



GLOBAL ECONOMIC DYNAMICS AND THE BIOSPHERE

THE ROYAL SWEDISH ACADEMY OF SCIENCES

The Erling-Persson Family Academy Programme

REPORT 2019



CONTENTS

INTRODUCTION	3
AIMS AND VISION	3
STAFF NEWS – GEDB is growing and evolving	4
RESEARCH ACHIEVEMENTS AND ACTIVITIES	5
Biosphere Finance.....	5
Earth System Finance	5
Supporting the financial sector to become ‘Earth System savvy’	5
Global Health and Biosphere Stewardship	6
Sustainable, resilient and healthy production systems.....	6
Risk and resilience in the global production ecosystem.....	7
Evolutionary-informed biosphere stewardship for global health and wellbeing	9
Global Child Health and Wellbeing and Biosphere Stewardship	10
Cross-cutting themes	11
Cross-scale Dynamics and Systems Transformation	11
Risk – a new emerging theme	12
COMMUNICATION AND IMPACT.....	13
APPENDIX	15

INTRODUCTION

This is the first annual report of the Global Economic Dynamics and the Biosphere programme (GEDB), in its second round of funding received from the Erling-Persson Family Foundation. GEDB is housed at the Royal Swedish Academy of Sciences, and focuses on the economic dynamics of global change in a biosphere context and its implications for a sustainable future.

The programme was set up to conduct interdisciplinary research that integrates social, economic and ecological dimensions, perspectives and data to explore scientific frontiers that lie at the nexus between these areas. In its six years of existence, the programme has performed rigorous, high-impact scientific work of relevance for, and in collaboration with, practice, policy, business and society as a whole. The emphasis of the programme has been, and remains, science for change.

The focus and achievements of GEDB so far have been of a highly emergent and innovative nature, combining methods

and disciplines across largely unexplored domains to develop sustainability science. This differs from most other academic efforts in (at least) three ways by:

- Connecting knowledge and competencies of researchers from disciplines that seldom interact.
- Combining whole areas of work that have previously not been combined.
- Enabling new forms of collaboration between science, practice and business for human wellbeing and biosphere stewardship.

The outcomes are novel and surprising research findings, the emergence of unexplored areas and new fields of research, and informed collaborative platforms engaging central actors in society and business. Together, these are solving problems and challenges of great relevance for actions towards sustainability and a prosperous future.

AIMS AND VISIONS

- To create a platform for interdisciplinary collaboration on the challenges of global change and sustainability, with a 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 economists and scientists from other 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.

STAFF NEWS

– GEDB is growing and evolving

As part of a reorganisation to align with new research themes, GEDB has recruited some new colleagues. Recruitment of postdocs has been ongoing throughout 2019 and has resulted in appointment of three successful candidates:

Tiscar Graells has taken up a postdoctoral research post in the 'AMResilience' project since February 2019, where she will be working on collecting, analysing and understanding success factors and obstacles to interventions aiming to limit antibiotic resistance in One Health systems.

Malin Jonell and **Miina Porkka** will join the Global Health and Biosphere Stewardship theme as postdoctoral fellows to develop work around strategies for transforming aquatic and terrestrial food systems, in Sweden and internationally (Malin), and to study the interplay between hydrology, climate and global food systems (Miina).

We have also been joined by a number of research assistants. These young, enthusiastic, extremely competent and highly motivated individuals are one of the ways in which GEDB contributes to capacity building in the next generation of transdisciplinary sustainability academics. Several of our research assistants have become PhD students and our first GEDB PhD student graduated in January 2020!

Joining us as research assistants in 2019 were **Kate Lillepold**, who has a background in epidemiology, and **Sofia Maniatakou**, with a background in sustainability science. **Moa Olsson** was recruited to join GEDB in mid-January 2020, also with a background in sustainability science.

One measure of the great success of the work of GEDB, and hence the value of the financial support from the Erling-Persson Family Foundation, is that it continues to attract additional external funding for various research projects. A good example is the work within the Biosphere Finance theme, which has resulted in two novel externally funded projects within which we have hired (or are in the process of hiring) a number of postdocs, research assistants and senior researchers.

Andrea Downing was recruited to join GEDB in January 2020, to work on the project 'Financial dimensions of a key climate system 'wild card': The atmospheric brown cloud over South Asia". This project was awarded funding from Formas to combine detailed information on black carbon emission sources with value chain analysis and analysis of corporate ownership and debt, in order to identify possible leverage points at which to exert agency through the financial sector to reduce black carbon emissions in the region, and thus improve human and environmental health.

Emma Sundström joined GEDB in autumn 2019 to help develop our financial data analyses. From January 2020, Emma will be working specifically to analyse the contribution to Earth System sustainability of environmental, social and governance (ESG) metrics currently used in the financial sector. Emma is a systems developer by training and has been working to support analysis in transdisciplinary environmental research for over a decade.



Photo: Albert Norström

Jean-Baptiste Jouffray with his supervisors and opponent at the successful defence of his thesis. From left: Albert Norström (SRC), Douglas McCauley (opponent, UC Santa Barbara), Jean-Baptiste Jouffray, Magnus Nyström (SRC), Beatrice Crona (GEDB executive director), Hensrik Österblom (SRC).

Congratulations to Jean-Baptiste Jouffray! On 17 January 2020, he successfully defended his thesis entitled: *'The Anthropocene Ocean'*. This is the first GEDB-funded PhD thesis to be completed. Jean-Baptiste is a former GEDB research assistant who embarked on his PhD studies in 2014, under the GEDB theme Marine Resource Trade, and he is already a highly published and well-cited academic.



Biosphere Finance

The Biosphere Finance theme examines the broader financial sector, specifically capital markets, and the many ways in which they are linked to, and determine outcomes for, the biosphere. When the theme first began this was completely uncharted terrain, but over the past three years the team has built up a scholarly foundation through high-impact published work, as well as a reputation for being able to deliver frontier science to users in the financial sector. This is evidenced by the many invitations to participate in national and international events explored in more detail below. However, the field is young, and the enormous development potential that exists must be tapped to unlock the power of the financial sector to fully promote biosphere sustainability and stewardship.

Earth System Finance

The 'Earth System finance' project in 2016 was the first research project initiated under the emerging Earth System Finance theme. Alice Dauriach, who joined GEDB as a research assistant in that year and who was instrumental in developing the methodology and analysis, transferred to the PhD programme in 2019. She will investigate the impacts of global corporate ownership patterns on critical processes for biosphere integrity and human wellbeing. Specifically, she will assess the degree to which corporate ownership networks of the largest companies in economic sectors associated with critical biosphere processes are linked to jurisdictions where secrecy, low taxes and lenient regulations prevail. [Read more: www.sleepinggiantsearth](http://www.sleepinggiantsearth)

Supporting the financial sector to become 'Earth System savvy'

A new Vinnova-funded project launched in November 2019 will build on the Earth System Finance theme by taking the next step and develop metrics that can support an informed shift of mainstream capital towards activities that reduce harm and promote biosphere resilience. The project, with the working name 'Earth System-savvy environmental impact metrics', will empirically evaluate the barriers that prevent current ESG ratings from unlocking financial sector engagement to avoid planetary tipping points and systemic climate risk. It is a collaboration between researchers at GEDB and Stockholm Resilience Centre, with four different Swedish investors (two large banks, a front-runner in sustainable investment, and a major Swedish pension fund) as partners to stress-test the deliverables.

Activities

- In 2019, two further dialogues were held with financial market representatives in collaboration with Future Earth. The first was in Tokyo in March and the second in Singapore in June in conjunction with the annual investment conference organised by Temasek Holding, who also sponsored the session.
- In June, Alice Dauriach took part in the first academic attempt at bringing together European scholars from various disciplines in the social sciences to discuss social and environmental impacts of tax and information havens, held at University of Birmingham, UK.



Global Health and Biosphere Stewardship

People are at the intersection of the global economy and the biosphere, but can often be left out from the equation in studies of global dynamics. GEDB’s new global health theme has been conceived with the aim of placing people front and centre to meet the sustainability challenges associated with the economy and the biosphere. In particular, the theme aims at uncovering how key elements of the biosphere support global health and wellbeing and how these elements can best be managed to improve health and wellbeing. This is an emerging research front, with many undiscovered connections for health, welfare and sustainable development that we hope will result in new research avenues and better understanding of global health. So far, the Global Health and Biosphere Stewardship theme has four sub-themes.

Sustainable, resilient and healthy production systems

A large part of the surface and volume of the planet is used for producing biomaterials for human consumption. This sub-theme studies how production can be governed to promote global health and environmental sustainability, including through consumption perspectives. A set of activities in this sub-theme relates to the EAT-Lancet Commission and follow-ups to the Commission on health and sustainable diets, such as the Blue Food Assessment. Other research activities investigate global dynamics of production and relates them to distal health risks, such as shocks to production, through a resilience lens.

The Eat-Lancet report and Blue Food Assessment

The EAT-Lancet report explored options for keeping healthy diets within planetary environmental limits and highlighted the important future role of seafood (Nyström et al. 2019; Willett et al. 2019). A complementary scoping report by the Beijer Institute and partner GEDB contributed with an in-depth analysis of the role of seafood for improved human health and environmental sustainability. It also investigated challenges and future prospects for increased seafood production.

The role aquatic foods can play in transitioning the world to a healthy and sustainable food system is an area which has received limited attention, but could be fundamental to efforts to change production and consumption to a resilient food system in the coming decade.



Sofia Käll did field work in Central Java, Indonesia in August, where she joined fishers to learn about their practices and conduct interviews. Sofia’s research focuses on opportunities and barriers for private governance to improve the sustainability of fisheries globally.

The Blue Food Assessment is a close collaboration between Stanford University and Stockholm Resilience Centre (with partners Beijer Institute and GEDB) to explore this issue. It is a large-scale scientific assessment comprising eight papers to be published in Nature-Springer journals over the coming 18 months, and is co-chaired by GEDB executive director Beatrice Crona and Stanford Professor Roz Naylor.

Risk and resilience in the global production ecosystem

This sub-theme explores the dynamics of ecosystem appropriation for production of harvestable biomass in the form of food, fuel and fibre. However, further land conversion and land redistribution is dwindling as options to meet projected global demand. As a result, ecosystems are being intensified and homogenised for the production of one or a few harvestable species. Although these alterations occur at local scales, their cumulative effect is transforming much of the Earth's biosphere into an intensive, simplified and – through socioeconomic and biophysical processes – hyperconnected 'global production ecosystem' (GPE).

GEDB was involved as a key contributor in publishing a paper exploring the anatomy and resilience of the GPE, which was published in the special issue of the journal *Nature* for its 150th anniversary (Nyström et al. 2019). The paper shows that certain features of the GPE converge to yield high and predictable supplies of biomass in the short term, but erode

global resilience and create conditions for novel and pervasive risks to emerge and interact in the longer term. Consequently, the limits of the biosphere in satisfying human demands may be set by the consequences of these emergent risks, as opposed to hard upper limits to production per se.

As part of the work in this sub-theme, a PhD student, Emmy Wassénus, is working on a global mapping of three trade-offs related to emerging risk from the GPE. These are: (1) food security versus safe production environments; (2) emergence of infectious diseases versus general resilience of the system; and (3) local supply resilience versus global supply resilience.

A key element of the biosphere that is being explored in the Global Health and Biosphere Stewardship theme is the global ecosystem of microorganisms (the global microbiome), especially with regard to preserving the potential of antibiotic treatments by preventing the spread of antibiotic resistance. Microorganisms have been living on this planet for billions of years and, while fundamental for human health, also pose challenges in terms of infectious diseases. Antibiotics have been called the miracle drugs of the 20th century, but are increasingly becoming ineffective due to evolution and spread of resistance among bacteria. This sub-theme takes a biosphere stewardship approach to the global health challenge of antibiotic resistance, which is fundamentally different to the dominant approach of drug innovation emphasised in

Photo: Nemanja Otic / Alamy Stock Photo





global policy discourse and action. As recent reports from the World Health Organisation have shown, new classes of drugs that can alleviate the impacts of resistance are decades into the future, emphasising the importance of a biosphere stewardship approach to antibiotic resistance.

The work in this sub-theme has two main goals:

- To provide new frameworks and analyses that guide transformations toward biosphere stewardship of antibiotic resistance ('Living with resistance' project).
- To provide a learning platform to study interventions on antibiotic resistance ('AMResilience' project).

Living with resistance – research on biosphere stewardship of antibiotic resistance

The 'Living with resistance' project ran for two years (2016-2018) at the U.S. National Socio-Environmental Synthesis Centre (SESYNC) and multiple outcomes are now being published. Previous key publications have studied global dynamics of antibiotic and pesticide resistance and highlighted the need for change and possible pathways that change could take.

Two publications in 2019 highlighted opportunities for sustainability assessments of antibiotic use in livestock production (Lhermie et al. 2019a, 2019b). In addition, a

publication introducing a framework for governing cultural evolution related to antibiotic and pesticide use was accepted for publication in the journal *Trends in Ecology and Evolution* and will come out in 2020. The paper sets out a framework for promoting innovative solutions for biosphere stewardship by understanding leverage points for cultural change.

Preliminary results from an ongoing analysis show that, while current policy action has been successful in lowering antibiotic use, it has proven much more difficult to change the frequency at which resistance to treatment is encountered. Worryingly, climate has been a much stronger driver of rapidly changing dynamics.

AMResilience – a learning platform to study interventions and enhance resilience

The 'AMResilience' project aims to study how interventions to limit antimicrobial resistance are reflected in the resilience and transformability of health systems. It is attempting to document which interventions work to limit antibiotic resistance across animal and human health (One Health). At the end of March 2019, the website for the project was officially launched. At the centre of the project is the aim to produce an online learning database platform to understand success factors and obstacles to interventions. It will seek to collect all interventions and specify important features to help experts and stakeholders determine which might be most suitable, depending on context.

Two papers, outlining the learning platform and its database, are now in review and in revision, respectively, with two peer-reviewed journals.

A questionnaire to gather information about interventions was designed jointly with our colleagues at the University of Waterloo, Canada. The purpose of the questionnaire was to obtain a detailed picture of interventions on antimicrobial resistance among different and broad fields and it was sent to key stakeholders and experts in late April-early May 2019. Responses were collected for two months. Another much shorter questionnaire was sent to corresponding authors of published articles reporting interventions, with the aim of gathering information often not specified in published papers, such as success factors or difficulties that affect interventions. [Read more: www.amr-resilience.gtglab.net](http://www.amr-resilience.gtglab.net)

The 'AMResilience' project reached another milestone in 2019 with the organisation of a series of workshops with experts on antimicrobial resistance. The first of these workshops focused on high-income countries and was held in September at Stockholm Resilience Centre. The second focused on low- to middle-income countries and was held in October in Worldfish Penang, Malaysia. In both workshops, the experts helped us assess our data and validate our preliminary findings based on their experience.

The SeaBOS initiative (see the Communication and Impact section of this report) also includes a focus on antibiotic use. A background brief on the status of the work and on challenges was developed for the dialogue in Phuket in 2019.

Evolutionary-informed biosphere stewardship for global health and wellbeing

Evolution is an intrinsic property of the biosphere and therefore, improving global health through biosphere stewardship will depend on improving the capacity for governing evolutionary processes. This sub-theme explores governance of evolution in the Anthropocene to improve global human health and wellbeing. In 2019, a major review on governing evolution in the Anthropocene biosphere was published in the journal *Annual Reviews in Ecology and Evolution* (Søgaard Jørgensen et al. 2019). In addition, a comparative case study of governance of resistance evolution in Bt-crops in the USA, Australia, Brazil and India was published in *Ambio* (Carrère et al. 2019). Ongoing work in this sub-theme is applying a predictive approach to map risk factors for emerging infectious disease events in humans, livestock and crops.

Photo: Claire Loy



Participants of the workshop in Malaysia within the 'AMResilience' project, where experts helped the researchers to assess data and validate findings.

In 2019, Peter Søgaard Jørgensen signed a contract with Princeton University Press for a book entitled *Evolution and Sustainability: Understanding the Dynamics of Rapid Change in the Anthropocene* (expected 2022). In 2020, Peter Jørgensen and Carl Folke will participate in a working group on studying evolution in social-ecological systems, to be held at the Konrad Lorenz Institute, Austria.

Global Child Health and Wellbeing and Biosphere Stewardship

This theme investigates how child health and wellbeing can be improved globally through biosphere stewardship. A key part of the work in this theme so far has been conducted in collaboration with the Swedish Institute for Global Health Transformations (SIGHT). GEDB contributed to a SIGHT report seeking to put child health at the centre of the 2030 Agenda and the Sustainable Development Goals (SDGs), while acknowledging the biosphere as the foundation for human health and wellbeing (Alfvén et al. 2019a, 2019b) (Fig. 1). This work is now being followed up with an empirical analysis of how child health outcomes are related to food production system characteristics in 100 low- and middle-income countries. We have also applied for additional funding through the Formas funding call on the SDGs, so that we can expand the collaboration with SIGHT.

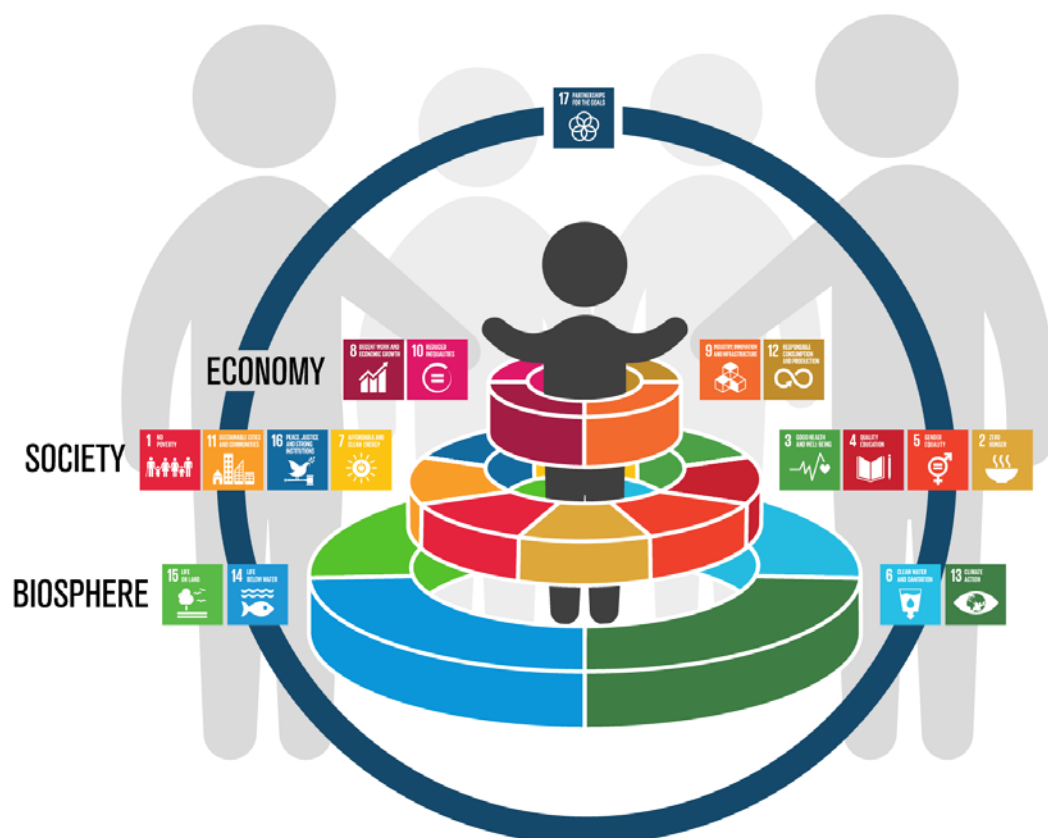


Figure 1. Child health and wellbeing. A new conceptual model placing children at the centre of the 16 United Nations Sustainable Development Goals.

Intergenerational perspective on global sustainability and well-being

Under the child and youth theme work has also been done to contribute to transdisciplinary, global sustainability initiatives to ensure the voice of young people is represented in topics of intergenerational importance for sustainability, health and wellbeing. A paper published in *Current Opinion in Environmental Sustainability* provides the first comparative assessment of how global sustainability initiatives are working with early-career researchers as a means of bridging differences in intergenerational perspectives on sustainability and wellbeing (Jørgensen et al. 2019). Assessing six modes of collaboration with early-career researchers, the assessment found widely varying levels of ambition among global sustainability initiatives, from working with all six modes to just a couple. The lessons learned from this assessment are now being implemented on the ground in work with Future Earth and the Association for Sustainability Research and Innovation, to create a society informed about sustainability science that works actively with intergenerational issues.

Activities

- Outreach associated with publication of the EAT-Lancet Commission's report.
- Workshop: Blue Food Assessment (BFA) 'Putting aquatic production at the heart of global food systems', Stockholm Resilience Centre, Stockholm. Organiser Max Troell, 11 June 2019. Presentation: 'EAT Blue scoping report'.
- Participation in a UK Royal Society scoping workshop on 'Scenarios for antibiotic resistance', March 2019.
- Throughout 2019, the 'AMResilience' project held stakeholder workshops to inform and co-produce an online learning platform for interventions targeting antibiotic resistance. This platform is called AMR-Intervene.

Cross-cutting themes

Cross-scale Dynamics and Systems Transformation

Ultimately, research at GEDB aims at a deeper understanding of critical features in the intertwined world, which could serve as leverage for systemic change towards sustainability and a prosperous future. New discoveries were made during the year, in addition to those reported above. They include work on major systemic tipping points in relation to destabilising fluctuations, uncertainty and exploration in many facets of contemporary society (Carpenter et al. 2019). This includes the role of transnational corporations in relation to biosphere dynamics (Folke et al. 2019), where we found that a handful of transnational corporations in agriculture, forestry, seafood, cement manufacture, minerals and fossil energy possess the ability to influence critical functions of the biosphere (Fig. 2). On a more hopeful note, we also identified six features of rapid change towards more sustainable business activities with significant potential for upscaling. In addition, we defined the concept 'corporate biosphere stewardship', which is now gaining attention in the business and policy realms.

In collaboration with corporate accounting scholars, we explored how accounting can engage with the new dynamics of the Anthropocene and devise a way by which corporate stewardship can engage more directly with issues of relevance for contributing to transformative change (Bebbington et al. 2019).

Finally, building on his previous experience and engagement with NATO, research assistant Amar Causevic has been pursuing ways to link Earth System tipping points to issues of national security. Amar was invited to give a presentation at NATO's Crisis Management and Disaster Response Centre of Excellence (CMDR COE) on 5–6 June in Sofia, Bulgaria, on the topic 'NATO in the Anthropocene: Emergence of tipping points and associated security challenges'.

Activities

- Max Troell presented 'Global perspective on foods and the role of aquaculture for sustainable growth' at the Future Industry Forum 'What will it take to create a new, profitable and sustainable industry?' in Karlstad, Sweden, on 14–15 March 2019.
- Max Troell contributed to the Krinova Food Hackaton, Krinova Incubator & Science Park, Kristianstad, Sweden, on 15 March 2019.

Illustration: Nature Ecology & Evolution

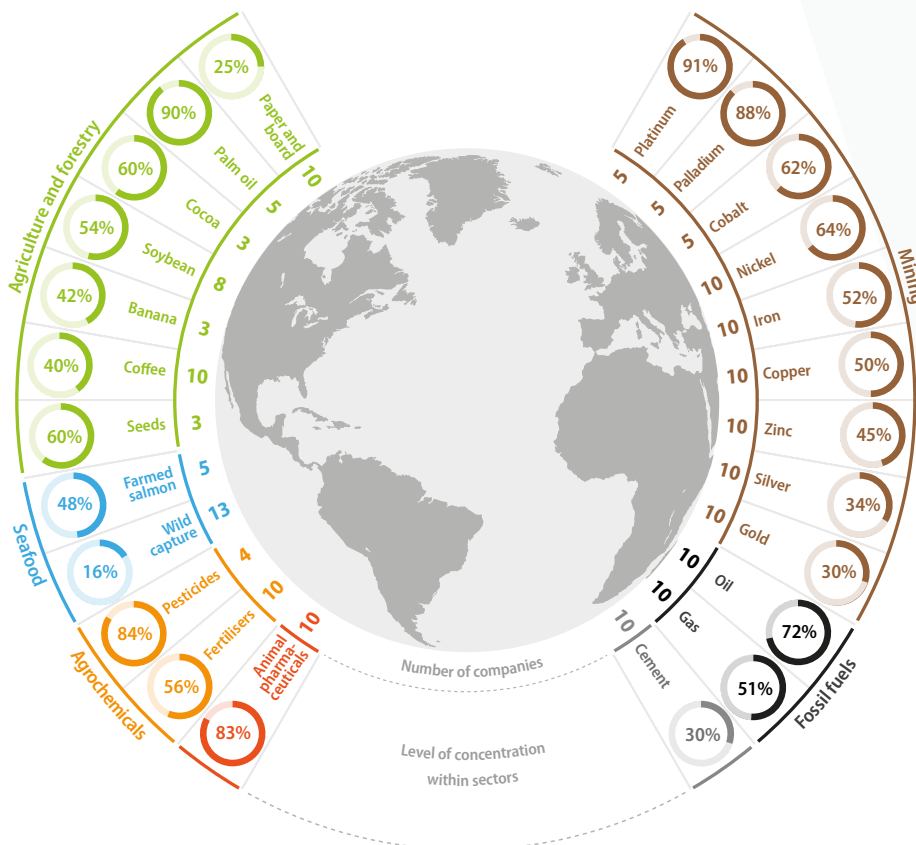


Figure 2. The biosphere in the hands of a few. Transnational corporations have become a major force shaping the world's ocean, atmosphere and terrestrial biomes. Based on available data, the diagram shows estimated levels of concentration for industries shaping the biosphere (Folke et al. 2019).



Victor Galaz at the annual meeting for Nordic Sustainable Investment Forums in November, where he presented the 'Sleeping Giants' report.

Risk – a new emerging theme

As work on the Biosphere Finance theme has progressed, a divergence in how risk is conceptualised and dealt with in sustainability science and finance has become apparent. Work to date indicates that this divergence can be a critical barrier to realising the potential of the financial sector to become a force for transformative change towards social and environmental sustainability. These emerging findings have led to the development of new research designed to make these differences explicit and, as a next critical step, outline ways to bring the divergent risk frameworks into closer alignment.

As GEDB-related research has shown (Nyström et al. 2019), food systems have become global complex adaptive systems (also referred to as 'global production ecosystems'). Thus the different food production and agribusiness sectors are today connected and interdependent in complex ways. One novel addition to the research areas under GEDB is a focus on systemic (or networked) risks to address connectivity in a system. This work aims to span the fields of sustainability, food systems and finance by connecting the tipping point dynamics in the biophysical realm to covariance risk metrics in finance. It will also move beyond a focus only on tipping

points, and ask questions such as: What risks are associated with loss of diversity in the global food production system? How do the patterns of diversity in food production affect risks to buffer capacity? How are these risks spread spatially across the globe? And what are the anticipated risks for the biosphere and for human health?

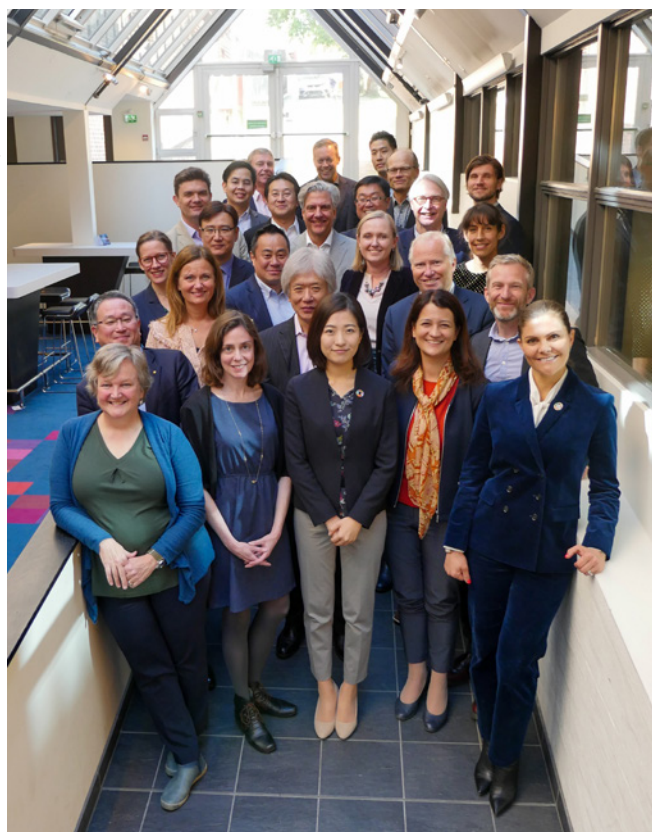
This new focus on risk will form a key thread in work cutting across the Biosphere Finance and Global Health and Biosphere Stewardship themes in years to come.

Activities

- Beatrice Crona co-developed and led a workshop on 'Active ownership and deforestation risks' with the Sustainable Finance Research Platform at Misum and Stockholm Sustainable Finance Centre. This was at the invitation of Sveriges Forum for Hållbara Investeringar (Swesif) and the Nordic Sustainable Investment Forum (SIF) and was held on 7 November 2019. Victor Galaz was one the plenary speakers.

COMMUNICATION AND IMPACT

Photo: Ingrid Jaeger/Mowi



Participants of the SeaBOS meeting in Bergen, Norway.

The emphasis at GEDB is on science for change. In 2019, GEDB initiated numerous engagements with practice, policy and business. These range from deep long-term collaborations, learning platforms for navigating change and dialogues for actions to lectures and presentations, conventional and social media communications, and participation in exhibitions and cultural events.

The year 2019 saw increased engagement with the business and financial sector. Our scientific findings have led to invitations to make presentations and hold dialogues with more than 40 financial actors, in Sweden and internationally, including leading Swedish Banks (e.g. SEB, Handelsbanken, Nordea, Swedbank and also Danske Bank), pension funds (e.g. Alecta, AMF, Council on Ethics Swedish National Pension Funds, Council on Ethics for the Norwegian Government Pension Fund Global), diverse investors (e.g. Nordic Sustainable Investment Forum, Öhmans Fonder, Summa Equity, Chairs Circle) and others (e.g. Swedish Investors for Sustainable Development, Swedish International Development Agency [Sida], Swedish Church, Finansliv). It also led to GEDB staff contributing 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 presented the 'Sleeping Financial Giants' findings internationally to several banks and funds (e.g. Legal & General, Aberdeen Standard Investments, HSBC Global Asset Management, CDC Group plc, Rathbone Brothers Plc, APG, Robeco, S&P Global Ratings, HSBC Bank, AXA XL) and at seminars in Japan (e.g. Sumitomo Mitsui Trust International, Mitsubishi UFJ Trust and Banking, Mitsubishi UFJ Morgan Stanley Sec. Co., Ltd., Development Bank of Japan, Mizuho Securities Co., DBS Bank Tokyo, Nomura Securities Co. Ltd., MS&AD Casualty Insurance, Citigroup Tokyo, FTSE Japan Limited, Government Pension Investment Fund Japan, Asset Management One Co., Ltd, JP).

Interactions have started with Temasek Holdings, a major South-East Asia investor based in Singapore. During its Ecosperity Conference week in 2019, we organised, together with Future Earth, a session on 'Sleeping Financial Giants - Opportunities for financial leadership for climate stability'. Beatrice Crona gave talks and participated in high-level meetings and Carl Folke has been invited to serve as scientific advisor to the Ecosperity Advisory Group.



Cover page - Principles of Responsible Investment

In collaboration with PRI (Principles for Responsible Investment)/ CERES, on 18 September GEDB published a statement on the Amazon region, with six principles for responsible investments. This inspired 230 investors (including several major Swedish pension funds) with assets under management of USD 16.2 trillion to call for corporate actions on deforestation, signalling support for the Amazon as a centre for sustainable development. The work was promoted by Fiona Reynolds, managing director of PRI, in her opening address at PRI's annual conference of investors.

Cooperation continues with the top ten transnational seafood corporations in the Keystone Dialogues and SeaBOS (Seafood Business for Ocean Stewardship). Strong actions are now being taken within and between the companies to create sustainable supply chains and seafood production, while efforts to include broader challenges of ocean stewardship are emerging.

During the year, the SeaBOS organisation was formally established. There were two dialogues in 2019 in Bergen, Norway and Phuket, Thailand. In addition to the companies and scientists involved, HRH Crown Princess Victoria, an SDG Ambassador, is engaged in the effort, as is Professor Jane Lubchenco, who has served as the U.S. Undersecretary of Commerce for the National Oceanic and Atmospheric Administration and as part of President Barack Obama's Science Team.

The SeaBOS initiative is creating rings on the water and has inspired actions by e.g. the Sustainable Ocean Business Action Platform of the UN Global Compact, The High Level Panel for a Sustainable Ocean Economy and the World Economic Forum's Friends of Ocean Action.

The Earth System Finance project was invited to present the project to 300 directors, producers and broadcasters at the Copenhagen Documentary Festival (26 March 2019), and to take part in a half-day workshop with six representatives of the film industry, where we brainstormed how to make a good documentary about this research. It was a fantastic opportunity to showcase our results to a broad audience and make connections in the film industry for a potential documentary.

APPENDIX

STAFF:

Director	Carl Folke
Executive Director	Beatrice Crona
Deputy Executive Director:	Peter Søggaard Jørgensen
Senior Academy Researchers:	Thomas Hahn Victor Galaz Emma Sundström Max Troell
Post-Doctoral Researchers:	Tiscar Graells
PhD Candidates:	Alice Dauriach Ami Golland Jean-Baptiste Jouffray Sofia Käll Emmy Wassénus
Research Assistants:	Amar Causevic Kate Lillepold Sofia Maniatakou
Communications Officer:	Agneta Sundin (on leave 2019) Hannah Griffiths-Berggren (until July 2019)
Finance and HR Administration:	Sofia-Kristin Kokinelis

FUNDING:

Core funding by the Erling-Persson Family Foundation.

Additional funding was also received in 2019 by the Swedish Research Council Formas, the Swedish Foundation for Strategic Environmental Research Mistra, Sweden's innovation agency Vinnova and the Swedish Research Council, VR.

NEW FUNDING:

ESG-rating as a key to unlock financial sector engagement with planetary tipping points and systemic climate risk. Vinnova, Sweden. Grant 5,527,741 SEK (of which 1,837,594 SEK to GEDB). Project lead (Crona).

Financial Dimensions of a key climate system "Wild Card": The Atmospheric Brown Cloud over South Asia. Formas, Sweden. Grant 7,393,000 SEK received in 2018 (of which 2,600,000 SEK to GEDB). Project lead (Crona).

JOURNAL ARTICLES PUBLISHED:

- Alfvén, T., J. Dahlstrand, D. Humphreys, D. Helldén, S. Hammarstrand, A.-C. Hollander, M. Målbqvist, S. Nejat, P. Søggaard Jørgensen, P. Friberg, and G. Tomson. 2019. Placing children and adolescents at the centre of the Sustainable Development Goals will deliver for current and future generations. *Global Health Action* 12:1–4.
- Aston, E. A., G. J. Williams, J. A. M. Green, A. J. Davies, L. M. Wedding, J. M. Gove, J.-B. Jouffray, T. T. Jones, and J. Clark. 2019. Scale-dependent spatial patterns in benthic communities around a tropical island seascape. *Ecography* 42(3):578–590.
- Bebbington, J., H. Österblom, B. Crona, J.-B. Jouffray, C. Larrinaga, S. Russell, and B. Scholtens. 2019. Accounting and accountability in the Anthropocene. *Accounting, Auditing and Accountability Journal* 33(1):152–177.
- Blasiak, R., C. C. C. Wabnitz, T. Daw, M. Berger, A. Blandon, G. Carneiro, B. Crona, M. F. Davidson, S. Guggisberg, J. Hills, F. Mallin, E. McManus, K. Ould-Chih, J. Pittman, X. Santos, L. Westlund, H. Wetterstrand, and K. Wiegler. 2019. Towards greater transparency and coherence in funding for sustainable marine fisheries and healthy oceans. *Marine Policy* 107:103508.
- Blasiak, R., J.-B. Jouffray, C. C. C. Wabnitz, and H. Österblom. 2019. Scientists should disclose origin in marine gene patents. *Trends in Ecology and Evolution* 34(5):392–395.
- Burch, S., A. Gupta, C. Y. A. Inoue, A. Kalfagianni, Å. Persson, A. K. Gerlak, A. Ishii, J. Patterson, J. Pickering, M. Scobie, J. van der Heijden, J. Vervoort, C. Adler, M. Bloomfield, R. Djalante, J. Dryzek, V. Galaz, C. Gordon, R. Harmon, S. Jinnah, R. E. Kim, L. Olsson, J. Van Leeuwen, V. Ramasar, P. Wapner, and R. Zondervan. 2019. New directions in earth system governance research. *Earth System Governance* 1:100006.
- Carpenter, S. R., C. Folke, M. Scheffer, and F. R. Westley. 2019. Dancing on the volcano: social exploration in times of discontent. *Ecology and Society* 24(1):23.
- Carrière, Y., Z. S. Brown, S. J. Downes, G. Gujar, G. Epstein, C. Omoto, N. P. Storer, D. Mota-Sanchez, P. Søggaard Jørgensen, and S. P. Carroll. 2019. Governing evolution: A socioecological comparison of resistance management for insecticidal transgenic Bt crops among four countries. *Ambio* 49:1–16.
- Crona, B., S. Käll, and T. Van Holt. 2019. Fishery Improvement Projects as a governance tool for fisheries sustainability: A global comparative analysis. *PLOS ONE* 14(10):e0223054.
- Drury O'Neill, E., B. Crona, A. J. G. Ferrer, and R. Pomeroy. 2019. From typhoons to traders: the role of patron-client relations in mediating fishery responses to natural disasters. *Environmental Research Letters* 14:045015.
- Drury O'Neill, E., T. Lindahl, T. Daw, B. Crona, A. J. G. Ferrer, and R. Pomeroy. 2019. An Experimental Approach to Exploring Market Responses in Small-Scale Fishing Communities. *Frontiers in Marine Science* 6:491.
- Folke, C., H. Österblom, J.-B. Jouffray, E. F. Lambin, W. N. Adger, M. Scheffer, B. I. Crona, M. Nyström, S. A. Levin, S. R. Carpenter, J. M. Anderies, S. Chapin III, A.-S. Crépin, A. Dauriach, V. Galaz, L. J. Gordon,

- N. Kautsky, B. H. Walker, J. R. Watson, J. Wilen, and A. de Zeeuw. 2019. Transnational corporations and the challenge of biosphere stewardship. *Nature Ecology and Evolution* 3:1396–1403.
- Fortnam, M., K. Brown, T. Chaigneau, B. Crona, T. M. Daw, D. Gonçalves, C. Hicks, M. Revmatas, C. Sandbrook, and B. Schulte-Herbruggen. 2019. The Gendered Nature of Ecosystem Services. *Ecological Economics* 159:312–325.
- Garcia, D., V. Galaz, and S. Daume. 2019. EAT-Lancet vs. yes2meat: Understanding the digital backlash to the planetary health diet. *The Lancet* 394(10215):2153–2154.
- González-Mon, B., Ö. Bodin, B. Crona, M. Nenadovic, and X. Basurto. 2019. Small-scale fish buyers' trade networks reveal diverse actor types and differential adaptive capacities. *Ecological Economics* 164:106338.
- Hallström, E., K. Bergman, K. Mifflin, R. Parker, P. Tyedmers, M. Troell, and F. Ziegler. 2019. Combined climate and nutritional performance of seafoods. *Journal of Cleaner Production* 230:402–411.
- Henriksson, P. J. G., L. K. Banks, S. K. Suri, T. Y. Pratiwi, N. A. Fatan, and M. Troell. 2019. Indonesian aquaculture futures — identifying interventions for reducing environmental impacts. *Environmental Research Letters* 14:124062.
- Jouffray, J.-B., B. Crona, E. Wassénus, J. Bebbington, and B. Scholtens. 2019. Leverage points in the financial sector for seafood sustainability. *Science Advances* 5(10):eaax3324.
- Jouffray, J.-B., L. M. Wedding, A. V. Norström, M. K. Donovan, G. J. Williams, L. B. Crowder, A. L. Erickson, A. M. Friedlander, N. A. J. Graham, J. M. Gove, C. V. Kappel, J. N. Kittinger, J. Lecky, K. L. L. Oleson, K. A. Selkoe, C. White, I. D. Williams, and M. Nyström. 2019. Parsing human and biophysical drivers of coral reef regimes. *Proceedings of the Royal Society B* 286(1896):20182544.
- Keys, P. W., V. Galaz, M. Dyer, N. Matthews, C. Folke, M. Nyström, and S. E. Cornell. 2019. Anthropocene risk. *Nature Sustainability* 2:667–673.
- Koh, N. S., T. Hahn, and W. J. Boonstra. 2019. How much of a market is involved in a biodiversity offset? A typology of biodiversity offset policies. *Journal of Environmental Management* 232:679–691.
- Lhermie, G., D. Wernli, P. Sogaard Jørgensen, D. Kenkel, C.-Y. C. Lin Lawell, L. W. Tauer, and Y. T. Gröhn. 2019. Tradeoffs between resistance to antimicrobials in public health and their use in agriculture: Moving towards sustainability assessment. *Ecological Economics* 166:106427.
- Lhermie, G., D. Wernli, P. Sogaard Jørgensen, D. Kenkel, L. W. Tauer, and Y. T. Gröhn. 2019. Global resistance to antimicrobials and their sustainable use in agriculture. *The Lancet Planetary Health* 3(3):PE109–E110.
- Luthman, O., M. Jonell, and M. Troell. 2019. Governing the salmon farming industry: comparison between national regulations and the ASC salmon standard. *Marine Policy* 106:103534.
- Metian, M., M. Troell, V. Christensen, J. Steenbeek, and S. Pouil. 2019. Mapping diversity of species in global aquaculture. *Reviews in Aquaculture*.
- Nyström, M., J.-B. Jouffray, A. V. Norström, B. Crona, P. Sogaard Jørgensen, S. R. Carpenter, Ö. Bodin, V. Galaz, and C. Folke. 2019. Anatomy and resilience of the global production ecosystem. *Nature* 575:98–108.
- Suškevičs, M., T. Hahn, and R. Rodela. 2019. Process and contextual factors supporting action-oriented learning: A thematic synthesis of empirical literature in natural resource management. *Society and Natural Resources* 32(7):731–750.
- Sogaard Jørgensen, P., C. Folke, and S. P. Carroll. 2019. Evolution in the Anthropocene: Informing Governance and Policy. *Annual Reviews in Ecology, Evolution and Systematics* 50:527–546.
- Sogaard Jørgensen, P., C. J. Evoh, L. C. Gerhardinger, A. C. Hughes, G. S. Langendijk, H. Moersberger, J. Pocklington, and N. Mukherjee. 2019. Building urgent intergeneration bridges: Assessing early career research integration in global sustainability initiatives. *Current Opinion in Environmental Sustainability* 39:153–159.
- Tlusty, M. F., P. Tyedmers, M. Bailey, F. Ziegler, P. J. G. Henriksson, C. Béné, S. Bush, R. Newton, F. Asche, D. C. Little, M. Troell, and M. Jonell. 2019. Reframing the sustainable seafood narrative. *Global Environmental Change* 59:101991.
- Willett, W., J. Rockström, B. Loken, M. Springmann, T. Lang, S. Vermeulen, T. Garnett, D. Tilman, F. DeClerck, A. Wood, M. Jonell, M. Clark, L. J. Gordon, J. Fanzo, C. Hawkes, R. Zurayk, J. A. Rivera, W. De Vries, L. Majele Sibanda, A. Afshin, A. Chaudhary, M. Herrero, R. Agustina, F. Branca, A. Lartey, S. Fan, B. Crona, E. Fox, V. Bignet, M. Troell, T. Lindahl, S. Singh, S. E. Cornell, K. S. Reddy, S. Narain, S. Nishtar, and C. J. L. Murray. 2019. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet* 393(10170):447–492.
- Williams, G. J., N. A. Graham, J.-B. Jouffray, A. V. Norström, M. Nyström, J. M. Gove, A. Heenan, and L. M. Wedding. 2019. Coral reef ecology in the Anthropocene. *Functional Ecology* 33(6):1014–1022.

BOOK CHAPTERS:

- Jonell, M., M. Tlusty, M. Troell, P. Rönnbäck. 2019. Certifying farmed seafood – a drop in the ocean or a 'stepping-stone' towards increased sustainability?. In: Vogt, M. (ed.) *Sustainability Certification Schemes in the Agricultural and Natural Resources Sectors: Outcomes for society and the environment*. Routledge, Oxon, UK. pp. 323–345.

OTHER:

- Causevic, A. 2019. NATO in the Anthropocene: Emergence of the Tipping Points and Associated Security Challenges. CMDR COE Conference Proceedings 2019.
- Hornborg, S., E. Hallström, F. Ziegler, K. Bergman, M. Troell, M. Jonell, P. Rönnbäck, and P. J. G. Henriksson. 2019. Frisk med fisk utan risk? Betydelsen av svensk konsumtion av sjömat för hälsa och miljö (Improved Human Health from Seafood Consumption without Risks – A Swedish Perspective). RISE report 2019:38.
- Troell, M., M. Jonell, and B. Crona. 2019. Beijer Discussion Paper 266: The role of seafood for sustainable and healthy diets – The EAT-Lancet commission report through a blue lens. *Beijer Discussion Paper Series*.

JOURNAL ARTICLES IN PRESS:

- Barrett S., A. Dasgupta, P. Dasgupta, P. Sogaard Jørgensen, et al. 2020. Social Dimensions of Fertility Behavior and Consumption Patterns in the Anthropocene. *Proceedings of the National Academy of Sciences of the United States of America*. In press.
- Causevic, A. and I. Al-Marashi. 2020. Can NATO evolve into a climate alliance treaty organization in the Middle East? *Bulletin of the Atomic Scientists*. In press.
- Sogaard Jørgensen, P. et al. 2020. Coevolutionary governance of antibiotic and pesticide resistance. *Trends in Ecology and Evolution*. In press.

WORK IN PROGRESS:

- Drury O'Neill, E., B. González-Mon, and S. Käll. Theoretical and methodological perspectives to understanding trade relationships within small-scale fisheries. In preparation.
- Golland, A. and T. Hahn. Impact Investing for Biodiversity Conservation. In preparation.
- Golland, A., V. Galaz, G. Engström, and J. Fichtner. Proxy Voting for the Earth System. In preparation.
- Léger, A., P. Sogaard Jørgensen, D. Wernli, et al. AMR-Intervene: A social-ecological framework to capture the diversity of actions to tackle antimicrobial resistance from a One Health perspective. *Journal of Antimicrobial Chemotherapy*. In review.
- Sogaard Jørgensen, P., A. Golland, and S. Maniatakou. Global Financial Crises and the Environment. In preparation.
- Van Holt, T., B. Crona, and S. Käll. Successful Fisheries Improvement Strategies. In preparation.
- Wernli, D., P. Sogaard Jørgensen, et al. 2020. Evidence for action: A One Health learning platform on interventions to tackle antimicrobial resistance. *The Lancet Infectious Disease*. In review.

SELECTED ACTIVITIES FEATURING GEDB RESEARCH:

- Staff day: Danske Bank, Örebro, Sweden, 19 January. Keynote lecture (Galaz).
- Workshop: Should we worry about the Brazilian Amazon? Stockholm Resilience Centre, Sweden, 5 February. Presentation: *Linking the finance sector and deforestation in the Amazon* (Dauriach).
- Workshop: Global Sustainability Strategy Forum. Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany, 4–8 March 2019. Participant (Folke).
- Workshop: Earth Resilience in the Anthropocene. Potsdam Institute for Climate Impact Research, Potsdam, Germany, 10–13 March 2019. Participant (Folke).
- Future Industry Forum. What will it take to create a new, profitable and sustainable industry?, Karlstad, Sweden, 14–15 March. Presentation: *Global perspective on foods and the role of aquaculture for sustainable growth* (Troell).
- Krinova Food Hackaton. Krinova Incubator and Science Park, Kristianstad, Sweden, 15 March. Presentation: *Can farmed seafood contribute to healthy people and a healthy planet?* (Troell).
- Symposium: Sustainable aquaculture at local and global scales. Kungl. Skogs- och Lantbruksakademien (KSLA), Stockholm, Sweden, 21 March. Presentation: *Perspectives on Sustainable Aquaculture* (Troell).
- Dialogue: Sleeping Financial Giants. Future Earth, Tokyo, Japan, 3 March. Lecture (Galaz).
- Meeting: Öhman Fonder, Stockholm, Sweden, 22 March. Lecture (Galaz).
- Conference: Sustainable Finance. Finansliv, Stockholm, Sweden, 28 March. Keynote lecture (Galaz).
- Meeting: Tipping towards climate stability – the role of the financial sector, Svensk Försäkring, Stockholm, Sweden, 29 March. Lecture (Crona).
- Radio programme: Svenska lösningar för hållbart vattenbruk. Sveriges Radio, Vetandes Värld, 17 April. *Svenska lösningar för hållbart vattenbruk*. Speaker (Troell).
- Workshop: MASMA research proposal evaluation. Nairobi, Kenya, 25–26 April. Evaluator (Troell).

- Meeting: Swedbank, Stockholm, Sweden, May 2019. Presentation: *Resilience thinking – a new mindset for sustainability – from risk to opportunity* (Folke).
- Symposium: Planet Earth: A Scientific Journey. Molecular Frontiers Foundation, Stockholm, Sweden, 9 May 2019. Lecture: *Natural capital, resilience and biosphere stewardship* (Folke).
- Workshop: Advancing the Seafood Business for Ocean Stewardship (SeaBOS) Initiative. Bergen, Norway 13–15 May. Presentation: *Antibiotics in aquaculture – Task Force III* (Troell). Participant (Folke).
- Nordic Sustainable Investment Forum, Stockholm, Sweden, 15 May. Keynote lecture (Galaz).
- Crisis Management and Disaster Response Centre of Excellence Conference 2019, Sofia, Bulgaria, 5–6 June. Presentation: *NATO in the Anthropocene: Emergence of the Tipping Points and Associated Security Challenges* (Causevic).
- EAT Competence Forum 2019. Stockholm, Sweden, 12 June. Participant (Troell).
- 13th International Conference of the European Society for Ecological Economics. Turku, Finland, June. Participant (Hahn).
- Behavioural Environmental Economics workshop and course. Swedish University of Agricultural Sciences, Uppsala, Sweden, 3–6 June. Presentation: *Culture of trust in global value chains* (Käll).
- Workshop: Blue Food Assessment (BFA) – Putting aquatic production at the heart of global food systems. Stockholm Resilience Centre, Stockholm, 11 June. Organiser and presentation: *EAT Blue scoping report* (Troell). Keynote lecture (Folke).
- The 10th MARE People and the Sea conference. Amsterdam, the Netherlands, 25–28 June. Presentation: *Theoretical and methodological mapping to understand trade relationships within marine systems* (Käll).
- International Tropical Summer Course (ITroSCo) 2019. Faculty of Fisheries and Marine Sciences Diponegoro University, Indonesia, August. Participant (Käll).
- Television programme: Forskare: Kopplingar mellan skatteparadis och miljöförstöring (Researchers: Links between tax havens and environmental degradation). Sveriges Television, 13 August. Interview (Galaz).
- Television programme: Regnskogsexperten: "Klimatförändringen inte skäl till att Amazonas briner" (Rainforest expert: "Climate change is not the reason the Amazon is burning"). Aftonbladet, 22 August. Interview (Crona).
- Television programme: Amazonas enormt viktig för att stabilisera klimatet (The Amazon rainforest is extremely important for the climate stability). Sveriges Television, 24 August. Interview (Crona).
- Radio programme: Regnskogen går snart inte att rädda (Soon the rainforest will be beyond salvation). Sveriges Radio, 25 August. Interview (Crona).
- Forskare: Regnskogen kan förvandlas till savann (Researchers: The rainforest can transform into savannah). Dagens Nyheter, 26 August. Interview (Crona).
- KOSMOS Conference. Humboldt University of Berlin, 28–30 August. Icebreaker speech: *A windy road back to KOSMOS? Reflections on sustainability challenges on the cusp of a new era* (Crona), and Presentation: *Transformation of the global value system framed by human rights and planetary boundaries* (Hahn). Participant (Wassénus).
- High-level meeting: The Phuket dialogue. SeaBOS CEO meeting. Phuket, Thailand, September 2019. Organizer (Folke).
- Meeting: Klimatjättar och finansjättar – Finanssektors roll för klimat och hållbarhet (Climate Giants and Finance Giants – The role of the financial sector for climate and sustainability). Swedish Banking Association, Stockholm, Sweden, 9 September. Lecture (Crona).

Meeting: Invited to Minister of International Aid to report on our research on sustainability and finance, Stockholm, Sweden, 10 September. Lecture (Crona and Galaz).

Course: Anthropocene risk. Stockholm Resilience Centre Masters Programme, Social-Ecological Resilience for Sustainable Development, Stockholm, Sweden, 11 September. Guest lecturer (Wassénius).

Documentary movie: Das Ende der Antibiotika? (The end of antibiotics?), 12 September. By NDR (Northern German Broadcasting). Interview (Søgaard Jørgensen).

BalticLead Programme. Stockholm Resilience Centre, Sweden, 22 September. Lecture (Dauriach).

Agri4D (Agricultural Research for Development Conference) 2019 Conference. Zero hunger by 2030, our shared challenge! Drivers of change and sustainable food systems, Uppsala, Sweden, 25–26 September. Participant (Troell).

Meeting: Climate Giants and Finance Giants – The role of the financial sector for climate and sustainability (Klimatjättar och finansjättar – Finanssektorns roll för klimat och hållbarhet). Exportkreditnämnden, Stockholm, Sweden, 25 September. Lecture (Crona).

Via Summa Day. Summa Equity (venture capital and private equity firm), Stockholm, Sweden, 30 September 2019. Keynote lecture (Folke).

Preparatory meeting: Nobel Prize Summit. Potsdam Institute for Climate Impact Research, Potsdam, Germany, October 2019. Participant (Folke).

Symposium: Swedish Investors for Sustainable Development. Swedish International Development Agency (Sida), Stockholm, Sweden, 10 October. Keynote lecture (Galaz).

Course: The global economy. Centre for Environment and Development Studies (CEMUS), Uppsala, Sweden, 31 October. Lecture (Dauriach).

CEO Executive Programme in Resilience Thinking: Transformative Business Leadership for a Prosperous Planet. Stockholm Resilience Centre, Stockholm, Sweden, November 2019. Lecture (Folke).

Focali Annual Meeting, Gothenburg, Sweden, 5 November. Remote presentation (Dauriach).


Nordic SIF meeting: Exploring the Frontier. Stockholm, Sweden, 7 November. *Workshop on Active Ownership and deforestation risks* (Crona). Keynote: *The role of financial institutions for forest wildfires and climate stability* (Galaz).

Workshop: MASMA Grantee research project evaluation meeting. Mombasa, Kenya 12–15 November. Evaluator (Troell).

Regional Workshop: Development of an Integrated Livelihoods Approach for Pacific Island Small-Scale Fishing Communities. Magnetic Island, QLD, Australia, 26–28 November. Participant (Troell).

Workshop: Food and nutrition security and the Blue Economy. Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong, Australia, 2–3 December. Participant (Troell).





GLOBAL ECONOMIC DYNAMICS AND THE BIOSPHERE
THE ROYAL SWEDISH ACADEMY OF SCIENCES
BOX 50005 SE-104 05 STOCKHOLM, SWEDEN
VISITING ADDRESS LILLA FRESCATIVÄGEN 4A STOCKHOLM, SWEDEN
WEBSITE www.gedb.se