensen).

Symposium: UN PRI Nordics signatory event, hosted by Alecta. Stockholm, Sweden, 21 April. Presentation: *Biodiversity, Nature-related risks & Investor voice* (Crona).

Seminar: The economics of biodiversity: Implications for policy and practice, with Partha Dasgupta. Stockholm School of Economics, 2 May. Panel member (Folke).

Dialogue: Uppsala Dialogue Meeting: The global need for effective antibiotics – unlocking barriers for collective action. International experts and stakeholder dialogue organised by Uppsala University and ReAct within the framework of the Swedish Presidency of the Council of the EU. Uppsala, Sweden, 9–10 May. Participant (Nguyen Thanh), keynote presentation: *The global need for effective antibiotics – unlocking barriers for collective action* (Sogaard Jørgensen).

Art and Science Collaboration: ‘Are we there yet?’ Collaboration with students at Beckman College of Design and Svenskt Tenn, Sweden, Spring 2023. Works exhibited at Royal Swedish Academy of Sciences, 18 April–8 May, at Design Firm Svenskt Tenn, Stockholm, Sweden, 8–17 June, and (in part) at Uppsala Dialogue Meeting, Sweden, 9–10 May. Tutors (Sogaard Jørgensen and Troell).

Workshop: Inaugural Interdisciplinary workshop on the Links between Sustainability Risks and Corporate Governance, Management, and Reporting. Stockholm, Sweden, 15–16 May. Organiser (Kashyap).

Workshop: Round table on Corporate Sustainability Reporting: Risks and opportunities under emerging frameworks. Co-hosted by GEDB, Stockholm Resilience Centre and Sustainable Finance Lab. Stockholm, Sweden, 16 May. Organiser (Kashyap).

Symposium: WWF Japan IUU and remote electronic monitoring event, Tokyo, Japan, 24 May. Participant (Blandon).

Dialogue: Antibiotics with focus on seafood, for food retailers in Sweden. Arranged by Axfoundation, Sweden, 24 May. Presentation (Troell).

Conference: Nobel Prize Summit – Truth, Trust, and Hope, Washington, USA, 25 May. Speaker (Folke).

Conference: Sustainable Science Days. Helsinki University, Helsinki, 25 May. Seminar organiser and presentation: *Leverage points for food system transformation* (Jonell).

Round table: Climate transformation for the finance sector. With the offices of the Swedish Minister for Climate and Energy and Government and Minister for Financial Markets, and Swedish investors. Organised by the Swedish Government Offices, Stockholm, Sweden 30 May. Participant and sole representative from academia (Crona).

Workshop: Ecocide law – the relevance for finance. Round table co-hosted by the Republic of Vanuatu, Stop Ecocide Foundation and Nature Finance. Online, 31 May. Participant (Kashyap).

Workshop: SeaBOS 6th working meeting, Stockholm, Sweden, May. Co-organiser and participant (Folke).

Dialogue: Biodiversity, climate and the Swedish forestry sector, for HRH Crown Princess Victoria. Haga Castle, Stockholm, Sweden, May. Organisers and lecturers (Crona, Folke).

Webinar: How can producers and the food retailers work together for more sustainable products on the shelf? Organised by Matlust and Royal Swedish Academy of Sciences, 1 June. Organiser and speaker (Jonell).

Symposium: Co-creation platform for fostering a green job market based on gastronomy geopolitics. Tokyo University, Japan, 7 June. Speaker (Blandon)

Conference: 13th European Network for Research in Organizational and Accounting Change (ENROAC) Conference. Västerås, Sweden, 13–15 June. Presentation: *The Curtains are Blue – Risk and Accountability Challenges under Converging Sustainability Reporting Frameworks* (Kashyap).

Conference: 9th European Institute for Advanced Studies in Management (EIASM) Workshop on Accounting and Regulation. Siena, Italy, 19–21 June. Participant (Kashyap).

Symposium: Future research and technological development towards turning Japan’s fishing industry into a growth industry and increasing its resilience. Tokyo Maritime University, Japan, 19 July. Participant (Blandon).

Conference: NorDoc PhD Conference and Summer School. Uppsala University and Karolinska Institute, Sweden, 15–18 August. Participant (Nguyen Thanh).

Webinar: WWF’s climate webinar for food companies, theme: Consumer behaviour. 18 August. Presentation: *Nudging and limited supply – What does the consumer say?* (Jonell).

Workshop: Net zero emissions food systems. The Aspen Global Change Institute, 20–25 August, Aspen, USA. Invited speaker (Troell).

Workshop: Fairtrans 2nd science meeting 2023. Stockholm Resilience Centre, Sweden, 28–29 August. Presentation: *Habits and transformations* (Linder).

Conference: 21st International Conference on Diseases of Fish and Shellfish (EAFP XXI). Aberdeen, Scotland, 11–14 September. Keynote presentation: *Opportunities for Blue Food in a turbulent future – what’s ahead for a growing aquaculture industry?* (Troell).

Conference: Impact week – Transformative investing. Organised by Norrskan and Gullspång Re: Food, Stockholm, Sweden, 13 September. Presentation: *Sustainable financing that facilitates real change – for the benefit of people and planet* (Crona).

Science and restaurant collaboration: A Planetary Lunch – Food For Thoughts! Organised by Restaurant Proviant and Stockholm Resilience Centre, Stockholm, Sweden, 20–23 September. Presentation: *Swedish cereals and food-producing landscapes* (Jonsson).

Seminar: Aquatic production and blue carbon. Lunch seminar with key Swedish food actors, Stockholm Resilience Centre, Mistra Food Future Project, Stockholm, Sweden, 26 September. Presentation: *Food for thought – Blue Food* (Troell).

Conference: Agri4D 2023-Building resilient food systems in uncertain times. Online. 26–28 September. Participant (Baudish).

Seminar: European Bank for Reconstruction and Development, Online meeting with bank strategists. 21 September. Key note presentation: *Resilience thinking in uncertain times* (Folke).

Workshop: The Retail for Sustainability (ReSus) Project. Torsåker, Sweden, 3 October. Presentation: *A psychological perspective on sustainable behavior change within the Swedish food system* (Linder).

Workshop: Perspectives on seafood sustainability: How different are we from lay stakeholders? 2023 Pew Fellows Program in Marine Conservation Annual Meeting. Oslo, Norway, 6 October. Co-organiser and presentation (Blandon)

SeaBOS CEO annual meeting. Busan, South Korea, October. Presentation: *Reflections on the development of SeaBOS* (Folke).

Workshop: Justice Working Group, EAT-Lancet 2.0 Commission. University of Lancaster, United Kingdom. 1–3 November. Participant (Baudish).

Workshop and Seminar: Hope in the Anthropocene. The Anthropocene Laboratory, Royal Swedish Academy of Sciences, 9 November. Organiser and speaker (Sogaard Jørgensen).

Conference: Annual Meeting of the Swedish Area Group in Environmental Psychology. Gothenburg University, Sweden, 9–10 November. Presentation: *Habits and Policy Acceptance* (Linder).

Conference: Changing the way we do research together: Research Conference. Platform for a Sustainable Future. Örebro University, Örebro, Sweden. 21 November. Presentation: *Risky decisions – understanding and handling risk in complex accountability systems* (Kashyap).

Conference: Psykologer för Hållbar Utveckling: Klimatpsykologikonferens (Psychologists for Sustainable Development: Climate Psychology Conference) 2023. Karolinska Institutet, Stockholm, Sweden, 24 November. Presentation: *Ett psykologiskt perspektiv på hållbara beteendeförändringar: Normer, Beslutssituationer och Vanor (A psychological perspective on sustainable behaviour changes: Norms, decisions and habits)* (Linder).

Conference: Stockholm Gastronomy Conference 2023. Stockholm, Sweden, 23–25 November. Organiser of Conference Track: Gastronomic landscape and biosphere stewardship: Food as a tangible entry point for revitalizing landscapes and equitable food system transformations. Presentation: *Gastronomic landscapes and biosphere stewardship* (Jonsson).

Conference: EAR LTC-Sarea-ENLIGHT Congress: Strengthening Antibiotic Resistance Networks. Bordeaux, France, 27–28 November. Poster presentation (Nguyen Thanh).

Dialogue: Interlinkages across climate, biodiversity and pollution for the OECD Environmental Outlook to 2050. OECD Environment Directorate. Online 13 December. Presentation (Folke).

Media appearances *(a selection)*

Radio program: Tama torskar ska upprepa laxodlingens framgångar i Norge (Tame cod will repeat the success of salmon farming in Norway). Swedish national radio (P1 Vetenskapsradion på djupet), 6 February. Interviewed (Troell). [Link](#)

Op-ed: We have been hit hard by food insecurity. Our oceans and seas can be the solution. In Euronews, 28 February. Author (Crona). [Link](#)

Radio report: Så kan finanssektorn bromsa klimatförändringarna (How the finance sector can slow climate change). Swedish radio (SR P1), 21 March. Interviewed (Crona). [Link](#)

Newspaper article: Därför behöver hållbara beteenden underlättas (That’s why sustainable behaviour must be facilitated). *Gefle Dagblad*, 14 May. Interviewed (Linder). [Link](#)

Op-ed: Sverige har en chans att påverka antibiotikans framtid (Sweden has a chance to influence the future of antibiotics). In medicine journal Dagens Medicin, 11 October. Co-author (Sogaard Jørgensen). [Link](#)

Newspaper article: Tycker bankerna att kärnvapen är hållbara? (Do the banks consider nuclear weapons sustainable?). *Göteborgsposten*, 20 November. Interview about green funds and problems with green measurements (Crona). [Link](#)

Radio interview (live): About the scientific article: *Managing waste behavior by manipulating the normative appeal of trash bins: Lessons from an urban field experiment*. Local Swedish Radio (P4 Gävleborg). Interviewed and author of article (Linder).



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