ANNUAL REPORT

Stockholm Resilience Centre

Annual report 2021

Stockholm Resilience Centre
Sustainability Science for Biosphere Stewardship

Stockholm University

A PARTNER WITH

Beijer Institute of Ecological Economics

Kungl. Vetenskaps Akademien
The Royal Swedish Academy of Sciences

Stockholm Resilience Centre Annual Report 2021
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Stockholm Resilience Centre Annual Report 2021

Vision & Mission

Our vision is a thriving and resilient biosphere that enables well-being for all.

Our mission is to:

- advance the scientific understanding of the complex, dynamic interactions of people and nature in the biosphere,
- train the next generation on of sustainability researchers and leaders
- engage in collaborations with change agents.

Chair's preface

I am deeply grateful to all those who have performed in such a remarkable, professional and collaborative manner

THERE ARE MAJOR CHALLENGES TO the ways we operate and organise societies. Simultaneously there are major changes to the resilience of the Earth system and its biosphere altering the playing field for civilisations. Now, in the Anthropocene, society and nature are not just linked but truly intertwined and coevolving. Science is needed to interpret data on the present situation and provide guidance towards a fairer, more sustainable future.

It is in this context that the Stockholm Resilience Centre (SRC) plays a significant role in our world, standing at the very forefront of science and sustainability. The SRC has a long legacy of researching social-ecological systems within the biosphere and investigating the best ways to protect, adapt and transform them – despite any complexities, uncertainties and changes that we might face. This has led to major systemic insights, which are now increasingly being acted upon. This is incredibly exciting!

Driven by curiosity, the SRC conducts interdisciplinary, problem-oriented research, which goes hand in hand with creating scientific policy via our many collaborations. Not only is this combination unique, but it is also significant, since it inspires both people and practice worldwide. The breadth of the SRC's accomplishments, captured in this Annual Report, reflects an impressive level of activity and commitment to quality. Some of our most notable achievements include the publication of numerous research articles in *Nature* and other *Nature*-related journals, *Proceedings of the National Academy of Sciences USA (PNAS), Science Advances, Global Environmental Change* and other leading journals. We have also shown deep engagement with transdisciplinary science for change and have played major roles at key events like the first Nobel Prize Summit – "Our Planet, Our Future" – and COP26. In addition, the SRC has been granted several large funds for research into food systems, transformation and sustainable finance. You can read more about these funds in this report. These new grants have enabled us to appoint two new professors – both of whom were evaluated through international competition – which is also very exciting.

The SRC is not just any centre for sustainability – it is an international leader in its field. It is a true pleasure and privilege to be involved with the Stockholm Resilience Centre and I am deeply grateful to all those who have performed in such a remarkable, professional and collaborative manner.

Professor Carl Folke, chair of the board

Director's view

Another year of the Covid-19 pandemic has passed, during which time our organisation has demonstrated remarkable resilience

TO BE PHYSICALLY APART for so long is a stretch for any workplace – especially one built on close collaboration and innovative partnerships. Despite this challenge, however, 2021 once again saw some very strong achievements by our staff. In terms of scientific output, we continued to publish papers on a variety of topics, across a more diverse range of journals. In fact, as the number of interdisciplinary journals in the field of sustainability science continues to grow, it is safe to say that our research is well-represented across the board. The number of SRC publications per year has averaged at around 190 over the past three years, with many of these papers being published in high-impact journals. Additionally, five of our researchers were acknowledged as Highly Cited Scholars in 2021. While this is fewer than last year (when we had eight), our researchers represent over 80% of the Highly Cited Scholars at Stockholm University. Our researchers also excelled in competitive research funding calls. We are deeply grateful for the new research grants that we have been awarded by foundations such as the IKEA Foundation and Gullspång Re:food. With this funding complementing the funding from the Curt Bergfors Foundation that we received in 2020, we have been able to recruit two new professors. Moreover, we are excited to be hosting a new large Mistra programme (FAIRTRANS) and a new European Research Council (ERC) starting grant, in addition to being a partner of the Sustainable Finance Lab at the KTH Royal Institute of Technology.

A scientific highlight of the year was the launch of the Blue Food Assessment – a collaboration between the SRC (led by professor Beatrice Crona), Stanford University and EAT. The assessment brought together over 100 researchers to explore the role of aquatic foods in building healthy, sustainable and equitable food systems. Research findings and opinion pieces were published in a collection of articles across *Nature* and other *Nature*-related journals and the results were fed straight into the UN Food System Summit. A further highlight was the first Nobel Prize Summit, hosted by the Nobel Foundation and organised by the US National Academy of Sciences, in partnership with the Potsdam Institute for Climate Impact Research, the SRC and the Beijer Institute. SRC and Beijer were the main organisers of the science session and professor Carl Folke led a landmark paper published in *Ambio*, which served as a background document for the whole summit.

Furthermore, our communication and engagement work is still going strong. For example, we were heavily involved in the COP26 in Glasgow, where the Global Resilience Partnership (GRP), hosted by the SRC, was the key organiser of the Resilience Hub and the lead coordinator for the "Race to Resilience" campaign. The Global Commons Alliance (established by the SRC and partners) led the Nature Hub, Nature News Room and Nature Positive Campaign. Throughout the year, our researchers also engaged in communication activities such as the Netflix documentary *Breaking Boundaries: The Science of Our Planet, and the associated book Breaking Boundaries* by Johan Rockström and Owen Gaffney. *The Routledge Handbook of Research Methods for Social-Ecological Systems*, edited by SRC researchers Oonsie Biggs and Maja Schlüter together with colleagues from Stellenbosch and Rhodes Universities, became the most read open-access book by Routledge in 2021. Two other popular science books were also released by colleagues: *Kursen* (The Course) by Lisen Schultz and Erica Treijs and *Den uppfinningsrika planeten* (The ingenious planet) by Fredrik Moberg. *Kursen* builds on insights from our executive programme on resilience thinking, which has been running since 2018. The programme is tailor-made for

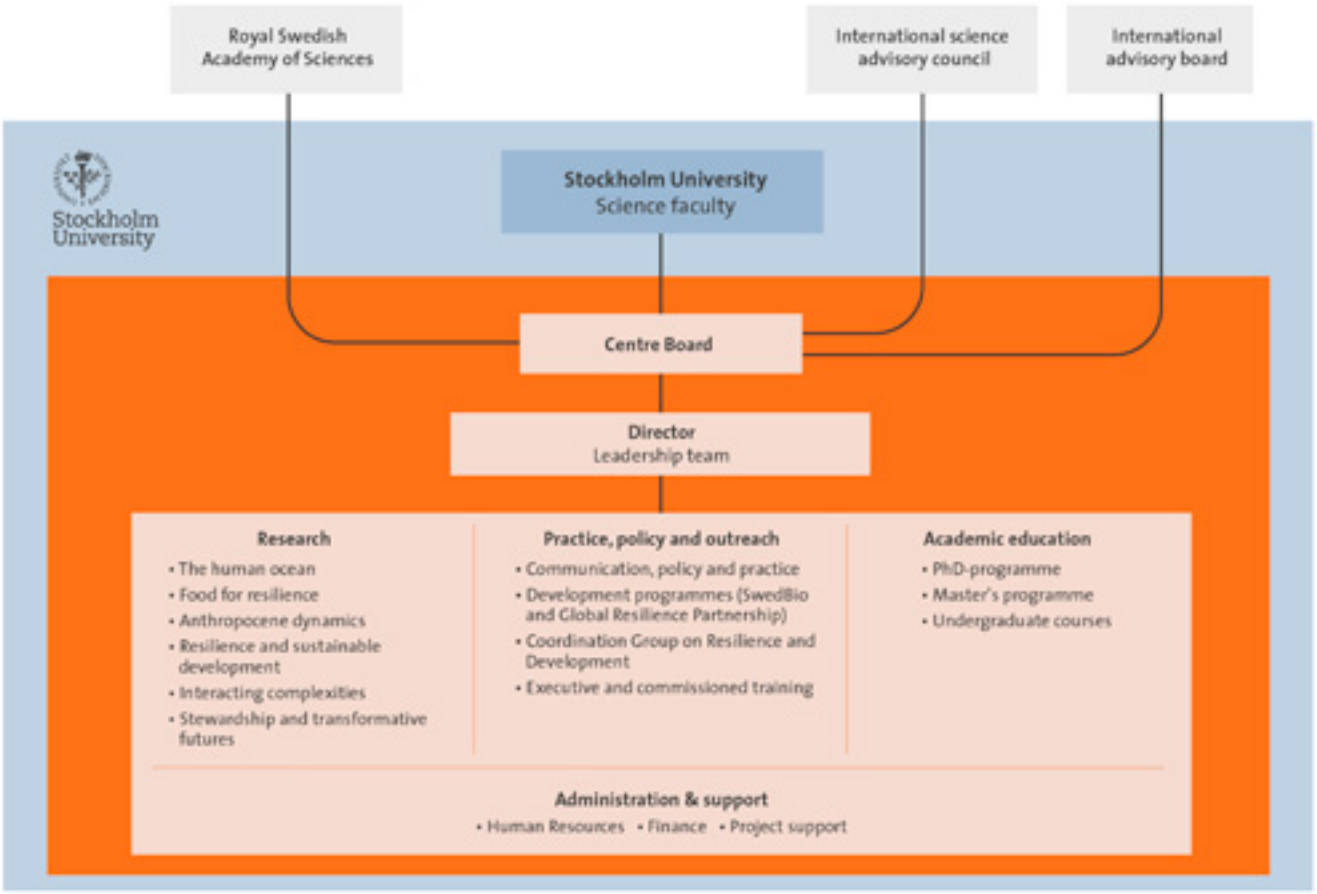
business leaders to take a deep dive into the megatrends shaping our planet and global economy.

Overall, our education programmes are going well. We started a new undergraduate course in Sustainability Science in 2021. Next year, we anticipate that over 100 students will attend this course, which will be delivered in collaboration with the Stockholm Business School.

Financially, we exceeded all expectations and ended up with a net positive result of over SEK 16 million. For the first time ever, our annual turnover surpassed SEK 200 million. However, this strong result constitutes the surplus that we have accumulated over the past three to four years, which we have only now been able to attain. After a couple of turbulent years, our financial and administrative capacity has improved, which is in turn reflected in our financial results.

To see results like these in the midst of a pandemic makes me feel particularly proud of my colleagues. It is thanks to their remarkable collaboration and their insightful work that we come out of 2021 stronger than ever.

Line Gordon,
director



Stockholm Resilience Centre organisation map.

Our research framework

Our curiosity-driven research is increasingly sought after by society, where there is a keen interest in learning from our findings. Meanwhile, we continue to contribute to the development of the research frontier

THERE WAS NOTHING ORDINARY about 2021. However, from a scientific point of view, the year perhaps represented the start of a new normal. As time went on, it became increasingly evident that science plays a fundamental role in the world's ability to deal with deep and often abrupt change. Similarly, the UN Food Systems Summit, the COP26 meeting in Glasgow and the Nobel Prize Summit, the latter of which we organised together with the Royal Swedish Academy of Sciences and the US National Academy of Science (hosted by the Nobel Foundation), demonstrated how science is at the very core of knowledge, learning, action and future vision. The general public are becoming increasingly aware of the scientific field as it continues to make its way into mainstream media, particularly when it comes to global sustainability challenges. In fact, we broke new ground when Netflix launched its own *Breaking Boundaries* documentary on the planetary boundaries framework. Meanwhile, Jennifer Lawrence and Leonardo DiCaprio encouraged us to "look up", in *Don't Look Up*, showing us why peer review is so important. If you haven't already done so, we recommend watching these films, which have a lot to say about science and its role in society.

We are proud and privileged to be a focal point in sustainability science as we continue to play a role in shaping the global discourse. Our core focus is to advance research at the forefront of biosphere-based sustainability science. We see humans as part of the biosphere and employ a diverse range of theories, methods and data to understand the intertwined reality that is the Anthropocene. Using both inductive and deductive research techniques, in addition to combining theory with practice, we are able to develop new theories, methods and approaches with which to tackle the world's most pressing and complex problems.

Our work is very much centred around resolving complex problems. In order to do this, we divide our observational research into different themes. The Anthropocene theme focuses on the connections between society and the earth, while our stewardship and transformation research is concerned with human activity and behaviour. It is important to observe the latter in order to determine how individuals, networks and organisations are using their agency to drive change. Currently focusing on the ocean, food and development, our thematic work is also based on this research structure. However, there is always room for additional research themes as new interests and funding creation opportunities arise. None of these themes means starting from scratch; rather, we are building and expanding on previous work. For instance, the theme of healthy and sustainable food systems is a consolidation of the work that we carried out for the EAT-Lancet Commission and the Blue Foods Assessment. Meanwhile, our Resilience and development theme builds on a long history of scientific research and engagement in both policy and practice in the Global South, combining knowledge and experience that we have gained from the GRAID programme, SwedBio and the Global Resilience Partnership. All of these themes are places where individuals working on different projects can combine their thoughts, insights and questions, to create interesting syntheses or conditions for learning. Theme leaders guide this process. In fact, this new, thematic organisation of our research accompanies a generational shift at the SRC, where a new cohort of theme leaders, still in their early to mid-careers, are stepping up to take on this important role. As a consequence new questions are being asked, different networks are becoming engaged and our established approaches are being revisited. In addition to biosphere-based sustainability science, which is ultimately the focus of all our themes, another key emerging focus is the role of equity in relation to sustainability and systemic change.

We are proud and privileged to be a focal point in sustainability science.

All of this makes it extremely exciting to be part of the work that is taking place at the SRC. As we slowly step out of the shadow of the pandemic, there is one thing that we can be sure of – that science will continue to play a critical role. Meanwhile, we remain committed to producing insights that could help us to transition into a more sustainable "normal".

PHOTO: Nobel Prize Outreach. PHOTO: Clément Morin

SRC partner of first ever Nobel Prize Summit on sustainable development

The first ever Nobel Prize Summit, "Our Planet, Our Future", was a digital three-day event held from 26-28 April, designed to explore actions that could be taken this decade to put the world on the right path towards a more sustainable, prosperous future

HOSTED BY THE NOBEL FOUNDATION and organised by the US National Academy of Sciences in partnership with the Potsdam Institute for Climate Impact Research, the SRC and the Beijer Institute of Ecological Economics, the summit drew upon lessons learned in the global response to the Covid-19 pandemic, in order to mobilise action on climate change and biodiversity loss, reduce inequality and advance transformative technologies.

Summit speakers included the Nobel Peace Prize laureate and former US vice president Al Gore; the Nobel Peace Prize laureate and Tibetan spiritual leader, the Dalai Lama; climate activist and youth leader Xiye Bastida; the chief medical adviser to the US president, Anthony Fauci; and Nobel Prize laureate and professor of biochemistry and biophysics at the University of California, Jennifer Doudna.

In a statement following the summit, 126 Nobel Laureates, including Brian Schmidt, the Dalai Lama, Steven Chu, Shirin Ebadi, Jennifer Doudna, Alice Munro and Paul Nurse, warned that "Humanity is taking colossal risks with its joint future," urging leaders to act quickly in order to halve greenhouse gas emissions and reverse loss of nature by 2030.

"The next decade is crucial: global greenhouse gas emissions need to be cut in half and the destruction of nature halted and reversed. An essential foundation for this transformation is to address destabilizing inequalities in the world."

The SRC hosted two sessions on the role that science plays in supporting transformations towards global sustainability (pictured). Contributions included HRH Crown Princess Victoria of Sweden, Carl Folke, Jane Lubchenco, Partha Dasgupta, Pamela Matson and the three editors-in-chief of *Nature, Science* and the *Lancet*, respectively.

"It's wrong to treat society as one thing and the environment another. In today's world, everything is completely intertwined. To really be able to collaborate, we need trust and social capital. Inequality is a counter-force in this space," said Carl Folke, chair of the board and co-founder of the SRC

PHOTO: W. S. GRAZIO/FLICKR (CC BY-NC-ND 2.0)

The Blue Food Assessment

Blue food, such as fish, shellfish and algae, is a source of untapped potential for global development, provided that the right policies and investments can be put into place, according to a global collaboration led by the SRC, Stanford and EAT

IN FEBRUARY 2020, researchers launched a new scientific study to look into the role of seafood as the world prepares to feed a global population estimated to reach 10 billion by 2050. Some 18 months later, five peer-reviewed papers provided a scientific foundation upon which to base policy discussions on how blue foods could contribute to healthier, more sustainable and more equitable food systems. These papers form part of the Blue Food Assessment (BFA) – an international initiative bringing together over 100 scientists from more than 25 different institutions. The research estimates that global demand for blue foods will roughly double by 2050 and will be met primarily through increased aquaculture production, rather than by capture fisheries. According to the assessment, this will help to address malnutrition, reduce the environmental footprint left behind by the food system and create sustainable livelihoods.

"Blue foods are much more diverse than typically thought – and so too are the many communities of small-scale fishers who are often overlooked despite providing the majority of blue food that we eat," says SRC deputy science director Beatrice Crona. She is co-chair of the BFA together with Roz Naylor – senior fellow and founding director of Stanford University's programme for Food Security and the Environment. "The only way to fix the global food system is to address the opportunities and challenges presented by blue and green foods together," adds Naylor. The five papers, published in Nature in 2021, are the first in a series produced by the study. They address nutrition, climate change, environmental performance, demand and small-scale actors in the blue food sector. Four more papers are expected to be published in 2022. These will address environmental change, justice, systems transformation and collaboration between public and private decision makers.

Launch activities

As part of the launch, Nature published an editorial, podcast and "immersive" web page about blue foods. The launch also included a global broadcast with Naylor and Crona, a stakeholder panel, shoutouts from "blue" celebrities and political figures, a keynote address from Peru's former minister of production and closing remarks from Sangeeta Mangubhai – the director of the Wildlife Conservation Society's Fiji Country Program. On 16 September, a report for decision makers was also made available prior to the UN Food Systems Summit. This was accompanied by a series of action briefs with specific findings and recommendations tailored to decision makers in the public health, development, environment, retail and food service sectors, as well as those working at blue food companies. Members of the BFA also led a session at the pre-summit on blue foods, in which seven Member States and leaders of the UN participated – including the UN Secretary-General's Special Envoy for the Food Systems Summit and Special Envoy for the Ocean. A Blue Food Coalition was subsequently announced as one of 12 coalitions of action emerging from the summit. This coalition emerged with strong BFA leadership support, while expanding participation to include a more diverse group of actors and stakeholders.

▶ Find out more here: www.bluefood.earth

PHOTO: C. BALLARD

All over the place

Beatrice Crona – the SRC's newly appointed professor in sustainability science – approaches her work with dedication, urgency and a healthy dose of serendipity

When you send an email to Beatrice Crona, you are likely to receive an automatic reply saying, "I am currently working on completing multiple projects and large bids." That may as well be the story of her work life! She always has so much going on and even admits that she can sometimes take on a little too much! Not only a professor, Crona also works as the deputy science director at the SRC. In addition, she leads the Global Economic Dynamics and the Biosphere programme at the Royal Swedish Academy of Sciences and is the co-leader of the Blue Food Assessment – an initiative that brings together over 100 scientists from more than 25 different institutions around the world. Oh! And she also supervises three PhD students on various marine-, food- and finance-related topics. There are several other projects worth mentioning, too – but there is only so much that can fit on a page!

Her dedication stems from the sense of urgency that she feels to deal with the environmental crisis that the world is currently facing. Serendipity is her favourite word, however. So, in addition to her hard work and dedication, she also leaves room for creativity and chance, seizing all opportunities that come her way, provided that they might contribute to positive change: "If this means I sometimes have to jump on a completely new track, I'll do it! Because I need to be working on things that can make a difference and are meaningful," she says. Her relentless efforts to do good can sometimes give the impression that she is attempting to carry the weight of the world on her shoulders – which can scare people off a bit, given that she has scant time for nonsense. "She will cut through faff like a hot knife through butter," says one colleague. But behind that seemingly regimented exterior is a kind-hearted colleague who genuinely cares about all those around her. Indeed, her PhD students praise her for "always finding the time when you need her the most".

Science remains one of our best tools for making important decisions.

As a scientist, Crona thrives when she is part of ground-breaking collaborations at the forefront of scientific progress. Even when others around her recommend that she play it safe and stick to what she knows, she is not afraid to push things further out of the box. One example of this is the Sleeping Financial Giants initiative, which connects potential investors in the financial sector with the latest science on "tipping elements" in the earth system. If regions like the Amazon rainforest are pushed too far, they can destabilise earth's climate and exacerbate global warming. Investors play a significant role in stabilising these tipping elements, which is why connections to the financial sector, established through programmes like the Sleeping Financial Giants initiative, are crucial.

In addition to the work mentioned above, Crona has also played a crucial role in the SeaBOS initiative – the first initiative to see 10 of the world's largest seafood companies collaborate with science to implement a joint vision of developing more sustainable seafood production and improved ocean health. Collaborations like these are the reason why she continues to do research. Because, despite the politics, power plays and the constant chase for funding, "science remains one of our best tools for making important decisions," she says. Is she worried that engagements with business and industry might compromise her scientific integrity? Not really – but it's important to be self-aware. "You have to navigate that space continuously and if your gut ever tells you it's not right, then you step away," she explains. Crona will continue to try to deliver good science – but only if it contributes to real change. Otherwise, she might try something new. Perhaps being a midwife, for instance ("I like seeing new things emerge from complex combinations of elements"). Alternatively, she might finally learn to play her grandmother's old piano.

Publications and special issues

At least 220 scientific articles were published in 2021, across more than 100 different scientific journals

OUR RESEARCH CONTINUES TO be published in leading, high-impact-factor journals. More than 25 articles were published in *Nature* and Lancet-related journals, as well as in *Proceedings of the National Academy of Sciences, USA (PNAS)*. Overall, about 220 scientific articles were published in peer-reviewed journals in 2021, across more than 100 different scientific journals. Over 60% of the articles appeared in journals with an impact factor of four or higher. Moreover, many of these articles were published in journals with a strong interdisciplinary focus. SRC researchers published five or more articles in *Ambio; Ecology and Society; Ecosystems and People; Environmental Research Letters; npj Urban Sustainability; One Earth; PNAS; and Sustainability Science*.

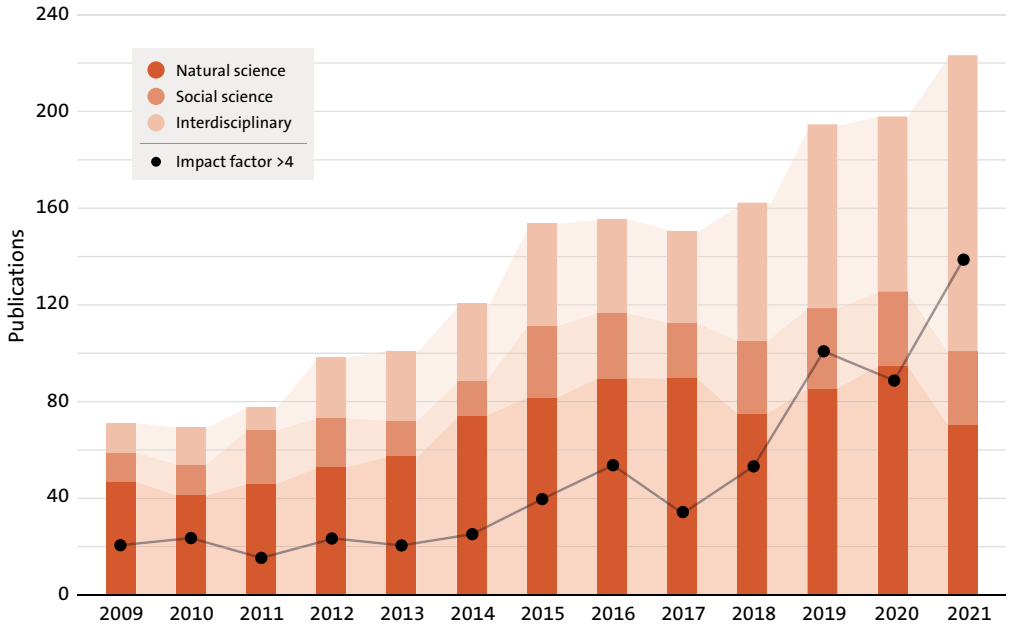
SRC articles published in 2021appeared in 36 journals that were new to the SRC publication list. These include: *BMC Infectious Diseases; Business and Society; Circular Economy and Sustainability; Climate and Development; Cryosphere; Environmental International; Environmental Evidence; Environmental Innovation and Societal Transitions; Frontiers in Ecology and Evolution; Frontiers in Public Health; Frontiers in Sociology; Global Ecology and Biogeography; International Journal of Agricultural Resources, Governance and Ecology; Journal of Antimicrobial Chemotherapy; Journal of Mathematical Biology; Lancet Planetary Health; National Science Review; Natural Product Reports; Nature Geoscience; npj Climate and Atmospheric Science; npj Urban Sustainability; and Technology in Society.*

Furthermore, a ground-breaking book on methods for understanding and governing complex social-ecological systems was published in 2021, namely *The Routledge Handbook of Research Methods for Social-Ecological Systems,* edited by Reinette Biggs, Alta de Vos, Rika Preiser, Hayley Clements, Kristine Maciejewski and Maja Schlüter.

A special issue on traps and transformations was also finalised. Edited by Hampus Eriksson, Jessica Blythe, Henrik Österblom and Per Olsson, "Beyond social-ecological traps: fostering transformations towards sustainability", published in *Ecology and Society*, contains 13 articles.

Articles from the Blue Food Assessment were also published in a Blue Food collection in *Nature* and the *Nature* journals. The journal *Ambio* (published by the Royal Swedish

Annual number of publications



Academy of Sciences) commemorated 50 years of publication throughout 2021, highlighting several articles written by SRC researchers on the themes of biodiversity conservation, urbanisation, the Anthropocene and solutions-oriented research. In the spring, *Ambio* also published "Our future in the Anthropocene biosphere" – the whitepaper for the first Nobel Prize Summit. In addition, at least 30 journal articles with official publication dates in 2022 appeared online in 2021.

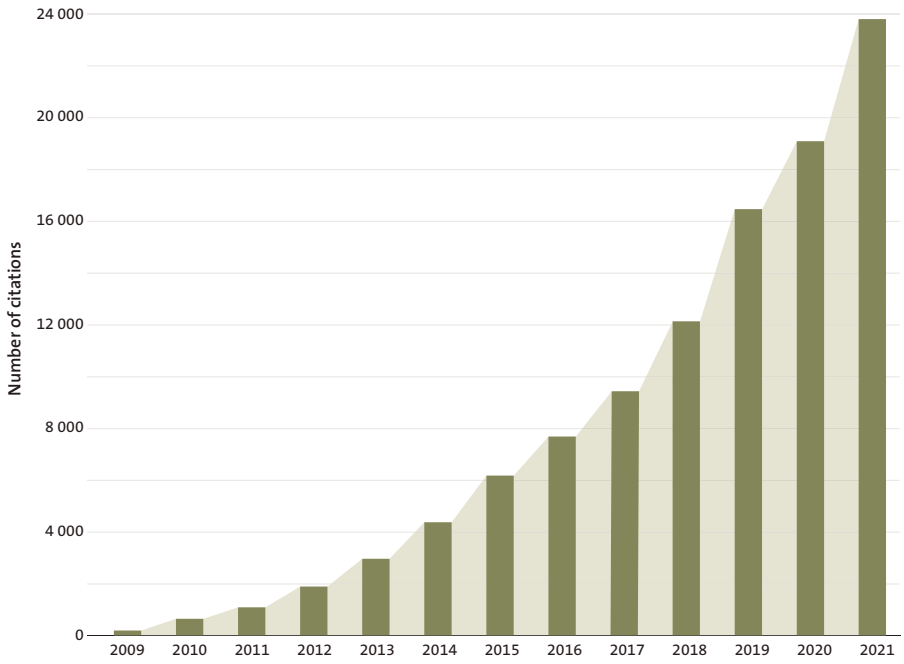
There were also several book chapters, as well as science, policy, practice, communication and outreach publications and reports published throughout the year. These include the Ocean Risk and Resilience Action Alliance reports (see p. 51) and learnings from how communities in the Global South responded to the COVID-19 pandemic.

Swedbio also published a range of reports and briefs including:

1. Indigenous futures thinking Changing the narrative and re-building based on re-rooting
2. Applying a human rights-based approach - Guidance on the application of a human rights-based approach in the post-2020 Global Biodiversity Framework
3. Human Rights in the post-2020 Global Biodiversity Framework - Options for integrating a human-rights based approach to achieve the objectives of the Convention on Biological Diversity.

The number of citations for SRC publications continues to rise. In 2021, it exceeded 23,000 and has now risen beyond 100,000 in total according to the ISI Web of Science. Four of the 2021 articles were acknowledged as "highly cited papers", with three of them also being listed as "hot papers". For context, highly cited papers are those that received enough citations to place them in the top 1% of their academic field. Meanwhile, hot papers are those that received enough citations in the last two years to place them in the top 0.1%. All in all, the ISI is currently listing approximately 115 SRC publications as highly cited papers and six SRC publications as hot papers.

Annual number of citations



THE ROUTLEDGE HANDBOOK OF RESEARCH METHODS FOR SOCIAL-ECOLOGICAL SYSTEMS, edited by SRC researchers Oonsie Biggs and Maja Schlüter, together with colleagues from Stellenbosch and Rhodes Universities, became the most-read open-access book by Routledge in 2021. It presents the wide range of approaches that are currently being applied in social-ecological research. The handbook contains contributions from almost 100 authors from 16 different countries.

IN APRIL CENTRE RESEARCHER and communications advisor Fredrik Moberg published "Den uppfinningsrika planeten" ("The ingenious planet"), a popular science book about biomimicry, sustainable solutions inspired by nature's form, processes and ecosystems. The book, which includes contributions from several SRC colleagues, deals with nature-inspired materials, medicine, energy, food production, cities, AI, and more. It has a narrative where nature gets to be a mentor and muse instead of just a victim of human impacts.

PHOTO: M. ROSENLÖF

The International Science Advisory Council (ISAC)

THE ISAC IS A BODY of leading international researchers that provides strategic advice and guidance on the scientific development and direction of the SRC. In 2021, the council met virtually for two days, on 25-26 October. On the first day, it focused on the current state of activities at the SRC; on the second, it discussed the role of sustainability science over the next 50 years.

Selected scientific publications

PHOTO: N. KAUTSKY/AZOTE

Global aquaculture has become more sustainable over the past 20 years

The industry has taken significant strides towards sustainability, according to a review in Nature.

Naylor, R.L., Hardy, R.W., Buschmann, A.H., Bush, S.R., Cao, L., Klinger, D.H., Little, D.C., Lubchenco, J., Shumway, S.E. & Troell, M. 2021. A 20-year retrospective review of global aquaculture. *Nature* 591(7851), 551–563. Author correction: *Nature 593(7858), E12, Publisher Correction: Nature 595(7868), E36.*

PHOTO: A. GRU/UNSPLASH

Aquatic foods offer great untapped potential for providing more sustainable diets

As the first evaluation of its kind, this publication produces environmental profiles on the full range of aquatic (blue) foods, to guide more sustainable food production and diets.

Gephart, J.A., Henriksson, P.J.G., Parker, R.W.R., Shepon, A., Gorospe, K.D., Bergman, K., Eshel, G., Golden, C.D., Halpern, B.S., Hornborg, S., Jonell, M., Metian, M., Mifflin, K., Newton, R., Tyedmers, P., Zhang, W., Ziegler, F. & Troell, M. 2021. Environmental performance of blue foods. *Nature* 597(7876), 360–365.

PHOTO: A. POPOV/UNSPLASH

Why sustainable finance risks undermining its own efforts

Many "green" investment strategies will not meaningfully contribute to sustainability because they are flawed, researchers warn.

Crona, B., Folke, C. & Galaz, V. 2021. The Anthropocene reality of financial risk. *One Earth* 4(5), 618–628.

PHOTO: WORLD METEOROLOGICAL ORGANIZATION

We are taking astounding risks, researchers warn

A new report summarises recent research on the scale of human activity. Inequality and environmental challenges are deeply linked; this must be a transformative decade.

Folke, C., Polasky, S., Rockström, J., Galaz, V., Westley, F., Lamont, M., Scheffer, M., Österblom, H., Carpenter, S.R., Chapin III, F.S., Seto, K.C., Weber, E.U., Crona, B., I., Daily, G.C., Dasgupta, P., Gaffney, O., Gordon, L.J., Hoff, H., Levin, S.A., Lubchenco, J., Steffen, W. & Walker, B.H. 2021. Our future in the Anthropocene biosphere. *Ambio* 50(4, SI), 834–869.

PHOTO: ROSSOGRAPHER

The "Ocean 100": how a small group of companies dominate the ocean economy

The 100 largest companies that operate within eight ocean industries took an estimated 60% of all revenue. The next step will be to explore their environmental footprint.

Virdin, J., Vegh, T., Jouffray, J.-B., Blasiak, R., Mason, S., Österblom, H., Vermeer, D., Wachtmeister, H. & Werner, N. 2021. The Ocean 100: Transnational corporations in the ocean economy. *Science Advances* 7(3), eabc8041.

PHOTO: J.B. JOUFFRAY

How to design more reflexive co-production of knowledge

Researchers identify six types of co-production and develop a tool to explore when and how particular approaches may be effective.

Chambers, J.M., Wyborn, C., Ryan, M.E., Reid, R.S., Riechers, M., Serban, A., Bennett, N.J., Cvitanovic, C., Fernández-Giménez, M.E., Galvin, K.A., Goldstein, B.E., Klenk, N.L., Tengö, M., Brennan, R., Cockburn, J.J., Hill, R., Munera, C., Nel, J.L., Österblom, H., Bednarek, A.T., Bennett, E.M., Brandeis, A., Charli-Jospeh, L., Chatterton, P., Curran, K., Dumrongrojwatthana, G., Durán, A.P., Fada, S.J., Gerber, J.D., Green, J.M.H., Haller, G.T., Horcea-Milcu, A.I., Leimona, B., Montana, J., Rondeau, R., Spierenburg, M., Steyaert, P., Zaehringer, J.G., Gruby, R., Hutton, J., & Pickering, T. 2021. Six modes of co-production for sustainability. *Nature Sustainability* 4(11), 983–996.

PHOTO: S. SAHA/UNSPLASH

For millions, food security is undermined by a lack of policy support for small-scale fisheries and aquaculture

This paper highlights the important role that small-scale fisheries and aquaculture play in both supporting livelihoods worldwide and tackling some of the world's most pressing challenges.

Short, R.E., Gelcich, S., Little, D.C., Micheli, F., Allison, E.H., Basurto, X., Belton, B., Brugere, C., Bush, S.R., Cao, L., Crona, B., Cohen, P.J., Defeo, O., Edwards, P., Ferguson, C.E., Franz, N., Golden, C.D., Halpern, B.S., Hazen, L., Hicks, C., Johnson, D., Kaminski, A.M., Mangubhai, S., Naylor, R.L., Reantaso, M., Sumaila, U.R., Thilsted, S.H., Tigchelaar, M., Wabnitz, C.C.C. & Zhang, W. 2021. Harnessing the diversity of small-scale actors is key to the future of aquatic food systems. *Nature Food* 2(9), 733–741. Author Correction: *Nature Food* 2(10), 828.

PHOTO: SERGEI A/UNSPLASH

Paris climate goals are unattainable without rich biodiversity and ecosystems

Large-scale conservation and the restoration of natural carbon sinks in forests, oceans and other ecosystems is an existential must for humanity.

Rockström, J., Beringer, T., Hole, D., Griscom, B., Mascia, M.B., Folke, C. & Creutzig, F. 2021. We need biosphere stewardship that protects carbon sinks and builds resilience. *Proceedings of the National Academy of Sciences* 118(38), e2115218118.

PHOTO: VERSTAPPEN PHOTOGRAPHY/UNSPLASH

Getting a more complete picture of our impact on nature

A new metric can help investors, companies, cities and governments to track their environmental impact beyond greenhouse gas emissions.

Lade, S.J., Fetzer, I., Cornell, S.E. & Crona, B. 2021. A prototype Earth system impact metric that accounts for cross-scale interactions. *Environmental Research Letters* 16(11), 115005.

PHOTO: THISSENGINEERING/UNSPLASH

Increased use of AIs could create new sustainability risks

Research identifies four areas in which the use of AI-technologies could create challenges for both people and the planet.

Galaz, V., Centeno, M.A., Callahan, P.W., Causevic, A., Patterson, T., Brass, I., Baum, S., Farber, D., Fischer, J., Garcia, D., McPhearson, T., Jiménez, D., King, B., Larcey, P. & Levy, K. 2021. Artificial intelligence, systemic risks, and sustainability. *Technology in Society* 67, 101741.

PHOTO: SKOGENS BILD/AZOTE

Why forest owners should consider mixed forests or continuous-cover forestry

Increased resilience to storms comes at the expense of private economic returns. However, the owners of forests located on highly vulnerable land may profit from mixed forests and continuous-cover forestry.

Hahn, T., Eggers, J., Subramanian, N., Caicoya, A.T., Uhl, E. & Snäll, T. 2021. Specified resilience value of alternative forest management adaptations to storms. Scandinavian *Journal of Forest Research* 36(7–8), 585–597.

PHOTO: BETTER WORLD CAMEROON – THE AFRICAN WAY

Why local realities are crucial to global environmental assessments

Locally, bottom-up-inspired futures are missing from global environmental assessments. A new method tested on the UN's sixth Global Environment Outlook hopes to change this.

Pereira, L., Asrar, G.R., Bhargava, R., Fisher, L.H., Hsu, A., Jabbour, J., Nel, J., Selomane, O., Sitas, N., Trisos, C., Ward, J., van den Ende, M., Vergvoort, J. & Weinfurter, A. 2021. Grounding global environmental assessments through bottom-up futures based on local practices and perspectives. *Sustainability Science* 16(6), 1907–1922.

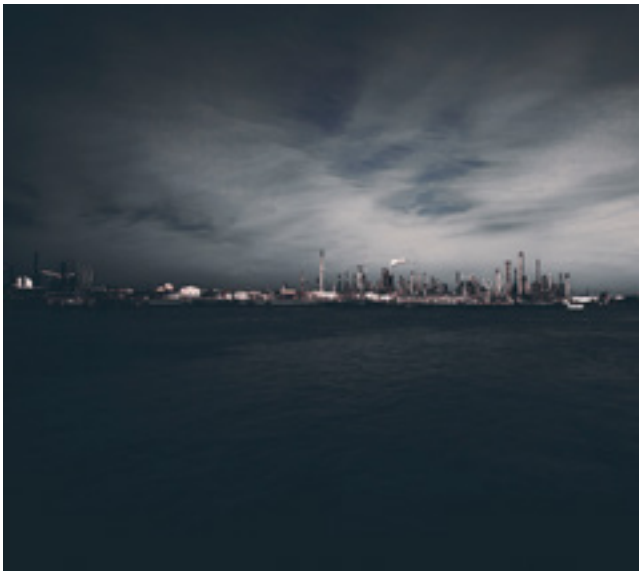
PHOTO: J. HEARD/UNSPLASH

How to deal with complexity

Guides on resilience, particularly those used in the development field, often lack theoretical grounding in terms of how to engage with shocks and disturbances. A new study addresses the problem.

Sellberg, M.M., Quinlan, A., Preiser, R., Malmborg, K. & Peterson, G.D. 2021 Engaging with complexity in resilience practice. *Ecology and Society* 26(3), 8.

PHOTO: DILIFF/WIKIMEDIA COMMONS



In a warming world, the ocean will struggle as a carbon sink

Biological feedback means that the ocean will struggle to remove as much carbon from the atmosphere as expected.

Armstrong McKay, D.I., Cornell, S.E., Richardson, K. & Rockström, J. 2021. Resolving ecological feedbacks on the ocean carbon sink in Earth system models. *Earth System Dynamics* 12(3), 797–818.

PHOTO: CIFOR/FLICKR

Uncovering the distal human and environmental impact of China's reforestation efforts

How and why national sustainability initiatives contribute towards unsustainable global development.

Downing, A.S., Wong, G.Y., Dyer, M., Aguiar, A.P., Selomane, O. & Aceituno, A.J. 2021. When the whole is less than the sum of all parts: Tracking global-level impacts of national sustainability initiatives. *Global Environmental Change* 69, 102306.

PHOTO: PIXABAY

Four signs that the seafood industry is getting wiser about the ocean

"Bitter realities" remain but signs show that seafood industry operations are beginning to become more aware of stewardship ideals.

Blasiak, R., Dauriach, A., Jouffray, J.-B., Folke, C., Österblom, H., Bebbington, J., Bengtsson, F., Causevic, A., Geerts, B., Grønbrekk, W., Henriksson, P.J.G., Käll, S., Leadbitter, D., McBain, D., Ortuño Crespo, G., Packer, H., Sakaguchi, I., Shultz, L., Selig, E.R., Troell, M., Villalón, J., Wabnitz, C.C.C., Wassénius, E., Watson, R.A., Yagi, N., & Crona, B. 2021. Evolving Perspectives of Stewardship in the Seafood Industry. *Frontiers in Marine Science* 8, 671837.

PHOTO: G ANEER/AZOTE

Six principles for a thriving Blue Economy

Increased interaction between sectors like fishing, drilling and shipping risk side-lining efforts for ocean equity and sustainability. A new review provides guidelines for a sustainable and fairer use of the ocean.

Crona, B., Wassénius, E., Lillepold, K., Watson, R.A., Selig, E.R., Hicks, C., Österblom, H., Folke, C., Jouffray, J.-B. & Blasiak, R. 2021. Sharing the seas: A review and analysis of ocean sector interactions. *Environmental Research Letters* 16(6) 063005.

PHOTO: T. FRAWLEY

Human relationships are still missing from fishery management models

Bioeconomic models used to guide the development of small-scale fishery programmes exclude significant interactions between fishers, traders and consumers. This may increase existing inequalities.

Elsler, L.G., Frawley, T.H., Britten, G.L., Crowder, L.B., DuBois, T.C., Radosavljevic, S., Gilly, W.F., Crépin, A.-S. & Schlüter, M. 2021. Social relationship dynamics mediate climate impacts on income inequality: evidence from the Mexican Humboldt squid fishery. *Regional Environmental Change* 21(2) 35.

PHOTO: M. PURSIC/UNSPLASH

On our "patchwork earth", there is no one-size-fits-all road to sustainability

Three ways science and policy can incorporate more of the world's diversity and complexity when thinking about the future.

Bennett, E.M., Biggs, R., Peterson, G.D. & Gordon, L.J. 2021. Patchwork Earth: navigating pathways to just, thriving, and sustainable futures. *One Earth* 4(2), 172–176.

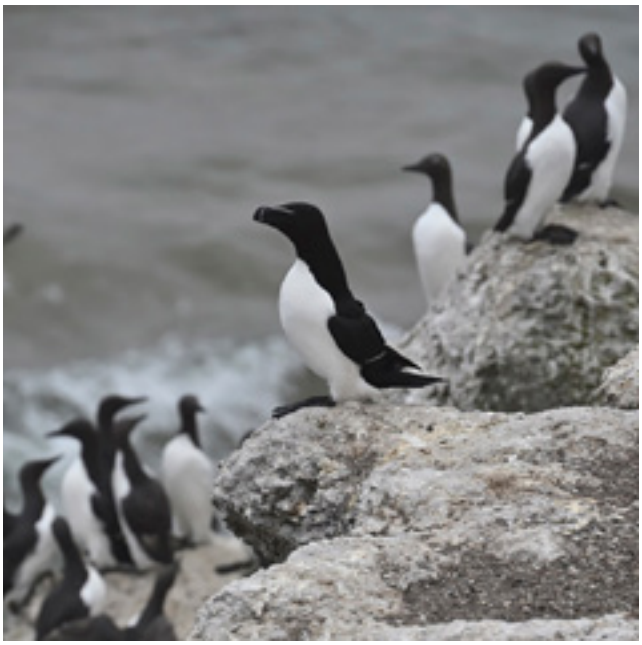
PHOTO: LJ. HAIDER

Time for a radical rethink of resilience and development

A focus on short-term economic goals that ignore social-ecological interdependencies fails to deliver development outcomes. A new perspective offers a radical alternative.

Haider, L.J., Schlüter, M., Folke, C. & Reyers, B. 2021. Rethinking resilience and development: A coevolutionary perspective. *Ambio* 50(7), 1304–1312.

PHOTO: O. OLSSON



Pandemic lockdown reveals that humans are both a threat to and the custodians of the environment

Nature may have received some respite during the Covid-19 lockdowns, but there were negative effects too.

Bates, A.E. et al. 2021. Global COVID-19 lockdown highlights humans as both threats and custodians of the environment. *Biological Conservation* 263(SI), 109175.

PHOTO: S. SMITH/WIKIMEDIA COMMONS (CC BY-SA 3.0)

Why small-scale fisheries pursue different ways to survive

A better understanding of diversification strategies could improve policies for the many millions of people who depend on small-scale fisheries.

Gonzalez-Mon, B., Bodin, O., Lindkvist, E., Frawley, T.H., Giron-Nava, A., Basurto, X., Nenadovic, M. & Schlüter, M. 2021. Spatial diversification as a mechanism to adapt to environmental changes in small-scale fisheries. *Environmental Science & Policy* 116, 246–257.

PHOTO: P. MAJCHER/UNSPLASH

How the Baltic Sea is really doing

A comprehensive assessment of the social, economic and environmental condition of the Baltic Sea reveals mixed results.

Blenckner, T., Möllmann, C., Lowndes, J.S., Griffiths, J.R., Campbell, E., De Cervo, A., Belgrano, A., Boström, C., Fleming, V., Frazier, M., Neuenfeldt, S., Niiranen, S., Nilsson, A., Ojaveer, H., Olsson, J., Palmlöv, C.S., Quaas, M., Rickels, W., Sobek, A., Viitasalo, M., Wikström, S.A. & Halpern, B.S. 2021. The Baltic Health Index (BHI): Assessing the social-ecological status of the Baltic Sea. *People and Nature* 3(2), 359–375.

PHOTO: M. BAUMEISTER/UNSPLASH

The rise of Earth altruism

Humanity may only be a short distance away from new norms needed to tackle growing global sustainability challenges.

Österblom, H. & Paasche, O. 2021. Earth altruism. *One Earth* 4(10), 1386–1397.

PHOTO: M. BAUMEISTER/UNSPLASH

How environmental change is forcing us to change the way we do science

Responding to rapid change requires researchers to master the fields of governance, law and science – all at once.

Cosens, B., Ruhl, J.B., Soininen, N., Gunderson, L., Belinskij, A., Blenckner, T., Camacho, A.E., Chaffin, B.C., Craig, R.K., Doremus, H., Glicksman, R., Heiskanen, A.-S., Larson, R. & Similä, J. 2021. Governing complexity: Integrating science, governance, and law to manage accelerating change in the globalized commons. *Proceedings of the National Academy of Sciences of the United States of America* 118(36) e2102798118.

PHOTO: G. SHAHANE/UNSPLASH

Want peace and security? Start by fixing the global food system

Ahead of the 2021 UN Food Systems Summit, researchers pushed for solutions that contribute towards sustainable and fair food-system transformations.

Queiroz, C., Norstrom, A.V., Downing, A., Harmackova, Z.V., De Coning, C., Adams, V., Bakarr, M., Baedeker, T., Chitate, A., Gaffney, O., Gordon, L., Hainzelin, E., Howlett, D., Krampe, F., Loboguerrero, A.M., Nel, D., Okollet, C., Rebermark, M., Rockström, J., Smith, M., Wabbes-Candotti, S. & Matthews, N. 2021. Investment in resilient food systems in the most vulnerable and fragile regions is critical. *Nature Food* 2(8), 546–551

PHOTO: W. ROSSEN/UNSPLASH

The 10 most important climate-science insights

A new report launched at COP26 in Glasgow summarises the most pressing research findings and emerging insights in the field of climate science.

Martin, M.A., Alcaraz Sendra, O., Bastos, A., Bauer, N., Bertram, C., Blenckner, Bowen, K., Brando, P., Rudolph, T.B., Büchs, M., et.al. 2021. Ten new insights in climate science 2021: a horizon scan. *Global Sustainability* 4, E25.

PHOTO: P4H.ERE

Why designing policies for extreme events requires a system overview

While low-cost, rapid responses to extreme events are required, proactive measures are more important.

Levin, S.A., Anderies, J., Adger N., Barrett, S., Bennett, E., Cardenas, J.C., Carpenter, S.R., Crépin, A.-S., Ehrlich, P.R., Fischer, J., Folke, C., Kautsky, N., Kling, C., Nyborg, K., Polasky, S., Scheffer, M., Segerson, K., Shogren, J., van den Bergh, J., Walker, B.H., Weber, E.U., & Wilen, J. 2021. Governance in the Face of Extreme Events: Lessons from Evolutionary Processes for Structuring Interventions, and the Need to Go Beyond. *Ecosystems* doi.org/10.1007/s10021-021-00680-2.

PHOTO: H. ELLGAARD/WIKIMEDIA COMMONS

Proximity to green areas boosts building projects

Proximity to ecosystem services raises the value of residential and commercial areas around cities. Future projects should focus more on green areas to keep it that way.

Pan, H., Page, J., Cong, C., Barthel, S. & Kalantari, Z. 2021. How ecosystems services drive urban growth: Integrating nature-based solutions. *Anthropocene* 35, 100297.

PHOTO: CRAZY D/WIKIMEDIA

Three things needed for successful climate adaptation in cities

Freiburg, Durban and Singapore show why combining social, nature-based and technological solutions to urban climate challenges can work.

Lin, B.B., Ossola, A., Alberti, M., Andersson, E., Bai, X., Dobbs, C., Elmqvist, T., Evans, K.L., Frantzeskaki, N., Fuller, R.A., Gaston, K.J., Haase, D., Jim, C.Y., Konijnendijk, C., Nagendra, H., Niemelä, J., McPhearson, T., Moomaw, W.R., Parnell, S., Pataki, D., Ripple, W.J. & Tan, P.Y. 2021. Integrating solutions to adapt cities for climate change. *Lancet Planetary Health* 5(7), E479–E486.

PHOTO: P. MALMER

Bridging citizen science and Indigenous knowledge for a healthier planet

Continuous, reflexive dialogue with Indigenous knowledge-holders is crucial for the successful stewardship of biodiversity and ecosystems.

Tengö, M., Austin, B.J., Danielsen, F. & Fernández-Llamazares, Á. 2021. Creating Synergies between Citizen Science and Indigenous and Local Knowledge. *BioScience* 71(5), 503–518.

PHOTO: KARTHIKEYAN K/UNSPLASH

What a "safe and just" future for people and the planet means

Leading social and natural scientists present an approach to define a "safe and just corridor" while addressing the limits of our planet.

Rockström, J., Gupta, J., Lenton, T.M., Qin, D., Lade, S.J., Abrams, J.F., Jacobson, L., Rocha, J.C., Zimm, C., Bai, X., Bala, G., Bringezu, S., Broadgate, W., Bunn, S.E., DeClerck, F., Ebi, K.L., Gong, P., Gordon, C., Kanie, N., Liverman, D.M., Nakicenovic, N., Obura, D., Ramanathan, V., Verburg, P.H., van Vuuren, D.P., Winkelmann, R. 2021. Identifying a Safe and Just Corridor for People and the Planet. *Earth's Future* 9(4), e2020EF001866.

PHOTO: US NAVAL FORCES (CC BY-ND 2.0)

A glimpse of the future can curb clashes at sea

Conflicts between fisheries are projected to increase dramatically in the future. Scenario development could help to prevent this.

Spijkers, J., Merrie, A., Wabnitz, C.C.C., Osborne, M., Mobjork, M., Bodin, O., Selig, E.R., Le Billon, P., Hendrix, C.S., Singh, G.G., Keys, P.W. & Morrison, T.H. 2021. Exploring the future of fishery conflict through narrative scenarios. *One Earth* 4(3), 386–396.

PHOTO: E. RÖÖS

How a single farm can align with both local and global sustainability targets

New indicators help to assess how a farm transitioning to sustainable agriculture contributes to global sustainability goals and resilience.

Röös, E., Bajzelj, B., Weil, C., Andersson, E., Bossio, D. & Gordon, L.J. 2021. Moving beyond organic – A food system approach to assessing sustainable and resilient farming. *Global Food Security* 28, 100487.

PHOTO: T. SCHMURR/WIKIMEDIA

How to reduce the risk of flooding in and around urban areas

A new tool helps to reveal dangerous areas that traditional assessments would otherwise dismiss.

Brandt, S.A., Lim, N.J., Colding, J. & Barthel, S. 2021. Mapping Flood Risk Uncertainty Zones in Support of Urban Resilience Planning. *Urban Planning* 6(3), 258–271.

PHOTO: UW-MADISON WATER SUSTAINABILITY AND CLIMATE PROJECT/FLICKR

Why land-use intensity can result in trade-offs among ecosystem services

Comparisons across cases can improve the ability to predict how land use alters ecosystem service relationships.

Qiu, J., Queiroz, C., Bennett, E.M., Cord, A.F., Crouzat, E., Lavorel, S., Maes, J., Meacham, M., Norström, A.V., Peterson, G.D., Seppelt, R. & Turner, M.G. 2021. Land-use intensity mediates ecosystem service tradeoffs across regional social-ecological systems. *Ecosystems and People* 17(1), 264–278.

PHOTO: F. THORSTEINSSON/AZOTELIBRARY.COM

A better understanding of how collaboration works

The way in which people interact does not necessarily align with the environmental problems they are supposed to address.

Hedlund, J., Bodin, O. & Nohrstedt, D. 2021. Policy issue interdependency and the formation of collaborative networks. *People and Nature* 3(1), 236–250.

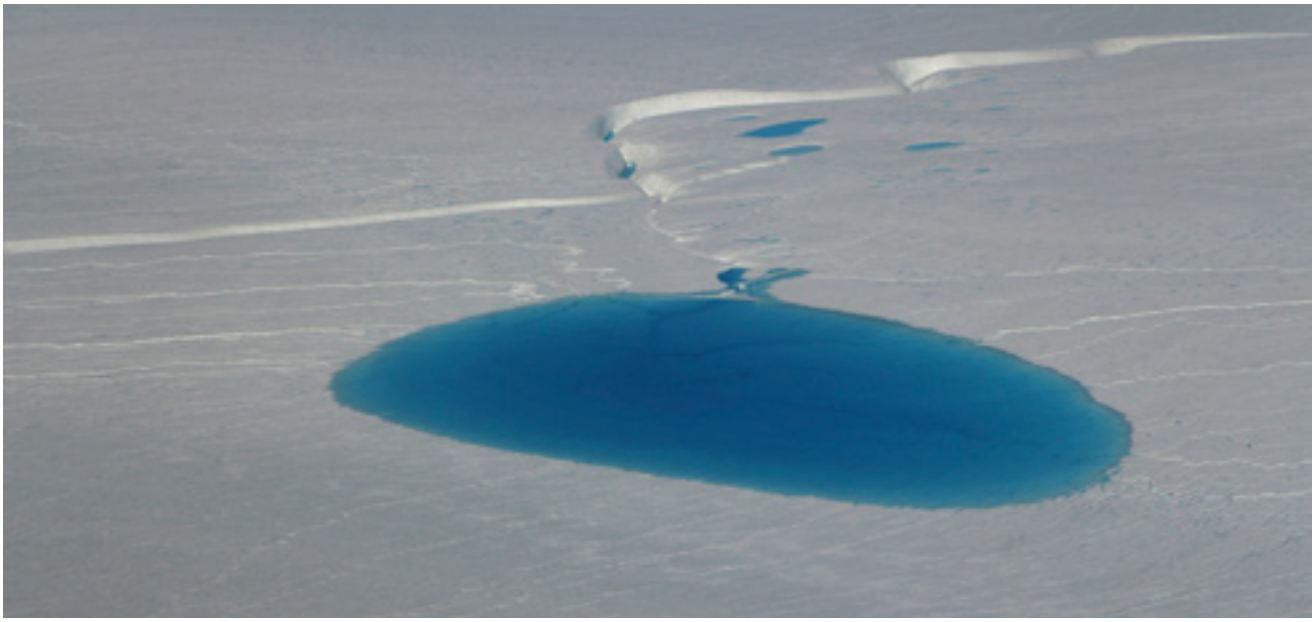
PHOTO: A. STEELS

Digitalisation is changing the way we behave and it is crucial that we understand how

Why the study of collective behaviour must be considered a "crisis discipline", just like medicine, conservation and climate science.

Bak-Coleman, J.B., Alfano, M., Barfuss, W., Bergstrom, C.T., Centeno, M.A., Couzin, I.D., Donges, J.F., Galesic, M., Gersick, A.S., Jacquet, J., Kao, A.B., Moran, R.E., Romanczuk, P., Rubenstein, D., I., Tombak, K.J., Van Bavel, J.J. & Weber, E.U. 2021. Stewardship of global collective behavior. *Proceedings of the National Academy of Sciences of the United States of America* 118(27), e2025764118.

PHOTO: NASA/FLICKR (CC BY-NC 2.0)



Increased knowledge about thresholds can help us to define safe operating spaces

Regime shifts are difficult to detect, which is why environmental management policies should pay closer attention.

Lade, S.J., Wang-Erlandsson, L., Staal, A. & Rocha, J.C. 2021. Empirical pressure-response relations can benefit assessment of safe operating spaces. *Nature Ecology & Evolution* 5(8), 1078–1079.

PHOTO: A. D. LERMAN/UNSPLASH

The quiet crossing of ocean tipping points

High-probability, high-impact ocean tipping points created by global warming, ocean acidification and deoxygenation may appear fragmented, but when added up, constitute a global problem.

Heinze, C., Blenckner, T., Martins, H., Rusiecka, D., Döscher, R., Gehlen, M., Gruber, N., Holland, E., Hov, O., Joos, F., Matthews, J.B.R., Rødven, R. & Wilson, S. 2021. The quiet crossing of ocean tipping points. *Proceedings of the National Academy of Sciences of the United States of America* 118(9), e2008478118.

PHOTO: T. TUCKER/UNSPLASH

Classifying the human planet

Researchers suggest that humans and nature interact with one another in the Anthropocene on three different levels.

Donges, J.F., Lucht, W., Cornell, S.E., Heitzig, J., Barfuss, W., Lade, S.J. & Schlüter, M. 2021. Taxonomies for structuring models for World-Earth systems analysis of the Anthropocene: subsystems, their interactions and social-ecological feedback loops. *Earth System Dynamics* 12(4), 1115–1137.

PHOTO: I. PETTERSSON/AZOTER

International trade must be taken into consideration when it comes to the sustainability of Baltic fisheries

Fast, global changes may have negative consequences for sustainability

Ammar, Y., Voss, R., Niiranen, S. & Blenckner, T. 2021. Quantifying socio-economic novelty in fisheries social-ecological systems. *Fish and Fisheries* doi.org/10.1111/faf.12626

PHOTO: J. WHEELER/UNSPLASH

Four ways to boost thinking and action around sustainability transitions

Cultivating a shared future consciousness is one of them.

Preiser, R., Biggs, R., Hamann, M., Sitas, N., Selomane, O., Waddell, J., Clements, H. & Hichert, T. 2021. Co-exploring relational heuristics for sustainability transitions towards more resilient and just Anthropocene futures. *Systems Research and Behavioral Science* 38(5, SI), 625–634.

PHOTO: C. WALTZ/FLICKR (CC BY-NC-SA 2.0)

Forests can help to mitigate heatwaves in Europe

The moisture from terrestrial sources such as forests plays a significant role given the critical nature of moisture-scarce periods during heatwaves.

Pranindita, A., Wang-Erlandsson, L., Fetzer, I. & Teuling, A.J. 2021. Moisture recycling and the potential role of forests as moisture source during European heatwaves. *Climate Dynamics* doi.org/10.1007/s00382-021-05921-7

PHOTO: P. EINERHAND/UNSPLASH

What it takes for transformation to happen

This study illustrates the importance of coordination and collaboration among diverse actors for transformative change in fishery policies.

Orach, K. & Schlüter, M. 2021. Understanding the dynamics of fish politics: The role of diverse actor interactions in transformations towards co-management. Environmental *Science & Policy* 124, 195–205.

PHOTO: C ZENINO/WIKIMEDIA

A better understanding of how tipping points work

Why the polar ice sheets are of particular importance for the stability of the climate system as a whole.

Wunderling, N., Donges, J.F., Kurths, J. & Winkelmann, R. 2021. Interacting tipping elements increase risk of climate domino effects under global warming. *Earth System Dynamics* 12(2), 601–619.

PHOTO: J WHEELER/UNSPLASH

How to manage future freshwater

Researchers propose a new framework for understanding water's many functions for supporting, regulating and stabilising climatic, ecological and social systems.

Falkenmark, M. & Wang-Erlandsson, L. 2021. A water-function-based framework for understanding and governing water resilience in the Anthropocene. *One Earth* 4(2), 213–225.

PHOTO: BILLYSHIVERSTICK/WIKIMEDIA COMMONS

Knowledge and perspectives of young stakeholders are crucial to conservation and development initiatives

The strengths, weaknesses and ways forward for 74 UNESCO Biosphere Reserves across 83 countries.

Barraclough, A.D., Schultz, L. & Maren, I.E. 2021. Voices of young biosphere stewards on the strengths, weaknesses, and ways forward for 74 UNESCO Biosphere Reserves across 83 countries. *Global Environmental Change* 68, 102273.

PHOTO: S BLASCH/UNSPLASH

Achieving an equitable ocean commons may just be our final frontier

The current expansion of human activity into the ocean has left us at a crossroads, argue researchers.

Claudet, J., Amon, D.J. & Blasiak, R. 2021. Transformational opportunities for an equitable ocean commons. *Proceedings of the National Academy of Sciences of the United States of America* 118(42) e2117033118.

PHOTO: D FOU/UNSPLASH

Has sustainability science turned left?

Why a broad spectrum of viewpoints should be given higher priority in all forums where issues of sustainability are discussed.

Bodin, O. 2021. Has sustainability science turned left? *Sustainability Science* 16(6), 2151–2155.

PHOTO: H MOREL/UNSPLASH

Novel conditions for life in the Baltic Sea

As positive as this may sound, it may signal large oncoming changes that could have devastating consequences for both biodiversity and ecosystem services.

Blenckner, T., Ammar, Y., Müller-Karulis, B., Niiranen, S., Arneborg, L. & Li, Q. 2021. The Risk for Novel and Disappearing Environmental Conditions in the Baltic Sea. *Frontiers in Marine Science* 8, 745722.

PHOTO: J TORRES/UNSPLASH

Old, unsustainable habits remain powerful barriers to significant change

Researchers present three arguments on why pro-environmental habits need to be high on the research agenda in the field of sustainability science.

Linder, N., Giusti, M., Samuelsson, K. & Barthel, S. 2021. Pro-environmental habits: An underexplored research agenda in sustainability science. *Ambio* 51, 546–556

PHOTO: L. GOULD/FLICKR (CC BY-NC-SA 2.0)

Drought and logging leave the Amazon vulnerable to irreversible damage

The increased frequency and intensity of forest fires could push large areas of Amazon forest towards a tipping point, resulting in transitions towards low-tree, high-grass zones.

De Faria, B.L., Staal, A., Silva, C.A., Martin, P.A., Panday, P.K. & Dantas, V.L. 2021. Climate change and deforestation increase the vulnerability of Amazonian forests to post-fire grass invasion. *Global Ecology and Biogeography* 30(12), 2368–2381.

PHOTO: NASA/LVIS TEAM

What 30,000 years of data can tell us about abrupt changes in the Earth system

The chances of detecting abrupt changes and tipping points increase with the length of observation. Geological records are the only long-term source of information available.

Brovkin, V., Brook, E., Williams, J.W., Bathiany, S., Lenton, T.M., Barton, M. et al., 2021. Past abrupt changes, tipping points and cascading impacts in the Earth system. *Nature Geoscience* 14(8), 550–558.

PHOTO: M. BAUMEISTER/UNSPLASH

What "science-based targets" are all about

The Paris Agreement set a watershed for defining science-based targets. Can we replicate this concept for the 2030 Agenda?

Andersen, I., Ishii, N., Brooks, T., Cummis, C., Fonseca, G., Hillers, A., Macfarlane, N., Nakicenovic, N., Moss, K., Rockström, J., Steer, A., Waughray, D. & Zimm, C. 2021. Defining "Science-based Targets". *National Science Review* 8(7), nwaa186.

PHOTO: WORLDFISH

Optimal aquaculture for both humans and the planet

Optimising nutrients from aquaculture while limiting the environmental impacts of production is a difficult task. Could efforts from Indonesia serve as inspiration?

Shepon, A., Gephart, J.A., Golden, C.D., Henriksson, P.J.G., Jones, R.C., Koehn, J.Z. & Eshel, G. 2021. Exploring sustainable aquaculture development using a nutrition-sensitive approach. *Global Environmental Change* 69, 102285.

PHOTO: M. OKON/UNSPLASH

The sea is a source of an untapped potential for better human health

The secrets of the sea have resulted in fundamental breakthroughs in human health. However, they still remain under-utilised for human benefit. Improved research and funding is still required.

Sigwart, J.D., Blasiak, R., Jaspars, M., Jouffray, J.-B. & Tasdemir, D. 2021. Unlocking the potential of marine biodiscovery. *Natural Product Reports* 38(7), 1235–1242.

PHOTO: J. HARTONO/UNSPLASH

What happens if you blend ecosystem services with resilience approaches in urban planning?

Lessons from the San Francisco Bay area.

Hamel, P., Hamann, M., Kuiper, J.J., Andersson, E., Arkema, K.K., Silver, J.M., Daily, G.C. & Guerry, A.D. 2021. Blending Ecosystem Service and Resilience Perspectives in Planning of Natural Infrastructure: Lessons from the San Francisco Bay Area. *Frontiers in Environmental Science* 9, 601136.

PHOTO: J.F. SALAS/UNSPLASH

Guiding principles for appreciating and maintaining urban nature

Strategies for improving urban quality of life should be based on a variety of methods and a certain degree of pragmatism.

Andersson, E., Borgström, S., Haase, D., Langemeyer, J., Mascarenhas, A., McPhearson, T., Wolff, M., Laszkiewicz, E., Kronenberg, J., Barton, D.N. & Herreros-Cantis, P. 2021. A context-sensitive systems approach for understanding and enabling ecosystem service realization in cities. *Ecology and Society* 26(2), 35.

PHOTO: R. GANZER/FLICKR (CC BY-NC-SA 2.0)

Creating more resilient fisheries

Social networks can both facilitate and limit the sharing of information and knowledge. What is the experience of Basque tropical tuna fishers?

Rubio, I., Hileman, J. & Ojea, E. 2021. Social connectivity and adaptive capacity strategies in large-scale fisheries. *Ecology and Society* 26(2), 42.

PHOTO: M. ALMQVIST/AZOTE

Why background conditions should not be put in the background

We must keep our options open to understand why certain things are seen the way they are.

Hertz, T. & Mancilla Garcia, M. 2021. The Cod and the cut: Intra-Active Intuitions. *Frontiers in Sociology* 6, 724751.

PHOTO: A. WAHID/UNSPLASH

Sustainability research is still slow when it comes to considering the nature of human behaviour

It's time to move from neglect and simplicity to a more integrated approach. This new study suggests a pathway for future improvement.

Constantino, S.M., Schlüter, M., Weber, E.U. & Wijermans, N. 2021. Cognition and behavior in context: a framework and theories to explain natural resource use decisions in social-ecological systems. *Sustainability Science* 16(5), 1651–1671.

PHOTO: T. STICEA/UNSPLASH

With antibiotic resistance looming over human health, assessments must improve

Life cycle assessments fail to acknowledge the environment impact of antibiotic resistance. This needs to change – but it's an enormous task.

Nyberg, O., Rico, A., Guinée, J.B. & Henriksson, P.J.G. 2021. Characterizing antibiotics in LCA—a review of current practices and proposed novel approaches for including resistance. *International Journal of Life Cycle Assessment* 26(9), 1906–1907.

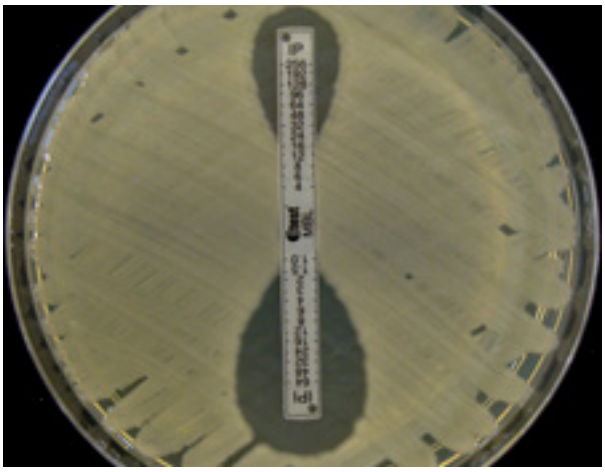


PHOTO: N READING/FLICKR (CC BY-NC-ND 2.0)

Better intervention is required to fight antimicrobial resistance

Reports on interventions should come with guidelines that can be shared among stakeholders in a transparent and comprehensive way.

Léger, A., Lambraki, I., Graells, T., Cousins, M., Henriksson, P.J.G., Harbarth, S., Carson, C.A., Majowicz, S.E., Troell, M., Parmley, E.J., Jørgensen, P.S. & Wernli, D. 2021. Characterizing social-ecological context and success factors of antimicrobial resistance interventions across the One Health spectrum: Analysis of 42 interventions targeting E. coli. *BMC Infectious Diseases* 21(1), 873.

PHOTO: CIFOR/FLICKR (CC BY-NC-ND 2.0)

This new approach can be used to study palaeoclimate regime changes

Non-linear time series analysis allows researchers to pinpoint distinct aspects within dynamic regime shifts in the palaeoclimate era.

Marwan, N., Donges, J.F., Donner, R., V. & Eroglu, D. 2021. Nonlinear time series analysis of palaeoclimate proxy records. *Quaternary Science Reviews* 274, 107245.

PHOTO: J. HARTONO/UNSPLASH

Why resilience and well-being don't always go hand in hand

An overly simplistic understanding of the two can leave the poorest, most marginalised people to suffer.

Chaigneau, T., Coulthard, S., Daw, T.M., Szaboova, L., Camfield, L., Chapin III, F.S., Gasper, D., Gurney, G.G., Hicks, C.C., Ibrahim, M., James, T., Jones, L., Matthews, N., McQuistan, C., Reyers, B. & Brown, K. 2021. Reconciling well-being and resilience for sustainable development. *Nature Sustainability* doi.org/10.1038/s41893-021-00790-8

PHOTO: K. MOUM/UNSPLASH

There are few realistic scenarios left to limit global warming to 1.5°C

Which of the hundreds of scenarios put forward to stabilise average global temperature increase at around 1.5°C are the most feasible? SRC analysts and colleagues identified 20 scenarios that were deemed to be most realistic.

Warszawski, L., Kriegler, E., Lenton, T.M., Gaffney, O., Jacob, D., Klingenfeld, D., Koide, R., Costa, M.M., Messner, D., Nakicenovic, N., Schellnhuber, H.J., Schlosser, P., Takeuchi, K., Van Der Leeuw, S., Whiteman, G. & Rockström, J. 2021. All options, not silver bullets, needed to limit global warming to 1.5 °C: A scenario appraisal. *Environmental Research Letters* 16(6), 064037.

PHOTO: A. RINCON/FLICKR (CC BY-NC-ND 2.0)

Can nature-based solutions foster transformative change?

Yes, they can. They are as much "people based" as they are "nature based".

Palomo, I., Locatelli, B., Otero, I., Colloff, M., Crouzat, E., Cuni-Sanchez, A., Gómez-Baggethun, E., González-García, A., Grêt-Regamey, A., Jiménez-Aceituno, A., Martin-López, B., Pascual, U., Zafra-Calvo, N., Bruley, E., Fischborn, M., Metz, R. & Lavorel, S. 2021. Assessing nature-based solutions for transformative change. *One Earth* 4(5), 730–741

PHOTO: OXFAM INTERNATIONAL/FLICKR (CC BY-NC-ND 2.0)

In drought-prone Sahel, rain still remains a gift that only few farmers can enjoy

Since the 1980s, rainfall conditions for agriculture have only improved in scattered areas across the region.

Porkka, M., Wang-Erlandsson, L., Destouni, G., Ekman, A.M.L., Rockström, J. & Gordon, L.J. 2021. Is wetter better? Exploring agriculturally-relevant rainfall characteristics over four decades in the Sahel. *Environmental Research Letters* 16(3), 035002.

PHOTO: MINISTERIO DEL AMBIENTE PERU/FLICKR (CC BY-NC-ND 2.0)

Better biodiversity-based agriculture requires better social networks

This review points to the major knowledge gap that exists when it comes to understanding how networks affect farmers' access to agrobiodiversity.

Labeyrie, V., Antona, M., Baudry, J., Bazile, D., Bodin, O., Caillon, S., Leclerc, C., Le Page, C., Louafi, S., Mariel, J., Massol, F. & Thomas, M. 2021. Networking agrobiodiversity management to foster biodiversity-based agriculture: A review. *Agronomy for Sustainable Development* 41(1), 4.

PHOTO: M. MARAIS/UNSPLASH

How do we prepare for the next pandemic?

Covid-19 has tested our resilience in many ways, far beyond just health. Resilience in its broadest sense is now required.

Wernli, D., Clausin, M., Antulov-Fantulin, N., Berezowski, J., Biller-Andorno, N., Blanchet, K., Böttcher, L., Burton-Jeangros, C., Escher, G., Flahault, A., Fekuda, K., Helbing, D., Jaffé, P.D., Jørgensen, P.S., Kaspiarovich, Y., Krishnakumar, J., Lawrence, R.J., Lee, K., Léger, A., Levrat, N., Martischang, R., Morel, C.M., Pittet, D., Stauffer, M., Tediosi, F., Vanackere, F., Vassalli, J.-D., Wolff, G., & Young, O. 2021. Building a multisystemic understanding of societal resilience to the COVID-19 pandemic. *BMJ Global Health* 6(7), e006794.

PHOTO: J. OWEN/UNSPLASH

How, where and when is it best to combat antimicrobial resistance?

The diverse range of actions designed to address antimicrobial resistance remains poorly understood from a One Health perspective.

Léger, A., Lambraki, I., Graells, T., Cousins, M., Henriksson, P.J.G., Harbarth, S., Carson, C., Majowicz, S., Troell, M., Parmley, E.J., Jørgensen, P.S. & Wernli, D. 2021. 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* 76(1), 1–21.

PHOTO: H. GRIMSTAD/UNSPLASH

What ecosystem service mapping is still missing

We still lack sufficient data on biodiversity. However, weighted provider richness may be the next step forward.

Ceausu, S., Apaza-Quevedo, A., Schmid, M., Martin-López, B., Cortes-Avizanda, A., Maes, J., Brotons, L., Queiroz, C. & Pereira, H.M. 2021. Ecosystem service mapping needs to capture more effectively the biodiversity important for service supply. *Ecosystem Services* 48, 101259.

PHOTO: NASA ICE

A collapse of the West Antarctic Ice Sheet is looming

More rigorous observations of the Pine Island Glacier confirm the warning signs.

Rosier, S.H.R., Reese, R., Donges, J.F., De Rydt, J., Gudmundsson, G.H. & Winkelmann, R. 2021. The tipping points and early warning indicators for Pine Island Glacier, West Antarctica. *Cryosphere* 15(3), 1501–1516.

A selection of contributions to journals, boards and committees

Journal editor

Journal of Marine Science (Robert Blasiak)
Ecology and Society (Örjan Bodin, Maja Schlüter, Thomas Hahn, Steve Lade, Michele-Lee Moore)
Current Opinion in Environmental Sustainability (Victor Galaz)
Ecological Economics (Anne-Sophie Crepín)
Ambio (Erik Andersson, Carl Folke)
npj Urban Sustainability (Thomas Elmqvist)
PNAS (Carl Folke)
Environmental Science and Policy (Laura Pereira)

Board memberships

Mistra Urban Futures (Thomas Elmqvist)
Mistra Environmental Communication (Sturle Hauge Simonsen)
Stockholm International Water Prize Jury (Line Gordon)
Stockholm University section board (Thorsten Blenckner)
Resilience Alliance (Garry Peterson)
SeaBOS Fundraising Foundation (Beatrice Crona, Henrik Österblom)
RECOFTC (Grace Wong)
Baltic Seabird Project Association (Olof Olsson)
Scientific Advisory & Ethical Board, Global Change Research Inst., Czech Academy of Sciences (Maria Tengö)
Donella Meadows Fellows committee (Jamila Haider)
EAT Foundation (Line Gordon)
The Adjudication Committee for the Nordic Council Environment Prize (Fredrik Moberg)

Various commissions and committees

Executive team and steering committee for the Nobel Prize Summit - Our planet, Our future (Carl Folke)
Scientific committee on Biodiversity and Ecosystem Services, Swedish Environmental Protection Agency (Thomas Hahn)
UN Global Compact Ocean Stewardship Coalition (Jean-Baptiste Jouffray)
The Erling-Persson Family Academy Programme, New Approaches to the Grand Challenge: Global Finance, Global Health and the Biosphere, the Royal Swedish Academy of Sciences (Beatrice Crona and Carl Folke)
Environmental committee, the Royal Swedish Academy of Sciences (Anne-Sophie Crepín)
Member of the Swedish National Committee for Global Environmental Change (Anne-Sophie Crepín)
Steering Committee, Agroforestry Network (Sara Elfstrand)
Steering Committee for the US-UK Scientific Forum on the Valuation of Biodiversity, National Academy of Sciences, USA, and Royal Society, UK (Carl Folke)
International Member of the US National Academy of Sciences, Washington (Carl Folke)
Swedish National Commission for UNESCO (Lisen Schultz)
Scientific and Technical Advisory Council of Culinary Institute of America's Menus of Change programme, (Line Gordon)
Scientific Advisory Board of the Swedish International Development Cooperation Agency (Lisa Deutsch)
UN World Ocean Assessment (Robert Blasiak)
REV Ocean Science and Innovation Committee (Lisen Schultz)
Konrad Lorenz Institute (Peter Søgaard Jørgensen)
Stockholm University Climate Roadmap (Line Gordon)
Global Environmental Facility (Garry Peterson)
SDG Transformations Forum Council (Per Olsson)
UNFCCC Race to Resilience (Albert Norström)
UK Natural Environmental Research Council (Tim Daw)
European Social Simulation Association (Ferdinanda Wijermans)

The Beijer Institute of Ecological Economics

The SRC's close collaboration with its founding partner, the Beijer Institute at the Royal Swedish Academy of Sciences, continues to prove incredibly productive, with multiple synergies and benefits being gained through joint projects, grants, workshops and publications

SRC RESEARCHERS ARE ENGAGED in several Beijer Institute research programmes, with SRC deputy director Victor Galaz currently leading the Governance, Technology and Complexity programme. In turn, Beijer researchers and Beijer young scholars are involved in the thematic research conducted by the SRC, acting as both participants and leaders. The collaboration between our two organisations consists of joint seminars, teaching and supervision, in addition to shared communication, outreach and policy engagements. Moreover, the Beijer Institute and the SRC acted as joint organisers of the first Nobel Prize Summit, "Our Planet, Our Future", together with the US National Academy of Sciences and the Potsdam Institute. The event was hosted by the Nobel Foundation on 26-28 April (see page 9) and brought together Nobel Prize laureates and other esteemed leaders from across the sciences, including policy-makers, businesses and members of the youth movement. Members of the arts were also involved in the effort to explore actions that could be taken this decade to put the world on the right path towards a more sustainable, more prosperous future for all. The Beijer Institute director and centre chair of the board, Carl Folke, led work on the scientific paper "Our future in the Anthropocene biosphere", which, written alongside several SRC colleagues and Beijer fellows, served as background for the meeting following its publication in the journal *Ambio*. Based on this paper and on summit discussions, a scientific statement was then signed by an unprecedented 126 Nobel Laureates, before being delivered to the G7 summit held in the UK in June.

The Beijer Institute's Urban Social-Ecological Systems research programme forms part of the major FAIRTRANS research programme designed to promote transformation towards a fair and fossil-free Sweden. The programme was granted joint funding from Swedish research councils Formas and Mistra and was awarded SEK 40 million for a duration of four years. Hosted by the SRC, the programme is led by SRC researchers Thomas Hahn and Stephan Barthel, alongside Beijer programme director Johan Colding, who leads one of the five available work packages (WP4) entitled "Fair Digital Transformation and Co-creation for Socially Accepted Climate Action".

In addition to the programmes mentioned above, the collaboration between the SRC and the Beijer Institute is particularly extensive within the seafood sector. One example of this is the Blue Food Assessment, which was launched in 2020 and described in last year's annual report. This year, five peer-reviewed papers were published in *Nature* journals as part of the Blue Food Assessment. They highlight the opportunities to leverage the vast diversity of aquatic – or "blue" – foods available to us over the coming decades, in order to address malnutrition, reduce the environmental footprint left behind by our food systems and create stable livelihoods. The assessment also consists of a report that includes key findings for decision makers, which was delivered to the UN Food Summit in September.

Finally, alongside colleagues from both the SRC and RISE Research Institutes of Sweden, Beijer Institute researchers have produced a series of policy briefs, providing authorities, companies and consumers alike with clear guidance and advice on actions that could increase sustainable and healthy seafood consumption, focusing particularly on Swedish conditions. The five policy briefs produced fall within the scope of the Seawin research project, funded by Formas. The aim of this project is to gain new insights into potential pathways towards our combined goal of improved human health and environmental sustainability in relation to seafood consumption and production. Furthermore, the collaborative projects on the sustainable development goals (SDGs) that we reported on last year, as well as the Stanford collaboration, are generating exciting new insights.

Read more: www.beijer.kva.se

The Global Economic Dynamics and the Biosphere programme

Work on the Global Economic Dynamics and the Biosphere programme continued to develop throughout 2021, within the areas of biosphere finance, global health and biosphere stewardship

The model for measuring the impact of financial investments on the earth system, developed by Steve Lade, Beatrice Crona and several other colleagues at the SRC, constitutes a particularly noteworthy achievement. This prototype is the first model of its kind to be able to capture earth-system processes beyond greenhouse gases, also including water- and land-use changes. In addition, it can capture any interactions between these processes and has the capacity to account for the differential impact of land-use change, depending on where on the planet these changes are made, thus incorporating the notion of tipping points into the earth system.

Similarly, within the field of biosphere finance, novel analysis of the complex issue of crop residue burning was also conducted. This process has a significant negative impact in northern India, particularly in terms of human health and soil and water quality. The practice is also at least partially responsible for the current destabilisation of the Indian summer monsoon and the Indian climate system as a whole. By mapping value chains within the Punjab rice and wheat production systems, Andrea Downing was able to lead a collaborative effort with the Departments of Environmental Science at Stockholm University and the University of Groningen, to identify the investors providing capital in the Punjab agrifood sector. The team identified two types of system changes required in order to bring about long-term sustainability in the rice and wheat systems, highlighting four ways in which public and private financial institutions could play a significant role in shifting practices.

As part of its biosphere finance research, the entire team of research assistants worked with executive director Beatrice Crona to deliver an extensive map of the different economic factors impacting SDGs. This map is to be included in an impact screening tool developed for the Swedish bank, SEB. Meanwhile, global health and biosphere stewardship research explored the ways in which antimicrobial resistance (AMR) hampers the achievement of many SDGs, including good health and well-being and zero hunger. Researchers also looked into how progress on those SDGs could subsequently help to contain AMR via clean water and sanitation, for example. Finally, multiple GEDB researchers formed part of the core team that delivered the Blue Food Assessment, led by the SRC and Stanford.

Find out more here: www.gedb.se

Our collaboration with Stanford University

The SRC has several collaborations with Stanford University, including the strategic research collaboration and postdoc programme on fundamental research in biosphere-based sustainability science

THE STRATEGIC RESEARCH collaboration and postdoc programme is funded by the Marianne and Marcus Wallenberg Foundation and links the SRC, the Beijer Institute and the Natural Capital Project at Stanford University. Led by Carl Folke and Gretchen Daily at Stanford, this research is pushing the frontiers of sustainability science through theoretical development, advancing assessment tools and expanding analysis and synthesis. Megan Meacham coordinates the programme and is also a postdoc fellow along with Jean-Baptiste Jouffray. SRC colleagues Garry Peterson and Henrik Österblom are responsible for the scientific method. Additionally, SRC researchers Erik Andersson, Thomas Elmqvist, Line Gordon, Peter Sörgaard Jörgensen, Jan Kuiper, Therese Lindahl (the Beijer Institute), Moa Ohlsson, Albert Norström, Juan Rocha and Cibele Queiroz played a key role in the work carried out under this partnership.

Among the main highlights of 2021 were the two webinars developed and hosted as part of the Natural Capital Conversations series. "The Anthropocene Ocean" brought a panel of key researchers together, to discuss what the Anthropocene means for our seas and how to steer it in a sustainable and equitable way. Meanwhile, "When and How Will Nature Provide Urban Solutions?" brought academics and practitioners together to explore city challenges and opportunities for nature-based solutions in city environments.

In 2021, the urban research conducted under the programme also benefited from a new open-source software with which to assess the different ways in which people experience nature in the cities where they live. This also made it possible to determine the role that urbanisation plays in achieving long-term global sustainability. City planners and developers can use the software to visualise where best to invest in nature, for instance in parks and marshlands, thus enabling them to maximise the benefits that such natural areas provide – including increased protection from flooding and improved health, for example. Read more about the software here: https://naturalcapitalproject.stanford.edu/software/urban-invest

SRC and Stanford Centre for Ocean Solutions are working closely on the SeaBOS initiative (see page 68) and the Blue Food Assessment (see page 10).

PHOTO: C. BALLARD

Improving science ninja-style

SRC researcher Andrea Downing on the joys and frustrations of science, dream teams and a good glass of whiskey

ANYONE WHO HAS BEEN AROUND ANDREA knows that there is much more than meets the eye. Beneath her kind, calm exterior lies sharp wit and dedication. She has been part of the SRC since 2014, working on issues ranging from planetary boundaries to manufactured fishponds. Her ability to work across such diverse topics is one of her greatest assets and she takes pride in being able to survive – and thrive – as a generalist. "Both methodologically and subject-matter wise, I've covered a fair bit of ground: I've collected data in the field, created data through modelling and used qualitative and quantitative analyses from the social and natural sciences, bridging theory and practice in systems ranging from coral reefs and lakes to global-scale sustainability concepts, agricultural systems, forests, drylands and financial systems, looking at micro-organisms, fish, social-ecological systems, value chains and inequitable distributions of power and representation, among other things."

Describing herself as a generalist is also a reflection of her own personal background. It has given her the opportunity to see many worlds – meeting, working with and being linked to a diverse range of people across many different contexts. The stories she can tell as a result reveal a rich and slightly random repository of experiences that show how life can be lived and perceived. Her wide-ranging experience has influenced her life as a researcher, too. It has taken her to universities in Geneva, Reunion Island, Townsville, Wageningen and now, Stockholm. "I love figuring things out and have always marvelled at how the world works, from the microscopic level – where apparently basic mechanisms allow simpler organisms to exist, shape their environment and wreak havoc for other organisms – to the patterns formed by complex behaviours of diverse organisms on a larger scale." However, her journey has also revealed the flaws of science. Just like the world we live in, academia itself is unjust and unsustainable. Diversity and representation of a range of perspectives are sorely lacking. "Ultimately, we don't want a glass ceiling or ivory tower for sustainability research that limits inclusion to those who fit the rules, world views and boxes established by a small group of white males."

There are other parts of it she could do without, too. "I cringe every time I hear long-established facts being expressed as novel ideas. I understand that it's necessary to repeat messages and findings in order for them to potentially make their way into political circles and become common knowledge, but I fear that by repeating ourselves too much, we are creating an excuse for the late adoption of sustainable practices, thus failing to support sustainable transformation." This is something that hits a nerve for Andrea: "Why are we still repeating things we already know, such as limits to growth or the fact that people depend on the environment? How can we still claim that such statements are ground-breaking? How can it be considered acceptable to ignore this?" To be clear, her frustration is born from the desire to improve a discipline that she loves, where she has met many interesting people. Which brings us to her scientific role models. Although she has many, they all have one thing in common: the ability to "break silos ninja-style" and the confidence to challenge assumptions. "These people dare to challenge and critique, but do so with integrity and care." Andrea has had the opportunity to spend time with many of the people she looks up to in science, drawing inspiration from them as she herself tries to push for change. Most of them share her love of the outdoors too – and some even share her love of whiskey! So, there you have it. If you would like to arrange a meeting with Andrea – or even suggest a hike or a swim – add a hipflask of whiskey and you'll have her undivided attention!

SES-LINK

In 2021, the SES-Link group continued its theoretical research into causality, monitoring and evaluation – approaching complex, multi-faceted issues by creating visual maps of causation and presenting co-evolutionary perspectives on resilience and development

SES-LINK BRINGS TOGETHER SRC researchers who share an interest in exploring the philosophical and theoretical foundations of social-ecological systems (SES) and their complex dynamics through a combination of in-situ empirical research and modelling. Team members lead and collaborate across several projects funded by the European Research Council (ERC), the Swedish Research Council (VR), Formas and Belmont/BiodivERsA.

In 2021, the SES-Link group continued its theoretical research into complex causality, exploring multiple approaches to causation (Schlüter et al. in review), monitoring and evaluation (Hertz et al. 2021), in addition to continuing to investigate ways in which to visually represent complex causation (Banitz et al. in press) and developing a co-evolutionary perspective on resilience and development (Haider et al. 2021). Research into the role that social and social-ecological relationships play in the responses of small-scale fisheries to environmental or institutional change yielded novel insights, revealing that spatial diversification and horizontal trade relationships could facilitate better adaptation to variable fish availability (Gonzalez et al. 2021a, Gonzalez et al. 2021b), in addition to demonstrating that social relationships can help to mediate the impacts of climate change (Elsler et al. 2021). Stories of fisherfolk in Zanzibar showcased the gendered diversity of their experiences with marine enclosures and compliance (O'Neill et al. in prep); this work subsequently served to inform the development of an octopus enclosure model (Lindkvist et al. in prep). A comparative analysis of transitions to co-management in five small-scale fisheries highlights the importance of (cross-scale and cross-type) coordination and collaboration among diverse political actors in creating conditions for the adoption of legislation, as well as the timing thereof during the policy process (Orach and Schlüter 2021). Model-based explorations of multi-level poverty traps revealed that the type and strength of connections between individual and community-level dynamics influences the dynamics of traps and the ways in which to alleviate them (Radosavljevic et al. 2021).

The pandemic impacted plans to conduct observational fieldwork for several different projects. Rather than going into the field, the Agent-Ex team reflected on the process of mixed-method research, particularly where this combines agent-based modelling with controlled behavioural experiments (Wijermans et al., in press). Data collection for a new case study on small-scale trade in South African fruit production was shifted to online expert interviews (Gonzalez et al. in prep), while stakeholder workshops for LimnoScenES also went online. International collaborations with colleagues, for instance from Princeton (Elke Weber and Sara Constantino), also became virtual, with work being carried out in accordance with an updated framework. This included the review of 31 theories on the study of human behaviour in social and biophysical contexts (Constantino et al. 2021) and a collaboration with colleagues from the sustainability and land systems science communities to discuss innovative ways of theorising in sustainability science (Schlüter et al. in press).

Relevant publications:

Banitz, T., Hertz, T., Johansson, L.G., Lindkvist, E., Martínez-Peña, R., Radosavljevic, S., Schlüter, M., Wennberg, K., Ylikoski, P., & Grimm, V. (in press). Visualization of causation in social-ecological systems. *Ecology and Society.*

Constantino, S. M., Schlüter, M., Weber, E. U., & Wijermans, N. (2021). Cognition and behavior in context: a framework and theories to explain natural resource use decisions in social-ecological systems. Sustainability Science, 16(5), 1651–1671.

Elsler, L.G., Frawley, T.H., Britten, G.L., Crowder, L.B., DuBois, T.C., Radosavljevic, S., Gilly, W.F., Crépin, A.-S., Schlüter, M., 2021. Social relationship dynamics mediate climate impacts on income inequality: evidence from the Mexican Humboldt squid fishery. *Regional Environmental Change* 21.2: 1–12.

Gonzalez-Mon, B., Bodin, Ö., Lindkvist, E., Frawley, T. H., Giron-Nava, A., Basurto, X., Nenadovic, M., Schlüter, M. (2021a). Spatial diversification as a mechanism to adapt to environmental changes in small-scale fisheries. *Environmental Science & Policy* 116 (2021): 246–257.

González-Mon, B., Lindkvist, E., Bodin, Ö., Zepeda-Domínguez, J.A., Schlüter, M., 2021b. Fish provision in a changing environment: The buffering effect of regional trade networks. *PLOS ONE* 16(12), e0261514.

Haider, L.J., Schlüter, M., Folke, C., Reyers, B., 2021. Rethinking resilience and development: A coevolutionary perspective. *Ambio* 50.7 (2021): 1304–1312.

Hertz, T., Brattander, E., & Rose, L. 2021. Complexity-Aware Monitoring and Evaluation. *Journal Of MultiDisciplinary Evaluation* 17.41 (2021): 35–50.

Orach, K. & Schlüter, M. 2021. Understanding the dynamics of fish politics: The role of diverse actor interactions in transformations towards co-management. *Environmental Science & Policy* 124 (2021): 195–205.

O'Neill et al. (in prep). Compliance, complexity and cephalopods – contested responses to collaborative marine natural resource management.

Radosavljevic, S., Haider, L.J., Lade, S.J., Schlüter, M., 2021. Implications of poverty traps across levels. *World Development* 144, 105437.

Schlüter, M., Hertz, T., Mancilla García, M., Banitz, T., Grimm, V., Johansson, L.-G., Lindkvist, E., Martínez-Peña, R., Radosavljevic, S., Wennberg, K. & Ylikoski, P (in review). Understanding and communicating causation in social-ecological systems: conceptual tools and a research agenda.

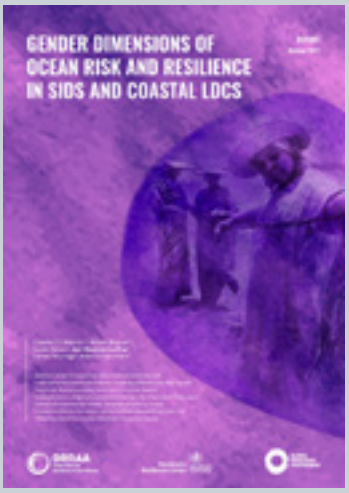
Schlüter, M., Caniglia, G., Orach, K., Bodin, Ö., Magliocca, N., Meyfroidt, P., & Reyers, B (in press). Why care about theories? Innovative ways of theorising in sustainability science. *Current Opinion in Environmental Sustainability.*

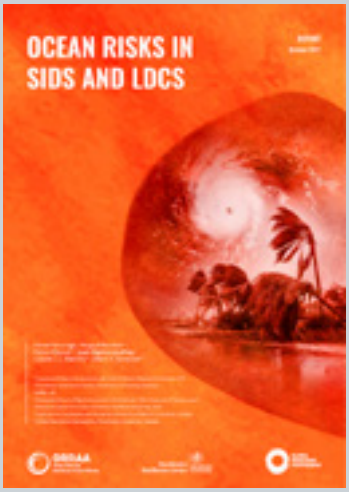
Wijermans, N., Schill, C., Lindahl, T., & Schlüter, M. (in press). Combining approaches: behind the scenes. Reflections on using agent-based models to integrate multiple types of evidence from controlled behavioural experiments. *International Journal of Social Research Methodology.*

Read more: www.seslink.org

The Ocean Risk and Resilience Action Alliance reports

A sustainable and equitable ocean economy is within reach. However, according to three reports written by SRC researchers for the Ocean Risk and Resilience Action Alliance, the risk of the opposite continues to loom over us, too





WE CURRENTLY STAND AT THE TIPPING POINT of a "blue economy" – an ocean economy that is truly sustainable and equitable. We have the potential for significant acceleration and growth – but only if the right frameworks are used to support this. This is the key finding in a series of reports published by the SRC and the Global Resilience Partnership and commissioned by the Ocean Risk and Resilience Action Alliance (ORRAA). The trio of reports, which constitute some of the most comprehensive research into levels of ocean-related investment and finance ever undertaken, point to the potential negative risks of unbalanced, inequitable and unsustainable investment decisions when it comes to our oceans. If we do not correct our course of action, there is a clear danger of such investments actually increasing levels of inequality and causing further harm to our seas and oceans, as well as to the communities that depend on them.

Albert Norström, SRC researcher and project lead for the reports, says: "These three reports collectively describe how we find ourselves in a new phase of humanity's use of the ocean – dubbed the 'blue acceleration' – which is rapidly transforming the ocean and producing major economic, social and ecological consequences."

Understanding the "complex ocean risks" that developing, small island states and the least developed coastal countries face is key to unlocking the potential for more equitable benefit. This includes recognising that factors such as climate change vulnerability do exist, on top of external socio-political factors that threaten to divide the communities at risk. The reports found that considerations of gender equality were largely absent in initiatives and policy-making decisions, with women tending to be underrepresented in this process.

To address this and secure a fairer, more sustainable ocean economy, the reports suggest urgent and collective action involving local communities, governments and public and private finance. During COP26, the prime minister of Canada, Justin Trudeau, confirmed a CA$9 million commitment to ORRAA to support the Alliance's ongoing work in developing small island states and coastal countries. Furthermore, Google announced a US$2 million commitment to ORRAA, on behalf of the Gordon and Betty Moore Foundation, for its work with partners to develop an innovative risk assessment system.

New projects and funding

The SRC receives substantial funding for research into sustainable food production

The IKEA Foundation has granted SEK 30 million to the SRC to continue its research into fairer, more sustainable food systems. Gullspång Invest and its subsidiary Gullspång Re:food have contributed an additional SEK 5 million

PHOTO: T. MOSSHOLDER/UNSPLASH

THE SRC HAS BEEN GIVEN a major opportunity to conduct scientific research into fairer, more sustainable ways of producing and consuming food. In 2021, the IKEA Foundation announced that it will provide the SRC with SEK 30 million of funding over a five-year period, to enable the centre to develop scientific insights that could help to transform global food systems and strengthen the resilience of our planet.

In addition, Gullspång Invest and its subsidiary Gullspång Re:food funded the establishment of a professorship in sustainability science, where the person appointed to this role – SRC deputy science director Beatrice Crona – will focus on research into sustainable food systems. Crona will join SRC director Line Gordon, who was appointed as professor in sustainability science through the Curt Bergfors Foundation earlier in 2021. While both researchers will focus on sustainable food systems, Crona's work will look specifically at aquatic food.

The funding will help the SRC to establish a new research programme that will allow us to identify key actions, leverage points and actors in the transformation of food systems. The research we will carry out will show how gastronomy and culinary craft can inspire more diverse, resilient food systems, making them fairer for everyone involved.

"Over the next five years, we want to present insights on how food systems can improve. We know that food systems need to change and substantial efforts to make this happen are currently being made in policy, business and civil society. We would consider it a great success if our research could inform such actions," says Henrik Österblom, SRC science director.

The IKEA Foundation is funded by the INGKA Foundation, which owns the INGKA Group of companies. The foundation is independent from the retail side of business, focusing solely on creating a brighter future for those living on our planet through its charitable donations and grants.

Petra Hans, head of agricultural livelihoods at the IKEA Foundation, says: "The IKEA Foundation is delighted to partner with the Stockholm Resilience Centre to develop a research and action agenda that could help to uncover the complex dynamics between people, the planet and our food systems. This will deliver solutions to make people and the planet more resilient."

PHOTO: J. FLOBRANT/UNSPLASH

SRC to host SEK 40 million research programme on the transformation to a fossil-free future

The four-year programme, Fair Transformations to a Fossil Free Future, is jointly funded by Mistra and Formas

THE SRC WILL HOST A NEW research programme designed to promote transformations towards a fair, fossil-free future in Sweden.

Fair Transformations to a Fossil Free Future (FAIRTRANS), will develop economic and political frameworks for transformation, alongside several other key actors from the business sector, trade unions and other organisations in Sweden.

"We will explore the ways in which we can turn conflicts into cooperation and contribute towards a thriving and sustainable planet and fair future for all," says Thomas Hahn, programme co-director and associate professor at the SRC.

Specifically, FAIRTRANS will:

- Calculate comprehensive national roadmaps, considering a globally fair national carbon budget and trade-offs with planetary boundaries and the UN Sustainable Development Goals.
- Develop a digital platform and a voluntary market for incentivising carbon sequestration in agriculture.
- Produce scientific knowledge to ensure fair and inclusive digital climate action.
- Develop new digital tools to capture broad-ranging societal attitudes towards transformation in both Sweden and the EU.
- Explore scenarios for decoupling and research rebound effects and the ways in which these might influence rapid, fair, growth-independent climate transformation.

"We will engage with large organisations to develop strategies for action and learning, to ensure that their members are included and can benefit from the transformations," adds Stephan Barthel, joint programme co-director. Barthel is also an SRC professor but represents the University of Gävle in this consortium.

Other partners include the Global Challenge ("Global Utmaning") think tank and Uppsala University, as well as individual researchers from the KTH Royal Institute of Technology, IVL Swedish Environmental Research Institute and Lund University.

PHOTO: S POLLOCK/UNSPLASH

Vinnova funds SEK 47 million initiative to promote sustainable finance

The SRC and the Royal Swedish Academy of Sciences are among partners involved in the Sustainable Finance Lab – an effort to boost the focus on the social and environmental sustainability of both Swedish and international financial markets

THE SUSTAINABLE FINANCE LAB (SFL), is designed to become a leading international authority on sustainable financial markets. Among other things, it will focus on new ways of thinking about risks and opportunities, sustainability regulations and policies, as well as promoting transformation, technology and innovation. In addition to the SRC and the Royal Swedish Academy, founding partners include some of Sweden's most influential researchers in the fields of environmental science and business sustainability: the KTH Royal Institute of Technology, Luleå University, Gothenburg University, the Institute for Research at the Stockholm School of Economics and the Swedish Environmental Research Institute. The Global Resilience Partnership, which is hosted by the SRC, is also among the organisations involved in the new programme. SRC deputy science director Beatrice Crona will act as the vice director and will focus particularly on the scientific assessment of impact.

"The fact that the social and environmental impacts of financial decisions are currently overlooked by actors in the financial market constitutes a universal challenge. We are excited to be founding members of this new centre, being able to drive research forward to address these pressing issues," says Crona.

In 2021, researchers affiliated with the SFL produced and published research on a variety of topics. For instance, they examined the need to further incorporate earth system science into environmental, social and governance standards, in order to empower financial institutions to mitigate risk. Meanwhile, other work analysed the logic behind sustainable investment. Researchers also shared their expertise on topics such as developing sustainable value chains and combating gender bias in innovation and entrepreneurship, among many others.

Read more: sustainablefinancelab.se

Shaping the conversation around Stockholm+50

Several dialogues and a report on how economies and the financial sector can accelerate sustainability and biosphere stewardship will be presented ahead of the high-level UN meeting in June 2022

UNDER THE TITLE OF "Economy and Finance for a Just Future on a Thriving Planet", the SRC and the Beijer Institute of Ecological Economics have been commissioned by the Swedish Ministry of the Environment to organise a series of discussions between leading scientists, international organisations, investors and other change makers. The conclusions of these discussions and the points raised throughout will form the basis of a summary report on how economies and the financial sector should help to accelerate change aimed at reaching sustainability and biosphere stewardship goals. The report will be launched ahead of the Stockholm+50 – an international meeting organised by the United Nations General Assembly, to be held in Stockholm between 2-3 June, 2022. This meeting will commemorate the 50th anniversary of the first United Nations conference on the human environment – the 1972 Stockholm Conference – and contribute towards accelerating change leading to a fair future on a thriving planet. "Stockholm+50 could become a key international event that helps to accelerate action for sustainability. We are delighted to be able to help shape the conversation, both ahead of and during this important international meeting," said Victor Galaz, project lead and deputy director of the SRC.

Peter S. Jørgensen receives European Research Council starting grant

AN EXPERT ON EMERGING pests and pathogens in social-ecological systems, Peter S. Jørgensen has been awarded five years of funding worth EUR 1.5 million for a new project studying the emergence of problem species in agriculture and human health. The project will determine how these species can be managed to secure positive outcomes for both humans and the environment alike. Jørgensen's research will fill an important gap in sustainability science, helping to develop the much-needed capacity to navigate a future in which shocks from pests and pathogens are likely to become more common. As part of this work, he will assemble a large database of some 1,600 emerging pests and pathogens.

PHD STUDENT CHANDRAKANT SINGH and 19 other young professionals from Europe have been selected to form the first "Youth for Water and Climate" cohort – eight-month skills-building programme that aims to support young professionals in the acquisition of both the specific and transferable skills that they will need to work in the water and climate sector. The programme is backed by funding from Erasmus+ and is developed and supported by the International Secretariat for Water, Solidarity Water Europe, the CEWAS, the Global Water Partnership and GoodPlanet Belgium. The awardees met for the first workshop in Budapest from 6-12 February.

Singh was also awarded the International Institute for Applied System Analysis (IIASA) Young Scientists Summer Program Fellowship, which ran from June to August, 2021, during which time he took on a scientific project on a topic related to the IIASA research agenda under the personal mentorship of senior IIASA scientists. The project was financially backed by Formas.

LAURA PEREIRA is part of Food Trails – a four-year EU-funded Horizon 2020 project that will implement the Milan Urban Food Policy Pact's shared vision and commitment to developing measurable, long-term progress towards sustainable food systems in Europe. The EUR 12 million project will focus on taking action across 11 European cities: Bergamo (IT), Birmingham (UK), Bordeaux (FR), Copenhagen (DK), Funchal (PR), Grenoble (FR), Groningen (NL), Milan (IT), Thessaloniki (GR), Tirana (AL) and Warsaw (PL).

PETER SØGAARD JØRGENSEN and **SARAH CORNELL** represent the SRC in a project designed to identify policies that could keep humanity within the planet's safe operating range, while also meeting other SDGs. The project, known as "The Economics of Planetary Boundaries", will develop an online integrated assessment model (IAM) that will help to identify policies that could ease the pressure on the nine planetary boundaries. The project is coordinated by Daniel Spiro at Uppsala University and Johan Gars at the Beijer Institute. It is funded by Formas and has a total budget of approximately SEK 20 million, spread over the course of four years.

PER OLSSON and **PETER SØGAARD JØRGENSEN** received SEK 3 million for their project on mobilising transformations towards fair and sustainable futures, which will study the roles and capabilities of large-scale coalitions. The two-year project will look at how transnational corporations, investors and charitable or non-profit organisations have intensified efforts to form coalitions, in order to respond to global, social and environmental challenges. In this project, Olsson and Jørgensen will examine how large-scale coalitions from the food and finance sectors have the ability required to drive transformations towards fairer, more sustainable futures.

PER OLSSON received SEK 2.5 million in funding from Vinnova for the Rapid Transition Lab – a project designed to identify opportunities and pathways along which actors in the Swedish food system might engage in rapid transition, in response to the Covid-19 crisis. The project constitutes a collaboration with Dark Matter Lab and will be linked to other ongoing transdisciplinary food system projects that Vinnova or the SRC lead or are partners in. These include Mistra Food Futures, Nordic Food Policy Lab, Sustainable Finance Lab and NorthWestern Paths. The Rapid Transition Lab will complement these projects by focusing on responses to the Covid-19 pandemic in Swedish food systems, using these insights to build scenarios that, in turn, will be used to develop transformation strategies and identify opportunities for change.

ANGELA GUERRERO GONZALEZ, JUAN ROCHA and **ÖRJAN BODIN** received SEK 3 million in funding from Formas for their project "Uncovering the social dynamics of environmental change across scales: The local, regional and global human networks influencing adoption of sustainable practices in food production systems". The project seeks to understand the adoption of sustainable practices by farmers and traders to reduce deforestation from soy and beef production in the Brazilian Cerrado and Colombian Amazon. **XIMENA RUEDA** from the Universidad de Los Andes is also a partner in the project.

SUSA NIIRANEN leads a work package on ecosystem resilience in a Horizon 2020-funded project, BRIDGE-BS, which will study the effects of environmental change on ecosystem service production in the Black Sea. With unique habitats, abundant resources and a rich cultural heritage, the Black Sea is vital to its coastal communities and the broader population of over 160 million inhabiting its watershed. The project has 33 partners and is coordinated by the Middle East Technical University in Turkey. The total funding available for the project is EUR 9 million.

TILMAN HERTZ was awarded SEK 3 million in funding by Formas for his project "Process relational-adaptation to climate change" (PRAda). The project will look at the apparent mismatch between knowledge and the values, identities and emotions that matter to people. Together with **FRANÇOIS BOUSQUET** from CIRAD, Hertz will address this mismatch by making sense of the vulnerability identified in people's specific, lived experiences. They will draw on assemblage theory developed by French philosophers Deleuze and Guattari and test the theory by applying it to the landscape around Lac du Salagou in France, using methods such as relational interviewing, participatory photography, narratives and participatory theatre. Specifically, the project will explore whether assemblage theory can help bridge the research-action divide and whether it can be a useful approach for adaptation action at community level.

Several SRC researchers are involved in the Formas-funded project **"INEQUALITY AND THE BIOSPHERE: ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS IN AN INEQUAL WORLD"**. Both the reduction of social inequalities and the maintenance of healthy marine and terrestrial ecosystems play a pivotal role in achieving sustainable development. However, the interactions between these goals remain largely underexplored. This four-year project will identify synergies and trade-offs between reducing inequalities (SDG 10) and safeguarding the biosphere (SDGs 14 and 15). Led by Carl Folke, the project will provide new data and scientific knowledge on the interactions between key SDGs, in addition to facilitating the application of this knowledge for transformative action on a local, regional and global scale. The following SRC researchers are involved: Carl Folke (PI), Anne-Sophie Crépin, Patrick Henriksson, Caroline Schill, Emelie Lindqvist and Juan Carlos Rocha. The total funding available for the project, which is managed by the Beijer Institute of Ecological Economics, is estimated at approximately SEK 20 million.

MAGNUS NYSTRÖM was awarded SEK 3.3 million in funding by the Swedish Research Council for his project "Investigating the nexus between homogenization, connectivity and contagious risk in the Global production ecosystem". The three-year project will look deeper into how much of the earth's ecosystems have been transformed into simplified production ecosystems that focus on a few harvestable species. Specifically, Nyström, together with colleagues Cibele Queiroz, Peter Søgaard Jørgensen and Jan Bengtsson (Swedish Agricultural University), will look at homogenisation over the past 60 years in agriculture (crops and livestock), forestry and fishery (aquaculture). The research will help to identify countries that display a particularly strong degree of homogenisation ("hotspots") within the aforementioned sectors. **DIANA VERONICA LUNA GONZALEZ** is a new PhD student within the project.

ELIZABETH DRURY O'NEILL was awarded SEK 4 million in funding for the project "Patron of the Seas: Rethinking patron-client relationships in small-scale fisheries". The four-year project aims to make significant advancements in understanding patronage for adaptation and the ways in which it may support or hinder the sustainable development of small-scale fisheries. The project will be carried out with colleagues from the University of the Philippines Western Visayas and the University of Connecticut.

ALBERT NORSTRÖM is part of "Eastern Tropical Pacific reef fish on the move: biodiversity reorganisation and societal consequences" (EASMO) – a four-year project that will look into ways to ensure that both fisheries and the well-being of humans can adapt in the face of climate change. Similar studies have so far focused disproportionately on wealthy parts of the world. This project will investigate the impact of climate change on the distribution of reef fish throughout the Eastern Tropical Pacific Ocean. EASMO is a partnership between the SRC and eight institutions across seven countries. It is coordinated by the Leibniz Centre for Tropical Marine Research. The total funding available to the SRC for this project is SEK 3.3 million.

ARTUR BRANNY and **ERIK ANDERSSON** are part of a Vinnova-funded project on multifunctional climate adaptation, in collaboration with the city of Stockholm, Stockholmshem, Stockholm Vatten och Avfall, the region of Stockholm (traffic management), the Stockholm School Properties Company, Mälarenergi, the city of Västerås, Edge of Civil design and the Scandinavian Green Roof Institute. The project aims to create the conditions required to implement efficient and sustainable climate adaptations in urban environments. It will focus on reducing the risk of flooding and heat waves, adopting measures that will further generate social, economic and environmental benefits.

JOHAN ENQVIST was awarded SEK 4 million in Formas funding for the project "UNRULY natures: awareness, attitudes and action in environmental stewardship for a better relationship between two urban primates". This project studies environmental stewardship in the context of "unruly" natures, where restoring and protecting "natural" land is not a viable option. One extremely unruly mammal is the baboon – a highly intelligent, social, omnivorous, dextrous and agile primate. The world's largest urban baboon programme is in Cape Town, aiming to deter foraging in built-up areas where they have learnt to access man-made food. Together with colleagues from the University of Cape Town and Rhodes University, Enqvist will map residents' awareness of and attitudes towards baboons, exploring how conflicting perceptions shape actions in order to promote sustainable coexistence.

ERIK ANDERSSON and **MARIA TENGÖ** will jointly lead one of the research clusters within a consortium of research institutes and wetlands organisations that will produce a more comprehensive understanding of how wetland restoration may provide a means for climate change mitigation and adaptation, biodiversity conservation and improving people's well-being and sense of place. The project, ALFAwetlands, is a Horizon Europe-funded project, with a total budget of approximately EUR 8 million. Specifically, the project will use state of-the-art geospatial knowledge and find ways to integrate multiple targets by supporting more inclusive, community-based approaches to wetland restoration. Consortium partners include the Natural Resources Institute Finland (project coordinator), the Michael Succow Foundation for the Protection of Nature, the University of Tartu, the International Institute for Applied Systems Analysis and the European Wilderness Society.

ÖRJAN BODIN is part of three new projects looking at wetlands in Sweden that will study the loss of predatory fish in the Baltic Sea and the interaction between species across grasslands. The first project will investigate how to build consensus, engagement and a deeper, broader, systems-based understanding among relevant actors in the drainage basin of the Nyköping watercourses – which, in recent years, has suffered from both droughts and flooding. Bodin will be joined by SRC colleague **KIRILL ORACH**. The second project will assess the role of mysids in controlling the presence of predatory fish like pike and perch. The project is a partnership with the Swedish Agricultural University and the research institute, AquaBiota. Finally, Bodin forms part of an international consortium investigating species interactions across different trophic levels in restored and degraded calcareous grasslands across Spain, Germany and Estonia. The results of the project will contribute to several Aichi targets and inform the European Habitats Directive of the effects that restoration measures can have on species interactions and ecosystem functions, further demonstrating how they are linked to social networks.

Scientific achievements and awards

Line Gordon appointed Curt Bergfors Professor in sustainability science

In 2021, Stockholm University appointed SRC director Line Gordon as professor in sustainability science, with a focus on sustainable food systems

THE PROFESSORSHIP IS funded by the Curt Bergfors Foundation and will focus on exploring and further developing the knowledge required to work towards a sustainable food system. Gordon is thrilled to have been given this opportunity to continue work on how we can transform our eating habits, improving food production and reducing food waste. "I am deeply grateful for the generosity shown by the Curt Bergfors Foundation and look forward to using this opportunity to further strengthen our ability to drive ground-breaking research on the future of sustainable, resilient food systems," she says.

The new professorship will be closely aligned with increased research efforts on how to produce enough nutritious food for a growing world population, while also decreasing pressure on the planet's climate and ecosystems.

Beatrice Crona appointed new professor in sustainability science

Following in the footsteps of SRC director Line Gordon, in 2021, deputy science director Beatrice Crona was appointed professor in sustainability science, where she will focus on sustainable food systems

Gullspång Invest and its subsidiary Gullspång Re:food funded the professorship alongside the IKEA Foundation. The position is tied to the Department of Environmental Science at Stockholm University, although Crona will be on leave from the department to work at the SRC, as well as at the Royal Swedish Academy, where she leads the Global Economic Dynamics and the Biosphere programme.

"I am proud and delighted to have been offered this opportunity. It will strengthen the SRC's already exciting work on developing healthy, sustainable and equitable food systems," says Crona.

PHOTO: O. BORDE/OCEANOGRAPHIC INSTITUTE

SRC researchers once again appear among the world's most cited

Carl Folke, Johan Rockström, Oonsie Biggs, Per Olsson and Thomas Elmqvist were listed on the exclusive 2021 Clarivate Analytics overview of the world's most cited researchers. The list identifies scientists and social scientists who have demonstrated significant influence through publication of multiple highly cited papers over the last decade. SRC researchers have consistently been represented on the list over the past years. In fact, Carl Folke has been among the world's most highly cited since the list began in 2014 and remains one of the world's most cited researchers across any discipline.

Carl Folke awarded the Prince Albert I Grand Medal 2021

SRC founder and current chair of the board Carl Folke was awarded the 2021 Prince Albert I Grand Medal for his "service to the ocean". When explaining the decision to grant him the prestigious award, the Oceanographic Institute describes Folke as "a pioneer in integrative science for sustainability", fostering a new generation of sustainability science researchers, both in Sweden and on an international scale. Folke has been breaking new ground in the analysis and understanding of the dynamics between humans and nature and between economy and ecology ever since the mid-1980s, producing significant research in key areas ranging from the management and stewardship of ocean ecosystem services to global sustainability.

The medal is the most prestigious prize awarded by the Institute. Each year, it rewards prominent international names in the marine world, based on both scientific contribution and mediation. The prize takes the form of a gilded bronze medal bearing the embossed profile of Prince Albert I – a pioneer of modern oceanography and founder of the Institute.

ERIK ANDERSSON was awarded a full extraordinary professorship at the North-West University in South Africa. He will thus continue to help to develop a social-ecological systems framework for connecting different branches of urban environmental expertise, in addition to building resilience through urban green infrastructure.

ENABLE – a project investigating the contextual factors that influence the potential for green and blue infrastructure that contributes to quality of life in cities – won the BiodivERsA Prize for Excellence and Impact. The project, led by Erik Andersson, was praised for producing excellent science with concrete impacts for both policy and society. ENABLE ran between 2016 and 2019, with particular focus on five European cities: Stockholm, Halle, Oslo, Barcelona and Lodz.

PHOTO: O. BORDE/OCEANOGRAPHIC INSTITUTE

SRC researchers **PATRIK HENRIKSSON** and **JEAN-BAPTISTE JOUFFRAY** were awarded SEK 100,000 and SEK 85,000 respectively by the King Carl XVI Gustaf 50th Anniversary Fund for Science, Technology and Environment. They received the funding for their work on reducing the use of antibiotics in aquaculture, as well as for their research on how the financial sector might contribute towards a more sustainable seafood industry.

ZUZANA HARMÁČKOVÁ won the Otto Wichterle award presented by the Czech Academy of Sciences for early career scientists' contributions to the advancement of scientific knowledge.

Deputy director **VICTOR GALAZ** was appointed a new member of the Swedish International Development Cooperation Agency' s governing board. The board consists of seven members and is the highest management body of the agency.

PHOTO: AZOTE IMAGES

Photo: The Mahila Housing Trust – one of GRP's partners – is hosting a meeting with its grassroots women's leaders. Photo: Mahila Housing Trust

Policy, practice and impact: the Global Resilience Partnership

Although the extensive effort that went into COP26 in Glasgow was one of the highlights of 2021, there were several other noteworthy accomplishments as well

Read more about our engagements at **COP26** on page 66

The Global Resilience Partnership (GRP) – an SRC-hosted partnership/initiative for resilience and development – is currently working alongside a diverse group of organisations to bolster and share innovation, knowledge and policy aimed at creating a more resilient world. Below are some of the GRP's accomplishments from 2021:

The Seeds of Resilience for Peace and Stability project successfully collected and analysed a growing set of pilot resilience-building initiatives, referred to as seeds (including initiatives from Sudan, Mali and Bangladesh). These seeds are currently being cultivated in a database, where they will be analysed in collaboration with other partners to highlight the key features of resilience that these initiatives show. As co-host of the Ocean Risk and Resilience Action Alliance (ORRAA), the GRP worked with AXA XL, a subsidiary of global insurance and reinsurance company Axa, and Ocean Unite to launch six projects for building coastal resilience and reducing ocean risk in vulnerable countries. Through the Ocean Resilience Innovation Challenge (ORIC), four winning applicants were mentored for seven months and participated in a Leadership Academy. Furthermore, a new ORIC challenge was launched at COP26 with funding from DEFRA and the Swiss Re Foundation. The ORRAA also published a trio of reports by the GRP and SRC, highlighting the risks currently challenging our ocean economy (see page 51).

In a combined effort with the Global Environment Facility (GEF) and the UN Development Programme, the GRP launched a call to scale and support innovative finance mechanisms to build resilience in fragile, conflict-prone regions. Two organisations have been shortlisted for final endorsement by the GEF. The three-year support that these organisations will receive as a result will include low-value grants of US$200,000 to US$300,000, in addition to mentoring and skill-building support.

Promoting shared learning and skills development

The GRP co-founded the Resilience Knowledge Coalition alongside the International Centre for Climate Change and Development (ICCCAD) and the Climate Development Knowledge Network (CDKN). This partnership aims "to come up with the best resilience-oriented knowledge and practices designed to shape policies, plans and investments, with a view to delivering a resilient future" through three areas of activity that enable collaboration, connection and application.

In June 2021, the GRP launched the Global South Talent Pool – an internship programme for graduates and young experts in the Global South. The programme includes skill building, experience exchange and support for the graduates and young experts involved.

The GRP also supported the implementation of the Voices from the Frontline initiative led by ICCCAD and CDKN, which documents the challenges and solutions emerging from community-led responses to the Covid-19 crisis, in addition to documenting lessons for building resilience. The Voices for the Frontline digibook was launched at COP26. Similarly, in 2021, the GRP, ICCCAD and the Climate Justice Resilience Fund launched a catalytic grants pilot scheme to foster continuity between events and promote locally led adaptation. There are currently eight teams supported by these catalytic grants.

Finally, the GRP launched three South to South Resilience Academies – a series of collaborations that aim to amplify, leverage and coordinate leadership and expertise in small, developing island states and less developed countries. The first of these academies, the Climate Resilience Academy for LDCs, is coordinated by ICCCAD and is approaching its final phase of knowledge-product generation (policy briefs, academic papers, blogposts, opinion pieces, for example) and dissemination of the same. The second academy, the Southern African Resilience Academy led by the Centre for Sustainability Transitions, ran multiple workshops with its academy cohort on the theme "The future of food in Southern Africa". It had strong connections to the UN Food Systems Summit held in September 2021. The third academy will begin in 2022, coordinated by the University of the West Indies. It will focus on climate change and health across vulnerable demographics.

Read more: www.globalresiliencepartnership.org

Community exchanges as part of the Indigenous futures thinking workshop. Alongside other community members, female vegetable farmers in Kotan-Segbe, Sado-Akrankou, Benin reflect on the impact that Covid-19 had on their lives and agricultural activities. Photo: GRABE-Benin ONG

SwedBio

In 2021, SwedBio transitioned into a new Sida-funded four-year programme phase, signing agreements with several new collaborative partner organisations

Under the new programme, SwedBio will embark on two complementary impact pathways. The first of these pathways is the "dialogue for knowledge and policy" pathway, via which SwedBio will engage with its partners in policy processes at the UN Convention on Biological Diversity (CBD) to drive further biodiversity-related policy processes. Examples of such partners include the Committee on World Food Security, the Committee on Fisheries, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services and the UN Framework Convention on Climate Change.

Meanwhile, through the second collaborative partner implementation pathway, SwedBio will enable strategically selected partner organisations to implement locally driven, fair and sustainable solutions through financial and technical support. "The focus on regional or global networks that coordinate and collaborate with both national and local partners constitutes a strategic decision to assist in bridging the gap between local and global levels, and narrowing the gap in policy implementation," explains Henrik Brundin, director of SwedBio.

SwedBio is organised into five different categories or themes:

Climate Change and Ecosystems

Agroecology for Resilient Food Systems

Sustainable Small-Scale Fisheries, Governance and Livelihoods

Urban Nature for Resilient Cities

Biocultural Diversity, Values and Governance

In addition to the above, SwedBio signed agreements with 27 collaborative partner organisations. These strategic collaborations facilitate learning through relevant regional and global initiatives, encouraging those working in a niche field to share knowledge across a range of different disciplines and implementation in the field and within policy development.

Gender equality is another central perspective in all areas of SwedBio's work. This is particularly evident in its new collaboration with Women4Biodiversity, which works to build resilience and weave gender approaches into biodiversity governance.

The deep connections between nature and people will continue to form the foundations of equitable and sustainable development at the heart of SwedBio's work, with human rights serving as an entry point. In relation to this, the post-2020 Global Biodiversity Framework has been a prominent area of work throughout 2021. As one of the founding members of the Human Rights in Biodiversity Working Group, SwedBio worked with its partners to produce policy briefs and co-hosted several online events to advance, maintain and strengthen elements of a human rights-based approach in the final draft of the Framework. The recent adoption by the UN Human Rights Council of a resolution on the human right to a clean, healthy and sustainable environment creates the momentum to continue the efforts of SwedBio and its partners to bridge the gap between environmental action and the protection of human rights as mutually dependent goals.

▶ Read more: www.swed.bio

Resilience in focus at COP26

The conference in Glasgow saw much more attention and funding being driven into resilience and adaptation by governments, the private sector, and communities

THROUGH THE GLOBAL RESILIENCE PARTNERSHIP (GRP), the Global Commons Alliance (GCA) and the Exponential Roadmap Initiative (ERI), the SRC was involved in several initiatives aimed at promoting resilience, nature and exponential action, in an effort to make them more prominent on political agendas. COP26 centred around three major campaigns: Race to Zero, Race to Resilience and Nature Positive. The GRP was a lead partner in Race to Resilience, while the ERI was a lead partner in the Race to Zero campaign and the GCA hosted the Nature Positive campaign.

The GRP invested a significant amount of time and resources into the COP. Together with partners and with strong interest from the High-Level Champions, COP26 unit and the Cabinet Office, the GRP was able to lead the establishment of the first ever Resilience Hub – a physical and virtual space that was open for the full two weeks of COP26. With over 154 events hosted by 80 event partners and featuring 176 participating organisations, the hub brought together a community of state and non-state actors in an unprecedented collaboration. The hub welcomed almost 10,000 physical visitors and also had over 7,500 virtual participants joining

from all over the world. Danida, Sida, USAID and the Dutch Ministry of Foreign Affairs endorsed the eight principles for locally led adaptation at the Resilience Hub, where these principles were developed to help ensure that local communities are empowered to lead sustainable and effective adaptation to climate change at the local level.

The GRP also launched the Innovating for Climate Resilience Fund in partnership with the Global Innovation Fund and the Adaptation Research Alliance using seed funding from the UK's Foreign Commonwealth and Development Office. The fund will support people living on less than US$5 per day, helping them to build resilience and the ability to adapt to shocks and stresses. Furthermore, alongside the Climate and Development Knowledge Network and the International Centre for Climate Change and Development, the GRP launched the "Voices for the Frontline" e-book, which summarises the voices heard in frontline stories collected from around the world. It looks at what communities have done to retain hard-won development in the midst of the Covid-19 crisis and multiple other shocks.

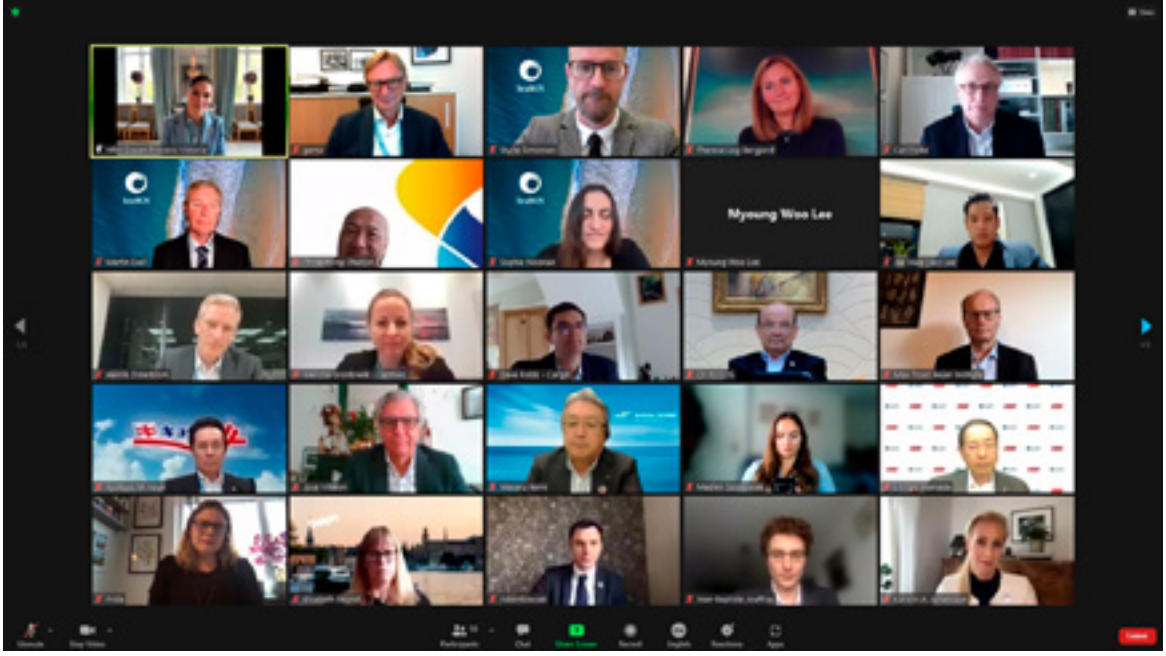
The GCA – a coalition of scientific and conservation organisations including the SRC as a partner – created the Nature Zone pavilion bringing together over 70 events from 63 different organisations. Featuring ministers, CEOs, scientific experts, climate activists and community representatives, the pavilion also hosted a number of press briefings, in addition to producing over 120 interviews that were broadcast worldwide via the Eurovision network. Owen Gaffney, director of international media and strategy at the SRC, launched a planetary dashboard called EarthHQ.org alongside colleagues. From wildfires and air pollution to coral reef bleaching, the Earth dashboard tracks all forces that put the natural systems supporting life on earth at risk, in almost real time, as they are happening. It presents a constant flow of reliable, accessible scientific data on what can and must be done to protect the global commons – namely, our vital resources and ecosystems.

SRC researcher Thorsten Blenckner was a co-author of the "Ten scientific insights", an annual horizon scan study supported by the World Climate Research Programme, the Earth League and Future Earth. It was presented to Patricia Espinosa, executive secretary of the United Nations Framework Convention on Climate Change

The following facts were were revealed:

- It is still possible to stabilise global warming at 1.5°C. However, immediate drastic global action is required to do so.
- Rapid growth in methane and nitrous oxide emissions has put us on a path that will reach a global temperature increase of 2.7°C.
- Climate change can exacerbate fires, forcing them to reach new heights and extremes. The impact of these megafires can be devastating.
- Climate tipping elements result in high-impact risks.
- Global climate action must be fair.
- It is crucial that we support changes in household behaviour. However, such changes are often overlooked when it comes to taking climate action.
- Political challenges limit the efficacy of carbon pricing.
- Nature-based solutions play a crucial role in meeting sustainability goals – but it is important to look at the fine print.
- It is possible to build the resilience of marine ecosystems through climate-adapted conservation and management techniques, in addition to global stewardship.
- The costs of climate change mitigation can be justified by the multiple immediate benefits to human health and nature.

Blenckner made a particularly noteworthy contribution to the ninth insight on marine ecosystems published in the report: "We could gain so much if we focused our efforts on marine ecosystems. They have the potential to deliver a triple benefit: carbon storage, biodiversity conservation and seafood supply."



Science-based approach paves way for seafood sector transformation

During the annual meeting of the science-industry collaboration Seafood Business for Ocean Stewardship (SeaBOS), CEOs of ten of the world's largest seafood companies reported on progress towards time-bound goals

Transdisciplinary science underpins the SeaBOS collaboration, and this has been evident in efforts to identify and eliminate IUU fishing and forced labour activities, which are endemic to the industry. The approach unites insights from organizational science, satellite tracking of vessel paths, knowledge of on-the-water practices and more to enable risk-based approaches that can extend across entire supply chains and operations around the world. This effort has shaped understanding of how science-industry collaboration can result in more detailed and impactful science and has resulted in a stepwise expansion of corporate strategies to address looming challenges such as the spread of antimicrobial resistance, and to address the diverse elements of a science-defined ocean stewardship agenda.

During the 2021 CEO dialogue, SeaBOS members agreed to:

- An Endangered Species Strategy (PDF) with an initial scope focused on elasmobranchs (sharks and rays) and seabirds, with time-bound goals for minimizing impacts and for progressively expanding the scope of the work to additional species groups in the coming years.
- An "Antibiotics Stewardship Roadmap" to not only phase out key antibiotics, but to reduce overall use across aquaculture production.
- Have GHG emission-reduction goals that align with the aims of the UN Framework Convention on Climate Change – namely, to limit global warming to well below 2°C and preferably, 1.5°C.
- Reinforce the SeaBOS "city to sea" strategy implemented in 2020 and report on plastic footprint assessments, as well as efforts to reduce or replace plastics in their operations by October 2022.

Members also emphasised the importance of collaboration across industry, science and policy to ensure that best practice in line with sustainability and ocean health translates into regulatory measures at a global level that support positive change. "It is stimulating and challenging to work with these companies and to see how SeaBOS is starting to generate real impacts. Despite the pandemic, we have been able to continue to develop our collaboration," says centre science director Henrik Österblom. He has been instrumental in the establishment of the initiative and its science-driven focus.

A science-driven initiative

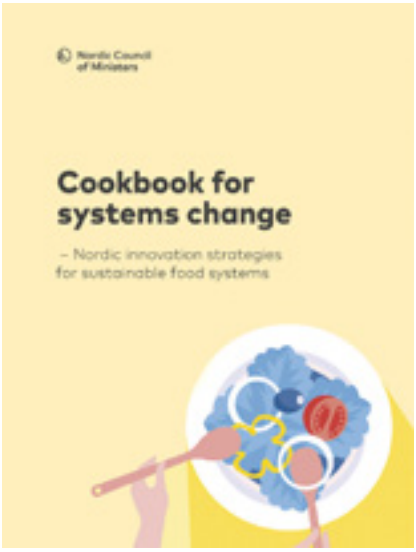
SeaBOS is unique because it is the first time ten of the world's largest seafood companies collaborate with science to implement a joint vision to develop more sustainable seafood production and improved ocean health. The collaboration has been coordinated by the SRC with scientific partners from the Beijer Institute of Ecological Economics at the Royal Swedish Academy of Science, the University of Lancaster, and the Stanford Center for Ocean Solutions. The scientific work is independently funded by the Walton Family Foundation, the Moore Foundation, and the Packard Foundation. SeaBOS companies represent over 10% of the world's seafood production and comprise over 600 subsidiary companies. The members include: Maruha Nichiro Corporation, Nissui, Thai Union, Mowi, Dongwon Industries, Cermaq, Cargill Aqua Nutrition, Nutreco/ Skretting, CP Foods, and Kyokuyo.

Read more: www.seabos.org

SRC contributes to Dasgupta review – a landmark report on the economic significance of nature

SRC CHAIR CARL FOLKE ACTED AS a reviewer for the Dasgupta review. This was the first time a national finance ministry has authorised a full assessment of the economic significance of nature. Led by Professor Sir Partha Dasgupta at the University of Cambridge, the report urges reform of the ways in which we measure economic success, if we wish to avoid catastrophic consequences for our economies and well-being. Grounded in a deep understanding of the relationship between ecosystem processes and human economic activity, the 600-page review is visibly guided by the SRC's work on planetary boundaries and biosphere stewardship. It is also strongly linked to the Natural Capital Project, which the SRC worked on in partnership with Stanford University. "The Dasgupta review clarifies that the economy and our societies are part of and embedded within the biosphere, and strongly dependent on the work of nature for our wellbeing, development and prosperity," says Folke.

A recipe for systemic change – Nordic innovation strategies for sustainable food systems



A PUBLICATION BY the Nordic Food Policy Lab, governed by the Nordic Council of Ministers, the SRC and EAT, suggests that strong public innovation networks constitute the most significant global contribution that Nordic countries can make towards achieving the SDGs set out in the Paris Agreement. The "cookbook" provides non-experts with templates for developing interventions, as well as containing guides on how to get started and presenting examples of cross-disciplinary projects. SRC researcher Amanda Wood was one of the contributors to the publication and has collaborated extensively with Nordic stakeholders on food system transformation. "This publication serves as a guide on how we can start tackling society's great challenges through smaller, orchestrated innovations across the food system," she explains.

Sida-commissioned report warns good business intentions might "bite back" in low- and middle-income countries

ACCORDING TO THE REPORT "Effects of transformations to climate-neutral societies on low-and middle-income countries", the ways in which we rebuild following the Covid-19 pandemic will define the equity and sustainability of our societies for decades to come. The report also addresses the need for actions that tackle complex and "impossible" problems, supporting continuous learning and evaluation across entire supply chains. For the private and public sectors and key actors in civil society, this includes new – and sometimes unfamiliar – ways of working together. The report was written by SRC researcher Per Olsson, together with SRC master's student Michael Bohlin and communications advisor and researcher Fredrik Moberg. Olsson explains that "In order to create impact at the required speed and magnitude, such efforts must be made carefully, using joint learning practices to explore potential pathways for transformation."

UNEP report calls for nature to be placed at the heart of decision-making processes

SRC RESEARCHER BELINDA REYERS co-authored a report published by the UN Environment Programme, which states that earth's interrelated environmental emergencies must be addressed together. Against the backdrop of a global failure to honour commitments to limit environmental damage, the report flags the links between environmental and development challenges, describing the role that all parts of society can play in the transformations required for a sustainable future. "The report highlights yet again the need for a fundamental rethink of how we view and value the environment in our lives, work and economies if we are to move out of this increasingly unequal and unsustainable model of development," says Reyers. The report suggests that governments should redirect some of the more than US$5 trillion currently spent in annual subsidies on fossil fuels, unsustainable agriculture and fishing, non-renewable energy, mining and transportation towards supporting low-carbon, "nature-friendly development" instead.

THOMAS HAHN was invited to review a chapter of a report from the UN Environment Programme World Conservation Monitoring Centre on human rights and biodiversity for the Convention on Biological Diversity's post-2020 global biodiversity framework. Hahn's work has been cited in their report "Driving ambition through national biodiversity commitments – Bringing experiences from other sectors to bear", which will be presented at the upcoming CBD-UN Convention on Biological Diversity COP15.

Based on a skills programme led by SRC researcher **MY SELLBERG** and Louise Hård af Segerstad at Albaeco, in 2021, the city of Södertälje incorporated the concept of resilience into its new food supply strategy. Södertälje is one of the first cities in Sweden to develop a food strategy that includes all aspects of work on food systems, including spatial planning, waste management, public meals, business development and crisis preparedness. The strategy serves to increase preparedness for crisis situations, in addition to strengthening sustainable development. My Sellberg continues to work with the city of Södertälje through a mobility grant designed to foster collaboration between academia and practice, funded by Formas.

Media impact

This was a big year for the centre's media and public engagement with many high points including a Netflix documentary about planetary boundaries and a global survey on public attitudes to transformation

The centre achieved over 1000 mentions in the media internationally in 2021. The biggest media moment landed in June when Netflix released Breaking Boundaries: the Science of our Planet a major documentary about the centre's planetary boundaries research.

The documentary, narrated by Sir David Attenborough, was widely acclaimed. Christiana Figueres, the former head of the United Nations Framework Convention on Climate Change said it is "probably the most important documentary that has ever been filmed."

Actor Leonardo DiCaprio said, "It is an incredible journey into the science of our living planet. This may be the best and most comprehensive narrative yet." SRC's Johan Rockström and Owen Gaffney were associate producers of the film and published a book alongside it. Rockström also joined Netflix's first sustainability advisory group. In autumn Gaffney also provided scientific advice for the BBC's major series EarthShot.

Centre researchers caught the eye of the New York Times, early in the year. The pandemic created the conditions for a "natural" experiment on a small Baltic island famous for its birdlife. Would the sudden absence of human visitors to Stora Karlsö affect bird populations? Centre researcher Olof Olsson and Jonas Hentati-Sundberg (formerly at SRC) found that the number of white-tailed eagles rose sevenfold once humans disappeared from the scene, wreaking havoc among the bird populations.

Linked to the UN's Food Systems summit, the centre partnered with Now This, one of the world's largest online media platforms. Now This published several video interviews with researchers from the centre including director Line Gordon and food systems researcher Malin Jonell.

In August, centre researchers published a global survey on attitudes to the global commons and transformations. Among the 20 richest countries on Earth (G20), 73% of people believe Earth is approaching tipping points (interpreted as regional-scale severe events that are abrupt or irreversible, for example relating to the Amazon rainforest or Greenland ice sheet). The survey also revealed that three in four people (74%) support economic systems change to protect people and planet, rather than a singular focus on profits. The report gained strong international media coverage and the findings were presented to a G20 preparatory meeting.

In Sweden, the centre is regularly asked to comment on rolling news relating to sustainability. The centre's deputy director Victor Galaz writes regular opinion articles for one of Sweden's leading newspapers Svenska Dagbladet focusing on topics as diverse as climate threats, governance, the sustainability of cryptocurrencies and the risks of artificial intelligence.

Education and training

Despite the challenging times we are living in, interest in our programmes and training continues to grow. We see increased interest in the field of sustainability science from a diverse group of people, ranging from university students to senior executives

SRC's executive programme's class of 2021. Top row, from the left: Joachim Alpen (SEB), Annica Bresky (Stora Enso), Carina Åkerström (Handelsbanken), Nina Lindvall (Interflora), Anne-Marie Gardshol (Postnord), Paul Schrotti (Lindéngruppen), Henric Andersson (Husqvarna). Bottom row, from the left: Niclas Mårtensson (Stena Line Group), Hans Beyer (SEB), Katarina Staaf (AP6), Helena Hedblom (Epiroc), Catharina Belfrage Sahlstrand (Handelsbanken), Cecilia Wikström (Beijerstiftelsen), Markus Granlund (Semcon), Kerstin Lindell (Bona). Not present: Christian Levin (Scania). Photo: C. Helander/Azote

The Covid-19 pandemic has taken its toll on our education programmes, forcing teaching to go online for the first half of 2021 and limiting fieldwork opportunities for thesis students. This has affected the ability of new students to get to know each other and the teaching staff, and reduced the breadth of learning opportunities usually available through our courses, particularly in terms of group work. It also severely reduced contact with SRC staff and events. Teachers and students have worked incredibly hard to create online activities that could help to reduce the impacts of not meeting in person.

Amid the challenges, there is good news. We have received increased interest in our programmes and courses, which means that we have bolstered our own team responsible for running and supporting the various activities we have to offer. In order to support this growing sector at the SRC, a Teachers' Board has been established. The board will give the SRC recommendations on how education at the SRC could continue to develop, while also supporting teachers and students in their ongoing work. New tasks and roles were added to clarify and further emphasise the role of education in our ongoing work: Lisen Schultz and Michele-Lee Moore joined the Education team as director of education and director of transdisciplinary education, respectively.

Graduate level

Our master's programme "Social-ecological Resilience for Sustainable Development" ran as normally as possible in 2021. While teaching during the first half of 2021 was largely conducted online, the start of the new academic year saw the return of students and teaching staff to the SRC. This allowed us to welcome our new students in person and we are thrilled to have welcomed another group of diverse, bright and motivated students to the SRC.

PhD level

Cancelled field trips, conferences, workshops and courses meant our doctoral students were also forced to adapt their

research. Amid the challenges, when larger physical meetings were allowed again, we organised a special two-day gathering for the students to recharge – both socially and intellectually. This gave them the chance to reconnect or even meet for the first time, get an overview of each other's work and share thoughts, ideas and skills. The event also provided an opportunity to meet with senior researchers and theme leaders to discuss and reflect on how to trust your ideas and put them into practice, among other things. Frances Westley and Elena Bennett – both members of SRC's International Science Advisory Council – kindly offered students some reflections and words of advice based on their own PhD journeys. Amid the many course cancellations, we are pleased to announce that the mandatory PhD course, Quantitative Methods for studying Social-Ecological Systems, continued to run successfully under the leadership of Maja Schlüter and colleagues.

University courses and programmes

Throughout the course of 2021, our deputy director of transdisciplinarity, Lisen Schultz, led the launch of a new course entitled "Sustainability Science I". This course is part of a new bachelor's programme called "Business, Ethics and Sustainability". The programme constitutes a collaboration with the Department of Business Economics and the Department of Philosophy at Stockholm University. Schultz's course was designed and delivered with module-leaders Tim Daw, Örjan Bodin, Robert Blasiak and Tiina Häyhää and received excellent reviews from the first class. Next year, class numbers will increase from 16 to 115 students. This will pave the way for the launch of "Sustainability Science II" – the second course for bachelor students – in 2022.

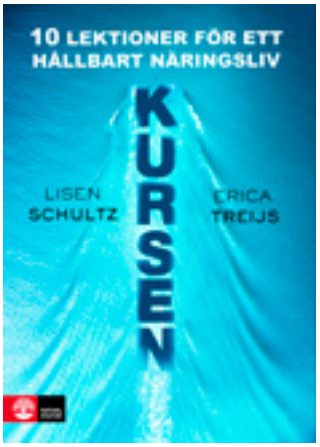
Our director of studies, Miriam Huitric, joined forces with Stockholm University colleagues Alasdair Skelton and Christina Fredengren to launch a new massive open online course (MOOC) designed to give students in-depth insight into our current situation and what we can do to combat the climate crisis. The MOOC, entitled "Taking on the Climate Crisis with Social Change", provided students with information on how to drive the social change that is fundamentally required for an effective response to climate change.

Our long-running course "Världens Eko" went online again in 2021, which made it possible to take on a larger cohort than usual. The quality of the course was not compromised despite these changes, thanks to the work and leadership of David Fagerlind, supported this year by Anna Steorn, who is currently working on her master's thesis. While all involved look forward to returning to campus in 2022, a great deal has been learned about online teaching and these insights will prove useful when developing future courses.

The three short courses developed in response to the Swedish government's call for courses to support those whose employment was disrupted by the pandemic received further funding so that they could be offered again in 2021. Once again, the courses received excellent reviews from participants and will continue to run in 2022. We are pleased to be able to contribute to our students' further development and professional re-direction and see this as an excellent opportunity to bridge the gap between research and real-world application in society. Thank you to Megan Meacham, Kara Pellowe, Erik Andersson, Louise Hård af Segerstad and My Sellberg for your leadership of and engagement in these courses.

Commissioned education and training

Our annual "Executive programme in resilience thinking" retreat was held twice during the autumn in 2021. The first meeting took place in September with the 2020 cohort whose training had been postponed due to the pandemic. This group included CEOs from H&M, Volvo, Investor, SEB, Axel Johnson, Kinnevik, Apoteket, Nobia and Martin & Servera. The second retreat took place in December and included CEOs from Stora Enso, PostNord, Scania, Stena Line Group, AP6, Interflora and Handelsbanken. The programme also received substantial media attention this year, with longer reports and interviews appearing in papers such as the SVT, Dagens industri and SvD.



A NEW BOOK WRITTEN by the executive programme director Lisen Schultz and climate journalist Erica Treijs provides insights into what some of Sweden's most influential CEOs and board members learned from the programme. The training is intended for anyone who wants to gain strategic insights into the latest research in sustainability science and learn how to identify opportunities for their companies to thrive by contributing to a prosperous planet. A hugely successful programme, several Swedish companies have since developed their own internal training initiatives and set climate targets. "We are seeing more and more signs that companies that were previously regarded as the root of the problem are now becoming part of the solution," says Schultz.

Robert Bosch Stiftung Postdoc Academy for Transformational Leadership

Participants were also introduced to Stockholm through a treasure hunt, which ended with a torrential downpour of rain! Photo: L. Pereira

Between 5-7 October 2021, the SRC hosted the third cohort of the Postdoc Academy for Transformational Leadership – specifically, a seminar on transformative capacity and agency for people and the planet. This seminar introduced postdocs to resilience thinking and the social-ecological system (SES) perspective. Particular emphasis was placed on the importance of fundamental changes in the interactions between humans and nature if we are to undertake the transformations necessary to achieve sustainable development. The agenda for the three days ranged from lectures and discussions from leading SRC researchers such as Garry Peterson, Line Gordon and Michele-Lee Moore to interactive sessions on facilitation led by Lisen Schultz and Jamila Haider. There was also a World Café discussion with Beatrice Crona, Guillermo Ortuno Crespo, Frida Bengtsson and Jean-Baptiste Jouffray. The Postdoc Academy for Transformational Leadership is an initiative of Robert Bosch Stiftung in collaboration with four academic centres: the Humbold University of Berlin, Leuphana University of Lüneburg, the SRC and the Dutch Research Institute for Transitions in Rotterdam. It provides intensive high-end training with four seminars being delivered over two years, designed to broaden the research skills of postdocs and promote their qualifications towards transdisciplinary leadership.

Catalysing change through public sector innovation

This programme, funded by the Swedish Institute and delivered in partnership with ADAPT South Africa, South Africa Food Lab and the Western Cape Economic Development Agency, strengthens skills within both the public and civil service sector across the 16 Southern African Development Community states for systems innovation and transformation. In 2021, 28 participants formed the core group attending online modules; however, each participant was also able to include up to four partners or team members in individualised online coaching sessions between modules. This ensured that the impact of the course reached a broader group and that participants incorporated what they had learned into their organisational teams.

Participants covered a diverse range of topics, including navigating complex system dynamics, working within and across SDGs and considering the ethics and histories of transformative change-making on the continent. All of these topics were set within the context of Africa and informed by African knowledge systems and cutting-edge sustainability science. The next cohort selected completed module 1 at the end of 2021 and will continue into 2022.

Read more: www.catalysingchange.org

Introducing the PhD class of 2021

Diana Veronica Luna-Gonzalez

Homogenisation of biomass production (crops, livestock, fisheries and forestry) and the increasing connectivity of the trade network may influence the resilience of the global production ecosystem in terms of response to diverse shocks (such as climate variability and extremes, pandemics and political and market instabilities). Using different production and trade datasets, satellite imagery and network analysis methods, Luna-Gonzalez aims to simulate the interdependence and tele-coupling of biomass production and exchange in the global production ecosystem. This exercise may provide new insights into vulnerabilities in the global production ecosystem and their impact on human and planetary health. Luna-Gonzalez has a formal education in nutritional science, food systems and complexity science. She also has experience in bio-economic modelling, geographic information systems and rural development. Before joining the SRC, she worked at the International Institute for Applied System Analysis modelling food-water through agroecological suitability analysis, hydrological data and optimisation models. She has also collaborated with research collectives on the topic of agroecology and food sovereignty.

Moa Ohlsson

Ohlsson's PhD project explores the complex interactions between actors, biodiversity and ecosystem functionality of terrestrial landscapes when exposed to climate change. While many studies have contributed to our understanding of how climate change will influence biodiversity, little is still known about how biodiversity and the diversity of actors interact and influence climate. Ohlsson's research aims to understand the role of diversity for climate resilience and to explore the emergent climate-diversity feedbacks within systems where social and ecological dimensions are tightly coupled. Her project contributes to empirical resilience assessments by exploring response diversity – a critical property of resilience that is understudied in intertwined social-ecological systems in the Anthropocene. Her research spans multiple spatial scales, from a local case study in Sweden to analysis on a European scale. Ohlsson holds a BSc in Environmental Science from Stockholm University and an MSc in Sustainable Development from the SRC. Her master's thesis explored the drought resilience of Swedish farms. She has previously worked as a research assistant at the SRC and the Royal Swedish Academy of Sciences.

Mary Katherine Scheuermann

Scheuermann's PhD project investigates how influential entities can help to facilitate transformative change in Nordic food systems. She is most interested in identifying system-level opportunities to improve population health that also support a sustainable biosphere and contribute to work that could inform public policy. She is currently mapping the legumes supply chain. Legumes are a significantly under-consumed food in Sweden, despite offering multiple health benefits. This mapping will enable her to identify key actor roles and leverage points to activate change. Through identifying existing actors and gaps where actors are required, this research project will build a path towards increased legume consumption in Sweden, also serving to further strengthen collaboration among existing organisations for guiding food system transformation in the Nordic region. Scheuermann holds graduate degrees in public health and social work from Washington University in St. Louis (US) and a BA in English from LaSalle University (US). She recently worked as a public health analyst in public administration, leading interdisciplinary teams to improve the quality and accountability of private sector services.

Daniel Itzamna Avila Ortega

Ortega's project aims to calculate the extent and net contribution of biosphere integrity provided by biodiversity to the whole economy. Given the rapid extinction of different species around the world as a result of anthropogenic activity, it is becoming increasingly necessary to determine the extent to which life on earth is compromised in terms of acting as a supporting system for ecosystem services that sustain most of the world's economic activity. Further, the project will advance knowledge on how cascading effects, tipping points and the other planetary boundaries affect or are affected by biodiversity decline, with the introduction of the Comprehensive Biodiversity Ecosystem Service relationship serving as a means to quantify the total impact of biodiversity on crop yields, carbon sequestration (climate mitigation) and crop yield stability (climate adaptation). Work is currently being carried out to assess the different biodiversity metrics and how they relate to the planetary boundaries framework and the top criteria selected by ecologists. Ortega holds a joint MSc in Industrial Ecology from Leiden University and TU Delft in the Netherlands. He also has a Postgraduate Certificate in Forest Carbon Science, Policy and Management from Michigan State University. Ortega co-founded the Mexican Center of Industrial Ecology in 2015 and Comuna Energia in 2021, in an effort to contribute to rapid decarbonisation in Mexico. He has also contributed to various worldwide assessments on circular economy, in addition to developing deep-decarbonisation scenarios and pathways for large corporations.

Patricia Villarrubia-Gómez

Villarrubia-Gómez' research focuses on the global challenge of plastic pollution from a social and ecological standpoint. Her PhD is a collaborative project between the SRC and Gothenburg University in Sweden, in partnership with the 5 Gyres Institute in the US. She adopts a resilience, system-thinking and complex-systems approach to investigate and drive sustainable change. She addresses the challenges of plastic pollution by focusing on international policy and social movements. She is especially passionate about equity, environmental and social justice and understanding how social groups translate scientific knowledge into effective responses and institutional change. She graduated with a bachelor's in Environmental Science from the University of Granada in Spain and holds a master's in Social-Ecological Resilience for Sustainable Development, which she completed at the SRC. For her master's thesis, she explored the feasibility of including marine plastic pollution as a novel entity within the planetary boundaries framework.

Master theses 2021

Social-ecological Resilience for Sustainable Development programme

Campbell, Laura-Bethia:
Women in Conservation: Narratives of Care, Place and Practice in the Lowveld Region, South Africa

Eggert, Hannes:
Navigating the politics of transformative change towards sustainability: A case study of Extinction Rebellion's climate crisisframing

Fredström, Linna:
REIMAGINING CLIMATE FUTURES – Using critical futures studies to explore scenarios for Ljungby municipality in Sweden

Holm, Minda:
Indigenous rights in changing forest landscapes in South-East Asia - How narratives in science and practice frame indigenous environmental justice and stewardship

Huber, Stephan:
"Walking encyclopedias of studies" for sustainability transformations? The role of information and discourse in the case of the German coal phase-out

Jacobson, Märta:
Food for transformation –food for thought: The development of transformative capacity of niche initiatives in the Greater Cape Town area and the Stockholm city-region

Lanyon Garrido, Carla Alejandra:
Decolonial understanding of the landscape through knowledge co-production. The case study of "Sirges Sámi village, Sábme"

Lindström, Kristen:
Climate security risks and resilience: Challenges and approaches for resilience building in fragile contexts

Najjar, Nadja:
A Green and Just Recovery from COVID-19 crisis as opportunity for urban socio-ecological transformation?

Nikkanen, Hanna:
A wealth of soil: Social-ecological traps, economy and agency on Finnish farms

Norrby, Jenny:
Navigating the transformation to sustainable public meals: The case of Södertälje municipality, Sweden

Sanchez Garcia, Paula Andrea:
The Political Economy of Deforestation in the Northwestern Colombian Amazon

Vrettos, Christos:
Instigating a post-growth transformation of the energy sector: the case of Greek energy communities

Vårhammar, Annelie:
Coming back to our senses: Exploring the potential of guided forest bathing as an intervention for human-nature connection

Åberg, Frida:
Impact of social-ecological changes on resilience in the Senegalese Sahel

Licentiate theses 2021

Palm, Celinda:
Re:ally re:think – seeking to understand the matters of sustainable fashion

Wassénius, Emmy:
Risk and resilience: An integrated approach for navigating a complex world

Doctoral theses 2021

Ammar, Yosr:
Novelty in the Anthropocene: Exploring past and future novelty in marine social-ecological systems

Collste, David:
The Indivisible 2030 Agenda: Systems analysis for sustainability

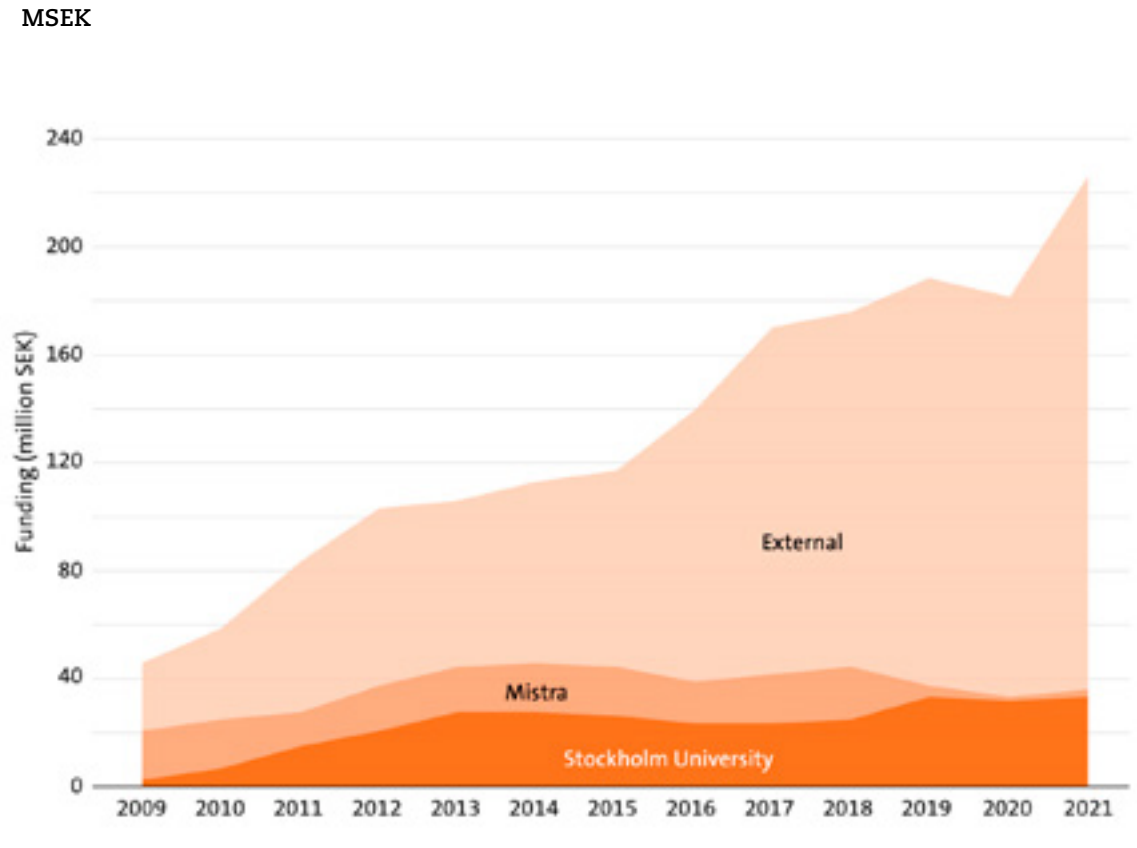
Hedlund, Johanna:
The environment knows no borders: Investigating the collective challenge of governing policy issue interdependencies

Hinton, Jennifer B.:
Relationship-to-Profit: A Theory of Business, Markets, and Profit for Social Ecological Economics

Malmborg, Katja:
How on Earth? Operationalizing the Ecosystem Service Concept for Sustainability

Appendix:

Finances



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- Gullspång Re:food II Invest AB
- IKEA Foundation
- Johansson Family Foundation
- Legal, Financial and Administrative Services Agency Sweden
- L'Oréal
- Marianne and Marcus Wallenberg Foundation
- Nippon Foundation
- Nordic Council of Ministers
- Oak Foundation
- Ocean Risk and Resilience Action Alliance
- Robert Bosch Stiftung
- Royal Swedish Academy of Sciences
- Swedish International Development Cooperation Agency
- Stockholm Regional Council
- Swedish Civil Contingencies Agency
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- Swedish Research Council
- The Curt Bergfors Foundation
- The Kamprad Family Foundation for Entrepreneurship, Research and Charity
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Beatrice Crona: *deputy science director*
Lisen Schultz: *director of education*
Carl Folke: *chair of the board*
Henrik Österblom: *science director*
Karl Hagström: *head of administration*

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Astrid Auraldsson: *coordinator, director*
Beatriz Berbegal: f*inancial controller*
Antonia Bondén: f*inancial assistant (consultant)*
Bengt Hall: *IT support*
Gunnar Jacobsson: *IT support*
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Education
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Michele-Lee Moore: *director of transdisciplinary education*
Miriam Huitric: *Master's programme director and director of studies*
Magnus Nyström: *Associated researchers director of studies (PhD students)*
Cornelia Ludwig: *education coordinator*
Emilia Arnerius: *project assistant (Catalysing Change)*

Research staff
Ana Paula Aguiar: *researcher*
Erik Andersson: *researcher*
Oonsie Reinette Biggs: r*esearcher*
Robert Blasiak: *researcher*
Thorsten Blenckner: *associate pro fessor*
Örjan Bodin: *senior lecturer*
Eleanore Campbell: *data analyst*
Sarah Cornell: *associate professor*
Beatrice Crona: *professor*
Timothy Daw: *associate professor*
Stefan Daume: *researcher*
Andrea de Cervo: *project assistant*
Lisa Deutsch: *senior lecturer*
Timothy DuBois: *researcher*
Andrea Downing: *researcher*
Thomas Elmqvist: *professor*
Johan Enqvist: *researcher*
Ingo Fetzer: *researcher*
Marnie Graham: *researcher*
Angela Guerrero: *research assistant*
Thomas Hahn: *associate professor*
Jamila Haider: *researcher*
Zuzana Harmáčková: *postdoc*
Patrik Henriksson: *researcher*
Tilman Hertz: *researcher*
Tiina Häyhä: *researcher*
Claudia Ituarte Lima: *researcher*
Amanda Jimenéz Aceituno: *researcher*
Malin Jonell: *researcher*
Karolin Johansson: *strategic advisor*
Lars-Göran Johansson: *researcher*
Krisztina Jónás: *research assistant*
Steven Lade: *researcher*
Emilie Lindkvist: *researcher*
Jan Kuiper: *researcher*
Maria Mancilla García: *researcher*
Katja Malmborg: *research assistant*
Vanessa Masterson: *researcher*
Romina Martin: *researcher*
Michele-Lee Moore: *researcher*
Susa Niiranen: *researcher*
Jon Norberg: *professor*
Albert Norström: *researcher*
Magnus Nyström: *senior lecturer*
Per Olsson: *associate professor*
Olof Olsson: *senior advisor*
Kirill Orach: *researcher*
Juan Carlos Rocha: *researcher*
Garry Peterson: *professor*
Laura Pereira: researcher
Cibele Queiroz: researcher
Sonja Radosavljevic: researcher
Belinda Reyers: *researcher*
Johan Rockström: *professor*
Udita Sanga: *researcher*
Maja Schlüter: *professor*
My Sellberg: r*esearcher*
Hanna Sinare: *researcher*
Uno Svedin: *senior researcher*
Peter Søgaard Jørgensen: *researcher*
Maria Tengö: *researcher*
Lan Wang-Erlandsson: *researcher*
Nanda Wijermans: *researcher*
Geoffrey Wells: *researcher*
Simon West: *researcher*
Grace Wong: *researcher*
Amanda Wood: *researcher*

Associated researchers
Stephan Barthel
Anne-Sophie Crépin
Deborah Goffner
Robert Costanza
Johan Colding
Therese Lindahl
Åsa Gren
Max Troell

Postdoc researchers
Shyam Basnet Kumar
Artur Branny
David Collste
Elizabeth Drury O'Neill
Jean-Baptiste Jouffray
Megan Meacham
Guillermo Ortuño Crespo
Kara Pellowe
Rebecca Short

Members of the Resilience Research School
Yosr Ammar, *PhD student (SRC staff)*
Supervisor: Thorsten Blenckner

Daniel Itzamna Avila Ortega, *PhD student (SRC staff)*
Supervisor: Peter Sögaard Jörgensen

Frida Bengtsson, *PhD student (SRC staff)*
Supervisor: Henrik Österblom

Anne Charlotte Bunge, *PhD student (SRC staff)*
Supervisor: Amanda Wood

Linus Dagerskog, *PhD student (SEI staff)*
Supervisor: Johan Rockström

Alice Dauriach, *PhD student (Beijer staff)*
Supervisor: Bea Crona

David Fagerlind, *PhD student (SRC staff)*
Supervisor: Tiina Häyhä

Blanca González García-Mon, *PhD student (SRC staff)*
Supervisor: Maja Schlüter

Ami Golland, *PhD student (Beijer staff)*
Supervisor: Victor Galaz

Johanna Hedlund, *PhD student (SRC staff)*
Supervisor: Örjan Bodin

Niak Koh, *PhD student (SRC staff)*
Supervisor: Thomas Hahn

Sofia Käll, *PhD student (Beijer staff)*
Supervisor: Beatrice Crona

Diana Luna Gonzales, *PhD student (SRC staff)*
Supervisor: Magnus Nyström

Katja Malmborg, *PhD student (SRC staff)*
Supervisor: Lisen Schultz

Kruger Maganiso Nyasulu, *PhD student (SRC staff)*
Supervisor: Ingo Fetzer

Moa Olsson, *PhD student (SRC staff)*
Supervisor: Cibele Queiros

Daniel Ospina, *PhD student (SRC staff)*
Supervisor: Garry Peterson

Celinda Palm, *PhD student (SRC staff)*
Supervisor: Sarah Cornell

Agnes Pranindita, *PhD student (SRC staff)*
Supervisor: Lan Wang

Kajsa Resare Sahlin, *PhD student (SRC staff)*
Supervisor: Line Gordon

Maria Schewenius, *PhD student (HIG staff)*
Supervisor: Fredrik Moberg

Mary Scheuermann, *PhD student (SRC staff)*
Supervisor: Amanda Wood

Chandrakant Singh, *PhD student (SRC staff)*
Supervisor: Ingo Fetzer

Arne Tobian, *PhD student (SRC staff)*
Supervisor: Sarah Cornell

Patricia Villarrubia, *PhD student (SRC staff)*
Supervisor: Sarah Cornell

Emmy Wassénius, *PhD student (Beijer staff)*
Supervisor: Bea Crona

New staff 2021
Rakel Alvstad: *research assistant*
Daniel Itzamna Avila Ortega: *PhD student*
Anne Charlotte Bunge: *PhD student*
Bwalya Chibwe: *research assistant*
Sofia Cortes Calderson: *research assistant*
Klara Eitrem Holmgren: *research assistant*
Carla Lanyon: *research assistant*
Diana Luna Gonzales: *PhD student*
Sonja Markovich: *project assistant*
Jenny Norrby: *research assistant*
Moa Olsson: *PhD student*
Chiara Pia: *research assistant*
Lucy Rist: *research assistant*
Paula Sánchez García: *research assistant*
Mary Scheuermann: *PhD student*
Naomi Terry: *research assistant*
Celina Thaller de Zárate: *financial administrator*
Patricia Villarrubia: *PhD student*

Visiting researchers
Nico Wunderling, *Potsdamm Institut, Germany*
Christian Riis-Hansen, *Crean Capital, Denmark*
Enrica Garau, *University of Gerona, Catalonia, Spain*
Maud Rio, *Univ. Grenoble Alpes/G-SCOP Laboratory, France*
Chen Haibin, *Northwest A&F University, China*
Michelle Tigchelaar, *Stanford University, Center for Ocean Solutions, USA*
Alfredo Santiago García de Vinuesa Gutiérrez, *Centro oceanográfico de Cádiz, Spain*

SRC publications 2021

Journal articles

Addo, K.A., Adeyemo, O., Adewumi, I.J., Blasiak, R., Juniper, S.K., Owens, D., Owens, T. & Sumaila, U.R. 2021. Informed selfishness – Practical reflections on building a sustainable ocean economy. *Marine Policy* 133, 104735.

Ahlstrom, H., Hileman, J., Wang-Erlandsson, L., Garcia, M.M., Moore, M.-L., Jonas, K., Pranindita, A., Kuiper, J.J., Fetzer, I., Jaramillo, F. & Svedin, U. 2021. An Earth system law perspective on governing social-hydrological systems in the Anthropocene. *Earth System Governance* 10, 100120.

Åkesson, A., Curtsdotter, A., Eklöf, A., Ebenman, B., Norberg, J. & Barabás, G. 2021. The importance of species interactions in eco-evolutionary community dynamics under climate change. *Nature Communications* 12(1), 4759.

Aminjafari, S., Brown, I., Chalov, S., Simard, M., Lane, C.R., Jarsjo, J., Darvishi, M. & Jaramillo, F. 2021. Drivers and extent of surface water occurrence in the Selenga River Delta, Russia. *Journal of Hydrology-regional Studies* 38, 100945.

Ammar, Y., Niiranen, S., Otto, S.A., Mollmann, C., Finsinger, W. & Blenckner, T. 2021. The rise of novelty in marine ecosystems: The Baltic Sea case. *Global Change Biology* 27(7), 1485–1499.

An, L., Grimm, V., Sullivan, A., Turner, B.L., II, Malleson, N., Heppenstall, A., Vincenot, C., Robinson, D., Ye, X., Liu, J., Lindkvist, E. & Tang, W. 2021. Challenges, tasks, and opportunities in modeling agent-based complex systems. *Ecological Modelling* 457, 109685.

Andersen, A.D., Frenken, K., Galaz, V., Kern, F., Klerkx, L., Mouthaan, M., Piscicelli, L., Schor, J.B. & Vaskelainen, T. 2021. On digitalization and sustainability transitions. *Environmental Innovation and Societal Transitions* 41(SI), 96–98.

Andersen, I., Ishii, N., Brooks, T., Cummis, C., Fonseca, G., Hillers, A., Macfarlane, N., Nakicenovic, N., Moss, K., Rockström, J., Steer, A., Waughray, D. & Zimm, C. 2021. Defining "science-based targets". *National Science Review* 8(7), nwaa186.

Andersson, D., Bratsberg, S., Ringsmuth, A.K. & de Wijn, A.S. 2021. Dynamics of collective action to conserve a large common-pool resource. *Scientific Reports* 11(1), 9208.

Andersson, E. 2021. Knowledge for a different urban future: a reflection. *Bothalia* 51(1, SI), 1–5.

Andersson, E. 2021. Reconnecting cities to the biosphere: Stewardship of green infrastructure and urban ecosystem services: where did it come from and what happened next? *Ambio* 50 (9, SI), 1636–1638.

Andersson, E., Borgstrom, S., Haase, D., Langemeyer, J., Mascarenhas, A., McPhearson, T., Wolff, M., Laszkiewicz, E., Kronenberg, J., Barton, D.N. & Herreros-Cantis, P. 2021. A context-sensitive systems approach for understanding and enabling ecosystem service realization in cities. *Ecology and Society* 26(2), 35.

Andersson, E., Borgström, S., Haase, D., Langemeyer, J., Wolff, M. & McPhearson, T. 2021. Urban resilience thinking in practice: ensuring flows of benefit from green and blue infrastructure. *Ecology and Society* 26(4), 39.

Archer, E., Dziba, L.E., Mulongoy, K.J., Maoela, M.A., Walters, M., Biggs, R., Salem, M.-C.C., DeClerck, F., Diaw, M.C., Dunham, A.E., Failler, P., Gordon, C., Harhash, K.A., Kasisi, R., Kizito, F., Nyingi, W.D., Oguge, N., Osman-Elasha, B., Stringer, L.C., de Morais, L.T., Assogbadjo, A., Egoh, B.N., Halmy, M.W., Heubach, K., Mensah, A., Pereira, L. & Sitas, N. 2021. Biodiversity and ecosystem services on the African continent – What is changing, and what are our options? *Environmental Development* 37, 100558.

Armstrong McKay, D.I., Cornell, S.E., Richardson, K. & Rockström, J. 2021. Resolving ecological feedbacks on the ocean carbon sink in Earth system models. *Earth System Dynamics* 12(3), 797–818.

Avery, R.S., Greenwood, S.L., Schenk, F., Morén, B.M., Armstrong McKay, D.I., Brunnberg, L. & Wohlfarth, B. 2021. A 725-year integrated offshore terrestrial varve chronology for southeastern Sweden suggests rapid ice retreat 15 ka BP. *Boreas* 50(2), 477–496.

Ayllon, D., Railsback, S.F., Gallagher, C., Augusiak, J., Baveco, H., Berger, U., Charles, S., Martin, R., Focks, A., Galic, N., Liu, C., Loon, E.E. van, Nabe-Nielsen, J., Piou, C., Polhill, J.G., Preuss, T.G., Radchuk, V., Schmolke, A., Stadnicka-Michalak, J., Thorbek, P. & Grimm, V. 2021. Keeping modelling notebooks with TRACE: Good for you and good for environmental research and management support. *Environmental Modelling & Software* 136, 104932.

Baho, D.L., Rizzuto, S., Nizzetto, L., Hessen, D.O., Norberg, J., Skjelbred, B., Jones, K.C., Zhang, H. & Leu, E. 2021. Ecological memory of historical contamination influences the response of phytoplankton communities. *Ecosystems* 24(7), 1591–1607.

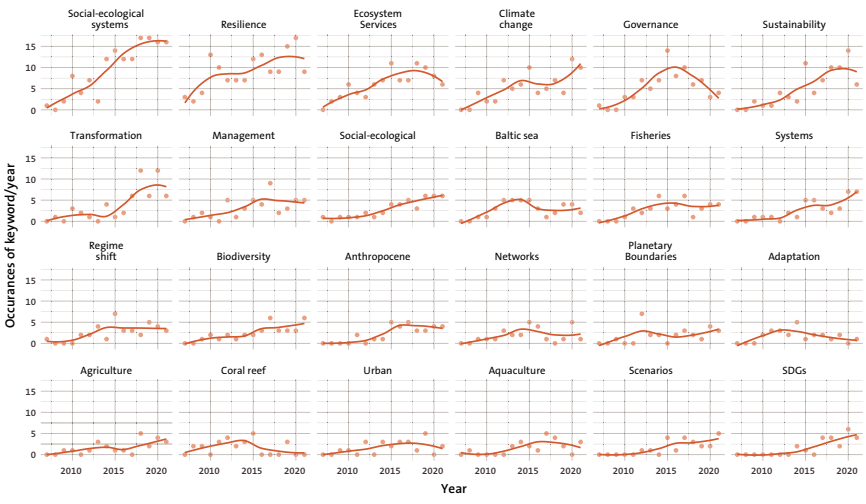
Bak-Coleman, J.B., Alfano, M., Barfuss, W., Bergstrom, C.T., Centeno, M.A., Couzin, I.D., Donges, J.F., Galesic, M., Gersick, A.S., Jacquet, J., Kao, A.B., Moran, R.E., Romanczuk, P., Rubenstein, D., I., Tombak, K.J., Van Bavel, J.J. & Weber, E.U. 2021. Stewardship of global collective behavior. *Proceedings of the National Academy of Sciences of the United States of America* 118(27), e2025764118.

Balvanera, P., Paz, H., Arreola-Villa, F., Bhaskar, R., Bongers, F., Cortes, S., del Val, E., García-Frapolli, E., Gavito, M.E., Gonzalez-Esquivel, C.E., Martínez-Ramos, M., Martínez-Yrizar, A., Mora, F., Naime, J., Pascual-Ramirez, F., Perez-Cardenas, N., Ugartechea-Salmeron, O.A., Siddique, I., Suazo-Ortuno, I. & Swinton, S.M. 2021. Social ecological dynamics of tropical secondary forests. *Forest Ecology and Management* 496, 119369.

Barraclough, A.D., Schultz, L. & Maren, I.E. 2021. Voices of young biosphere stewards on the strengths, weaknesses, and ways forward for 74 UNESCO Biosphere Reserves across 83 countries. *Global Environmental Change* 68, 102273.

Basnet, S.K. 2021. Analysing and measuring the economic effects of zero-tillage technology: The case of the rice-wheat cropping system of the Indo-Gangetic Plains. *International Journal of Agricultural Resources, Governance and Ecology* 17(1), 38–62.

Basnet, S.K., Jansson, T. & Heckelei, T. 2021. A Bayesian econometrics and risk programming approach for analysing the impact of decoupled payments in the European Union*. *Australian Journal of Agricultural and Resource Economics* 65(3), 729–759.



Keyword trends 2017-2021(source: Web of Science)

Bates, A.E. et al. 2021. Global COVID-19 lockdown highlights humans as both threats and custodians of the environment. *Biological Conservation* 263(SI), 109175.

Baudena, M., Tuinenburg, O.A., Ferdinand, P.A. & Staal, A. 2021. Effects of land-use change in the Amazon on precipitation are likely underestimated. *Global Change Biology* 27(21), 5580–5587.

Belgrano, A., Novaglio, C., Svedang, H., Villasante, S., Melian, C.J., Blenckner, T., Bergstrom, U., Bryhn, A., Bergstrom, L., Bartolino, V., Skold, M., Tomczak, M., Wikstrom, S.A., Hansen, A.S., Linke, S., Emmerson, R., Morf, A. & Tonnesson, K. 2021. Mapping and Evaluating Marine Protected Areas and Ecosystem Services: A Transdisciplinary Delphi Forecasting Process Framework. *Frontiers in Ecology and Evolution* 9, 652492.

Benestan, L., Fietz, K., Loiseau, N., Guerin, P.E., Trofimenko, E., Rühs, S., Schmidt, C., Rath, W., Biastoch, A., Pérez-Ruzafa, A., Baixauli, P., Forcada, A., Arcas, E., Lenfant, P., Mallol, S., Goñi, R., Velez, L., Höppner, M., Kininmonth, S., Mouillot, D., Puebla, O. & Manel, S. 2021. Restricted dispersal in a sea of gene flow. *Proceedings of the Royal Society B: Biological Sciences* 288(1951), 20210458.

Bengtsson, J., Angelstam, P., Elmqvist, T., Emanuelsson, U., Folke, C., Ihse, M., Moberg, F. & Nystrom, M. 2021. Reserves, resilience and dynamic landscapes 20 years later. *Ambio* 50(5, SI), 962–966.

Bennett, E.M., Biggs, R., Peterson, G.D. & Gordon, L.J. 2021. Patchwork Earth: navigating pathways to just, thriving, and sustainable futures. *One Earth* 4(2), 172–176.

Björkvik, E., Boonstra, W.J. & Telemo, V. 2021. Going on and off the map: Lessons from Swedish fisher knowledge about spawning areas in the Baltic Sea. *Ocean and Coastal Management* 211, 105762.

Blandon, A. & Ishihara, H. 2021. Seafood certification schemes in Japan: Examples of challenges and opportunities from three Marine Stewardship Council (MSC) applicants. *Marine Policy* 123, 104279.

Blasiak, R., Leander, E., Jouffray, J.-B. & Virdin, J. 2021. Corporations and plastic pollution: Trends in reporting. *Sustainable Futures* 3, 100061.

Blasiak, R., Dauriach, A., Jouffray, J.-B., Folke, C., Österblom, H., Bebbington, J., Bengtsson, F., Causevic, A., Geerts, B., Grönbrekk, W., Henriksson, P.J.G., Kall, S., Leadbitter, D., McBain, D., Crespo, G.O., Packer, H., Sakaguchi, I., Schultz, L., Selig, E.R., Troell, M., Villalon, J., Wabnitz, C.C.C., Wassenius, E., Watson, R.A., Yagi, N. & Crona, B. 2021. Evolving Perspectives of Stewardship in the Seafood Industry. *Frontiers in Marine Science* 8, 671837.

Blenckner, T., Moellmann, C., Lowndes, J.S., Griffiths, J.R., Campbell, E., De Cervo, A., Belgrano, A., Boström, C., Fleming, V., Frazier, M., Neuenfeldt, S., Niiranen, S., Nilsson, A., Ojaveer, H., Olsson, J., Palmloev, C.S., Quaas, M., Rickels, W., Sobek, A., Viitasalo, M., Wikstroem, S.A. & Halpern, B.S. 2021. The Baltic Health Index (BHI): Assessing the social-ecological status of the Baltic Sea. *People and Nature* 3(2), 359–375.

Blenckner, T., Ammar, Y., Mueller-Karulis, B., Niiranen, S., Arneborg, L. & Li, Q. 2021. The Risk for novel and disappearing environmental conditions in the Baltic Sea. *Frontiers in Marine Science* 8, 745722.

Bodin, O. 2021. Has sustainability science turned left? *Sustainability Science* 16(6), 2151–2155.

Borgström, S., Andersson, E. & Björklund, T. 2021. Retaining multi-functionality in a rapidly changing urban landscape: Insights from a participatory, resilience thinking process in Stockholm, Sweden. *Ecology and Society* 26(4) 17.

Brandt, S.A., Lim, N.J., Colding, J. & Barthel, S. 2021. Mapping flood risk uncertainty zones in support of urban resilience planning. *Urban Planning* 6(3), 258–271.

Brockhaus, M., Di Gregorio, M., Djoudi, H., Moeliono, M., Pham, T.T. & Wong, G.Y. 2021. The forest frontier in the Global South: Climate change policies and the promise of development and equity. *Ambio* 50(12, SI), 2238–2255.

Broek, K.L., Klein, S.A., Luomba, J. & Fischer, H. 2021. Introducing M-TOOL: A standardised and inclusive mental model mapping tool. *System Dynamics Review* 37(4), 353–362.

Brondizio, E.S., Andersson, K., de Castro, F., Futemma, C., Salk, C., Tengö, M., Londres, M., Tourne, D.C., Gonzalez, T.S., Molina-Garzón, A., Russo Lopes, G. & Siani, S.M. 2021. Making place-based sustainability initiatives visible in the Brazilian Amazon. *Current Opinion in Environmental Sustainability* 49, 66–78.

Brovkin, V., Brook, E., Williams, J.W., Bathiany, S., Lenton, T.M., Barton, M., DeConto, R.M., Donges, J.F., Ganopolski, A., McManus, J., Praetorius, S., de Vernal, A., Abe-Ouchi, A., Cheng, H., Claussen, M., Crucifix, M., Gallopin, G., Iglesias, V., Kaufman, D.S., Kleinen, T., Lambert, F., van der Leeuw, S., Liddy, H., Loutre, M.-F., McGee, D., Rehfeld, K., Rhodes, R., Seddon, A.W.R., Trauth, M.H., Vanderveken, L. & Yu, Z. 2021. Past abrupt changes, tipping points and cascading impacts in the Earth system. *Nature Geoscience* 14(8), 550–558.

Brugere, C., Troell, M. & Eriksson, H. 2021. More than fish: Policy coherence and benefit sharing as necessary conditions for equitable aquaculture development. *Marine Policy* 123, 104271.

Bundy, A., Renaud, P.E., Coll, M., Koenigstein, S., Niiranen, S., Pennino, M.G., Tam, J.C. & Travers-Trolet, M. 2021. Editorial: Managing for the future: Challenges and approaches for disentangling the relative roles of environmental change and fishing in marine ecosystems. *Frontiers in Marine Science* 8, 753459.

Bunge, A.C., Wickramasinghe, K., Renzella, J., Clark, M., Rayner, M., Rippin, H., Halloran, A., Roberts, N. & Breda, J. 2021. Sustainable food profiling models to inform the development of food labels that account for nutrition and the environment: a systematic review. *Lancet Planetary Health* 5(11), E818–E826.

Care, O., Bernstein, M.J., Chapman, M., Diaz Reviriego, I., Dressler, G., Felípe-Lucía, M.R., Friis, C., Graham, S., Haenke, H., Haider, L.J., Hernandez-Morcillo, M., Hoffmann, H., Kernecker, M., Nicol, P., Pineiro, C., Pitt, H., Schill, C., Seufert, V., Shu, K., Valencia, V. & Zaehringer, J.G. 2021. Creating leadership collectives for sustainability transformations. *Sustainability Science* 16(2, SI), 703–708.

Ceausu, S., Apaza-Quevedo, A., Schmid, M., Martin-Lopez, B., Cortes-Avizanda, A., Maes, J., Brotons, L., Queiroz, C. & Pereira, H.M. 2021. Ecosystem service mapping needs to capture more effectively the biodiversity important for service supply. *Ecosystem Services* 48, 101259.

Chambers, J.M., Wyborn, C., Ryan, M.E., Reid, R.S., Riechers, M., Serban, A., Bennett, N.J., Cvitanovic, C., Fernandez-Gimenez, M.E., Galvin, K.A., Goldstein, B.E., Klenk, N.L., Tengo, M., Brennan, R., Cockburn, J.J., Hill, R., Munera, C., Nel, J.L., Österblom, H., Bednarek, A.T., Bennett, E.M., Brandeis, A., Charli-Joseph, L., Chatterton, P., Curran, K., Dumrongrojwatthana, P., Duran, A.P., Fada, S.J., Gerber, J.-D., Green, J.M.H., Guerrero, A.M., Haller, T., Horcea-Milcu, A.-I., Leimona, B., Montana, J., Rondeau, R., Spierenburg, M., Steyaert, P., Zaehringer, J.G., Gruby, R., Hutton, J. & Pickering, T. 2021. Six modes of co-production for sustainability. *Nature Sustainability* 4(11), 983–996.

Chang, H., Pallathadka, A., Sauer, J., Grimm, N.B., Zimmerman, R., Cheng, C., Iwaniec, D.M., Kim, Y., Lloyd, R., McPhearson, T., Rosenzweig, B., Troxler, T., Welty, C., Brenner, R. & Herreros-Cantis, P. 2021. Assessment of urban flood vulnerability using the social-ecological-technological systems framework in six US cities. *Sustainable Cities and Society* 68, 102786.

Chow, C.F.Y., Wassenius, E., Dornelas, M. & Hoey, A.S. 2021. Species differences drive spatial scaling of foraging patterns in herbivorous reef fishes. *Oikos* 130(12), 2217–2230.

Chu, O.J., Donges, J.F., Robertson, G.B. & Pop-Eleches, G. 2021. The microdynamics of spatial polarization: A model and an application to survey data from Ukraine. *Proceedings of the National Academy of Sciences of the United States of America* 118(50) e2104194118.

Claudet, J., Amon, D.J. & Blasiak, R. 2021. Transformational opportunities for an equitable ocean commons. *Proceedings of the National Academy of Sciences of the United States of America* 118(42) e2117033118.

Coelho, A., Aguiar, A., Toledo, P., Araujo, R., do Canto, O., Folhes, R. & Adami, M. 2021. Rural landscapes and agrarian spaces under soybean expansion dynamics: A case study of the Santarem region, Brazilian Amazonia. *Regional Environmental Change* 21(4) 100.

Collste, D., Cornell, S.E., Randers, J., Rockström, J. & Stoknes, P.E. 2021. Human well-being in the Anthropocene: Limits to growth. *Global Sustainability* 4 e30, 1–9.

Constantino, S.M., Schlüter, M., Weber, E.U. & Wijermans, N. 2021. Cognition and behavior in context: A framework and theories to explain natural resource use decisions in social-ecological systems. *Sustainability Science* 16(5), 1651–1671.

Cortes-Calderón, S., Mora, F., Arreola-Villa, F. & Balvanera, P. 2021. Ecosystem services supply and interactions along secondary tropical dry forests succession. *Forest Ecology and Management* 482, 118858.

Cosens, B., Ruhl, J.B., Soininen, N., Gunderson, L., Belinskij, A., Blenckner, T., Camacho, A.E., Chaffin, B.C., Craig, R.K., Doremus, H., Glicksman, R., Heiskanen, A.-S., Larson, R. & Simila, J. 2021. Governing complexity: Integrating science, governance, and law to manage accelerating in the commons. *Proceedings of the National Academy of Sciences of the United States of America* 118(36) e2102798118.

Cottrell, R.S., Metian, M., Froehlich, H.E., Blanchard, J.L., Sand Jacobsen, N., McIntyre, P.B., Nash, K.L., Williams, D.R., Bouwman, L., Gephart, J.A., Kuempel, C.D., Moran, D.D., Troell, M. & Halpern, B.S. 2021. Time to rethink trophic levels in aquaculture policy. *Reviews in Aquaculture* 13(3), 1583–1593.

Crona, B., Wassenius, E., Lillepold, K., Watson, R.A., Selig, E.R., Hicks, C., Össterblom, H., Folke, C., Jouffray, J.-B. & Blasiak, R. 2021. Sharing the seas: A review and analysis of ocean sector interactions. *Environmental Research Letters* 16(6) 063005.

Crona, B., Folke, C. & Galaz, V. 2021. The Anthropocene reality of financial risk. *One Earth* 4(5), 618–628.

Crona, B., Eriksson, K., Lerpold, L., Malmstrom, M., Sanctuary, M. & Sandberg, J. 2021. Transforming toward sustainability through financial markets: Four challenges and how to turn them into opportunities Comment. *One Earth* 4(5), 599–601.

Cropper, S., Solander, K., Newman, B.D., Tuinenburg, O.A., Staal, A., Theeuwen, J.J.E. & Xu, C. 2021. Comparing deuterium excess to large-scale precipitation recycling models in the tropics. *npj Climate and Atmospheric Science* 4(1), 60.

Dadd, L., Norman-Dadd, C., Graham, M., Suchet-Pearson, S., Glass, P., Scott, R., Narwal, H. & Lemire, J. 2021. Buran Nalgarra: An Indigenous-led model for walking with good spirit and learning together on Darug Ngurra. *Alternative-an International Journal of Indigenous Peoples* 17(3), 357–367.

De Faria, B.L., Staal, A., Silva, C.A., Martin, P.A., Panday, P.K. & Dantas, V.L. 2021. Climate change and deforestation increase the vulnerability of Amazonian forests to post-fire grass invasion. *Global Ecology and Biogeography* 30(12), 2368–2381.

De Garine-Wichatitsky, M., Binot, A., Ward, J., Caron, A., Perrotton, A., Ross, H., Quoc, H.T., Valls-Fox, H., Gordon, I.J., Promburom, P., Ancog, R., Kock, R.A., Morand, S., Chevalier, V., Allen, W., Phimpraphai, W., Duboz, R. & Echaubard, P. 2021. "Health in" and "Health of" Social-Ecological Systems: A Practical Framework for the Management of Healthy and Resilient Agricultural and Natural Ecosystems. *Frontiers in Public Health* 8, 616328.

De Luca, C., Langemeyer, J., Vaňo, S., Baró, F. & Andersson, E. 2021. Adaptive resilience of and through urban ecosystem services: a transdisciplinary approach to sustainability in Barcelona. *Ecology and Society* 26(4), 38.

Dellmuth, L.M., Petersson, M.T., Dunn, D.C., Boustany, A. & Halpin, P.N. 2021. Dataset on non-state actor participation in regional fisheries management organizations. *Data in Brief* 34, 106682.

Donges, J.F., Lochner, J.H., Kitzmann, N.H., Heitzig, J., Lehmann, S., Wiedermann, M. & Vollmer, J. 2021. Dose-response functions and surrogate models for exploring social contagion in the Copenhagen Networks Study. *European Physical Journal-special Topics* 230(16–17, SI), 3311–3334.

Donges, J.F., Lucht, W., Cornell, S.E., Heitzig, J., Barfuss, W., Lade, S.J. & Schlüter, M. 2021. Taxonomies for structuring models for World-Earth systems analysis of the Anthropocene: subsystems, their interactions and social-ecological feedback loops. *Earth System Dynamics* 12(4), 1115–1137.

Downey, A.E., Groffman, P.M., Mejia, G.A., Cook, E.M., Sritrairat, S., Karty, R., Palmer, M., I. & McPhearson, T. 2021. Soil carbon sequestration in urban afforestation sites in New York City. *Urban Forestry & Urban Greening* 65, 127342.

Downing, A.S., Wong, G.Y., Dyer, M., Aguiar, A.P., Selomane, O. & Aceituno, A.J. 2021. When the whole is less than the sum of all parts: Tracking global-level impacts of national sustainability initiatives. *Global Environmental Change* 69, 102306.

Duvat, V.K.E., Magnan, A.K., Perry, C.T., Spencer, T., Bell, J.D., Wabnitz, C., Webb, A.P., White, I., McInnes, K.L., Gattuso, J.-P., Graham, N.A.J., Nunn, P.D. & Le Cozannet, G. 2021. Risks to future atoll habitability from climate-driven environmental changes. *Wiley Interdisciplinary Reviews-climate Change* 12(3) e700.

Eddy, T.D., Bernhardt, J.R., Blanchard, J.L., Cheung, W.W.L., Colleter, M., du Pontavice, H., Fulton, E.A., Gascuel, D., Kearney, K.A., Petrik, C.M., Roy, T., Rykaczewski, R.R., Selden, R., Stock, C.A., Wabnitz, C.C.C. & Watson, R.A. 2021. Energy flow through marine ecosystems: Confronting transfer efficiency. *Trends in Ecology & Evolution* 36(1), 76–86.

Edwards, M.G., Alcaraz, J.M. & Cornell, S.E. 2021. Management education and Earth System science: Transformation as if Planetary Boundaries mattered. *Business & Society* 60(1, SI), 26–56.

Egerer, M., Haase, D., McPhearson, T., Frantzeskaki, N., Andersson, E., Nagendra, H. & Ossola, A. 2021. Urban change as an untapped opportunity for climate adaptation. npj Urban Sustainability 1(1), 22.

Elmqvist, T., Andersson, E., McPhearson, T., Bai, X., Bettencourt, L., Brondizio, E., Colding, J., Daily, G., Folke, C., Grimm, N., Haase, D., Ospina, D., Parnell, S., Polasky, S., Seto, K.C. & Van Der Leeuw, S. 2021. Urbanization in and for the Anthropocene. *npj Urban Sustainability* 1(1), 6.

Elmqvist, T., Acuto, M., Anderson, P., Larsen, L., McPhearson, T. & Zhang, X. 2021. Urbanization in the Anthropocene: Inaugural npj Urban Sustainability. *npj Urban Sustainability* 1(1), 7.

Elsler, L.G., Frawley, T.H., Britten, G.L., Crowder, L.B., DuBois, T.C., Radosavljevic, S., Gilly, W.F., Crepin, A.-S. & Schlüter, M. 2021. Social relationship dynamics mediate climate impacts on income inequality: Evidence from the Mexican Humboldt squid fishery. *Regional Environmental Change* 21(2) 35.

Enfors-Kautsky, E., Jarnberg, L., Quinlan, A. & Ryan, P. 2021. Wayfinder: A new generation of resilience practice. *Ecology and Society* 26(2) 39.

Engström, R.E., Collste, D., Cornell, S.E., Johnson, F.X., Carlsen, H., Jaramillo, F., Finnveden, G., Destouni, G., Howells, M., Weitz, N., Palm, V. & Fuso-Nerini, F. 2021. Succeeding at home and abroad: accounting for the international spillovers of cities' SDG actions. *npj Urban Sustainability* 1(1), 18.

Eriksson, H., Blythe, J.L., Österblom, H. & Olsson, P. 2021. Beyond social-ecological traps: fostering transformations towards sustainability. *Ecology and Society* 26(1) 13.

Falkenmark, M. & Wang-Erlandsson, L. 2021. A water-function-based framework for understanding and governing water resilience in the Anthropocene. *One Earth* 4(2), 213–225.

Farmery, A.K., Allison, E.H., Andrew, N.L., Troell, M., Voyer, M., Campbell, B., Eriksson, H., Fabinyi, M., Song, A.M. & Steenbergen, D. 2021. Blind spots in visions of a "blue economy" could undermine the ocean's contribution to eliminating hunger and malnutrition. *One Earth* 4(1), 28–38.

Folke, C., Gren, A., Larsson, J. & Costanza, R. 2021. Cities and the Biosphere. *Ambio* 50(9, SI), 1634–1635.

Folke, C., Haider, L.J., Lade, S.J., Norström, A. & Rocha, J. 2021. Resilience and social- ecological systems: A handful of frontiers. *Global Environmental Change* 71, 102400.

Folke, C., Polasky, S., Rockström, J., Galaz, V., Westley, F., Lamont, M., Scheffer, M., Österblom, H., Carpenter, S.R., Chapin, F.S., III, Seto, K.C., Weber, E.U., Crona, B., I., Daily, G.C., Dasgupta, P., Gaffney, O., Gordon, L.J., Hoff, H., Levin, S.A., Lubchenco, J., Steffen, W. & Walker, B.H. 2021. Our future in the Anthropocene biosphere. Ambio 50(4, SI), 834–869.

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L. & Walker, B. 2021. Resilience: Now more than ever. *Ambio* 50(10, SI), 1774–1777.

Ford, A.K., Visser, P.M., van Herk, M.J., Jongepier, E. & Bonito, V. 2021. First insights into the impacts of benthic cyanobacterial mats on fish herbivory functions on a nearshore coral reef. *Scientific Reports* 11(1) 7147.

Frantzeskaki, N., McPhearson, T. & Kabisch, N. 2021. Urban sustainability science: Prospects for innovations through a system's perspective, relational and transformations' approaches. *Ambio* 50(9, SI), 1650–1658.

Gadgil, M., Berkes, F. & Folke, C. 2021. Indigenous knowledge: From local to global. *Ambio* 50(5), 967–969.

Galaz, V., Centeno, M.A., Callahan, P.W., Causevic, A., Patterson, T., Brass, I., Baum, S., Farber, D., Fischer, J., Garcia, D., McPhearson, T., Jimenez, D., King, B., Larcey, P. & Levy, K. 2021. Artificial intelligence, systemic risks, and sustainability. *Technology in Society* 67, 101741.

Gandica, Y., Lansing, J.S., Chung, N.N., Thurner, S. & Chew, L.Y. 2021. Bali's ancient rice terraces: A Hamiltonian approach. *Physical Review Letters* 127(16), 168301.

Gaupp, F., Ruggeri Laderchi, C., Lotze-Campen, H., DeClerck, F., Bodirsky, B.L., Lowder, S., Popp, A., Kanbur, R., Edenhofer, O., Nugent, R., Fanzo, J., Dietz, S., Nordhagen, S. & Fan, S. 2021. Food system development pathways for healthy, nature-positive and inclusive food systems. *Nature Food* 2(12), 928–934.

Gephart, J.A., Henriksson, P.J.G., Parker, R.W.R., Shepon, A., Gorospe, K.D., Bergman, K., Eshel, G., Golden, C.D., Halpern, B.S., Hornborg, S., Jonell, M., Metian, M., Mifflin, K., Newton, R., Tyedmers, P., Zhang, W., Ziegler, F. & Troell, M. 2021. Environmental performance of blue foods. *Nature* 597(7876), 360-365.

Gephart, J.A., Golden, C.D. Asche, F., Belton, B., Brugere, C., Froehlich, H.E., Fry, J.P., Halpern, B.S., Hicks, C.C., Jones, R.C., Klinger, D.H., Little, D.C., McCauley, D.J., Thilsted, S.H., Troell, M. & Allison, E.H. Scenarios for global aquaculture and its role in human nutrition. *Reviews in Fisheries Science & Aquaculture* 29(1), 122-138.

Goberdhan, L. & Kininmonth, S. 2021. Insights into coral growth rate trends in Fiji. *Coral Reefs* 40(1), 251–266.

González-Mon, B., Lindkvist, E., Bodin, Ö., Zepeda-Domínguez, J.A. & Schlüter, M. 2021. Fish provision in a changing environment: The buffering effect of regional trade networks. *PLOS ONE* 16(12), e0261514.

Gonzalez-Mon, B., Bodin, O., Lindkvist, E., Frawley, T.H., Giron-Nava, A., Basurto, X., Nenadovic, M. & Schlüter, M. 2021. Spatial diversification as a mechanism to adapt to environmental changes in small-scale fisheries. *Environmental Science & Policy* 116, 246–257.

Graham, M. & Dadd, U.L. 2021. Deep-colonising narratives and emotional labour: Indigenous tourism in a deeply-colonised place. *Tourist Studies* 21(3), 444–463.

Grêt-Regamey, A., Switalski, M., Fagerholm, N., Korpilo, S., Juhola, S., Kyttä, M., Käyhkö, N., McPhearson, T., Nollert, M., Rinne, T., Soininen, N., Toivonen, T., Räsänen, A., Willberg, E. & Raymond, C.M. 2021. Harnessing sensing systems towards urban sustainability transformation. *npj Urban Sustainability* 1(1), 40.

Guerrero, A.M., Sporne, I., McKenna, R. & Wilson, K.A. 2021. Evaluating institutional fit for the conservation of threatened species. *Conservation Biology* 35(5), 1437–1450.

Guerrero, A.M., Jones, N.A., Ross, H., Virah-Sawmy, M. & Biggs, D. 2021. What influences and inhibits reduction of deforestation in the soy supply chain? A mental model perspective. *Environmental Science & Policy* 115, 125–132.

Gupta, J., Liverman, D., Bai, X., Gordon, C., Hurlbert, M., Inoue, C.Y.A., Jacobson, L., Kanie, N., Lenton, T.M., Obura, D., Otto, I.M., Okereke, C., Pereira, L., Prodani, K., Rammelt, C., Scholtens, J., Tabara, J.D., Verburg, P.H., Gifford, L. & Ciobanu, D. 2021. Reconciling safe planetary targets and planetary justice: Why should social scientists engage with planetary targets? *Earth System Governance* 10, 100122.

Hahn, T., Eggers, J., Subramanian, N., Caicoya, A.T., Uhl, E. & Snall, T. 2021. Specified resilience value of alternative forest management adaptations to storms. *Scandinavian Journal of Forest Research* 36(7–8), 585–597.

Haider, L.J., Schlüter, M., Folke, C. & Reyers, B. 2021. Rethinking resilience and development: A coevolutionary perspective. *Ambio* 50(7), 1304–1312.

Hamel, P., Hamann, M., Kuiper, J.J., Andersson, E., Arkema, K.K., Silver, J.M., Daily, G.C. & Guerry, A.D. 2021. Blending ecosystem service and resilience perspectives in planning of natural infrastructure: Lessons from the San Francisco Bay Area. *Frontiers in Environmental Science* 9, 601136.

Hamel, P., Guerry, A.D., Polasky, S., Han, B., Douglass, J.A., Hamann, M., Janke, B., Kuiper, J.J., Levrel, H., Liu, H., Lonsdorf, E., McDonald, R.I., Nootenboom, C., Ouyang, Z., Remme, R.P., Sharp, R.P., Tardieu, L., Viguié, V., Xu, D., Zheng, H. & Daily, G.C. 2021. Mapping the benefits of nature in cities with the InVEST software. *npj Urban Sustainability* 1(1), 25.

Harker-Schuch, I., Lade, S., Mills, F. & Colvin, R. 2021. Opinions of 12 to 13-year-olds in Austria and Australia on the concern, cause and imminence of climate change. *Ambio* 50(3), 644–660.

Harmackova, Z., V., Blattler, L., Aguiar, A.P.D., Danek, J., Krpec, P. & Vackacova, D. 2021. Linking multiple values of nature with future impacts: Value-based participatory scenario development for sustainable landscape governance. *Sustainability Science* doi.org/10.1007/s11625-021-00953-8

Hebinck, A., Zurek, M., Achterbosch, T., Forkman, B., Kuijsten, A., Kuiper, M., Nørrung, B., van 't Veer, P., & Leip, A. 2021. A Sustainability Compass for policy navigation to sustainable food systems. *Global Food Security* 29, 100546.

Hebinck, A., Selomane, O., Veen, E., de Vrieze, A., Hasnain, S., Sellberg, M., Sovová, L., Thompson, K., Vervoort, J. & Wood, A. 2021. Exploring the transformative potential of urban food. *npj Urban Sustainability* 1(1), 38.

Hedlund, J., Bodin, Ö. & Nohrstedt, D. 2021. Assessing policy issue interdependencies in environmental governance. *International Journal of the Commons* 15(1), 82-99.

Hedlund, J., Bodin, O. & Nohrstedt, D. 2021. Policy issue interdependency and the formation of collaborative networks. *People and Nature* 3(1), 236–250.

Heinze, C., Blenckner, T., Martins, H., Rusiecka, D., Doscher, R., Gehlen, M., Gruber, N., Holland, E., Hov, O., Joos, F., Matthews, J.B.R., Rodven, R. & Wilson, S. 2021. The quiet crossing of ocean tipping points. *Proceedings of the National Academy of Sciences of the United States of America* 118(9), e2008478118.

Henriksson, P.JG., Cucurachi, S., Guinee, J.B., Heijungs, R., Troell, M. & Ziegler, F. 2021. A rapid review of meta-analyses and systematic reviews of environmental footprints of food commodities and diets. *Global Food Security-Agriculture Policy Economics and Environment* 28, 100508.

Henriksson, P.J.G., Troell, M., Banks, L.K., Belton, B., Beveridge, M.C.M., Klinger, D.H., Pelletier, N., Phillips, M.J. & Tran, N. 2021. Interventions for improving the productivity and environmental performance of global aquaculture for future food security. *One Earth* 4(9), 1220–1232.

Henriksson, R., Vincent, K., Archer, E. & Jewitt, G. 2021. Understanding gender differences in availability, accessibility and use of climate infor-

mation among smallholder farmers in Malawi. *Climate and Development* 13(6), 503–514.

Hentati-Sundberg, J., Olin, A.B., Evans, T.J., Isaksson, N., Berglund, P.-A. & Olsson, O. 2021. A mechanistic framework to inform the spatial management of conflicting fisheries and top predators. *Journal of Applied Ecology* 58(1), 125–134.

Hentati-Sundberg, J., Berglund, P.-A., Hejdstrom, A. & Olsson, O. 2021. COVID-19 lockdown reveals tourists as seabird guardians. *Biological Conservation* 254, 108950.

Herrero, M., Thornton, P.K., Mason-D'Croz, D., Palmer, J., Bodirsky, B.L., Pradhan, P., Barrett, C.B., Benton, T.G., Hall, A., Pikaar, I., Bogard, J.R., Bonnett, G.D., Bryan, B.A., Campbell, B.M., Christensen, S., Clark, M., Fanzo, J., Godde, C.M., Jarvis, A., Loboguerrero, A.M., Mathys, A., McIntyre, C.L., Naylor, R.L., Nelson, R., Obersteiner, M., Parodi, A., Popp, A., Ricketts, K., Smith, P., Valin, H., Vermeulen, S.J., Vervoort, J., van Wijk, M., van Zanten, H.H., West, P.C., Wood, S.A. & Rockström, J. 2021. Articulating the effect of food systems innovation on the Sustainable Development Goals. *The Lancet Planetary Health* 5(1), e50–e62.

Herreros-Cantis, P. & McPhearson, T. 2021. Mapping supply of and demand for ecosystem services to assess environmental justice in New York City. *Ecological Applications* 31(6), e02390.

Hertz, T. & Mancilla Garcia, M. 2021. The cod and the cut: Intra-active intuitions. *Frontiers in Sociology* 6, 724751.

Hileman, J.D., Angst, M., Scott, T.A. & Sundstrom, E. 2021. Recycled text and risk communication in natural gas pipeline environmental impact assessments. *Energy Policy* 156, 112379.

Hinton, J. 2021. Five key dimensions of post-growth business: Putting the pieces together. *Futures* 131, 102761.

Hoover, F.-A., Meerow, S., Grabowski, Z.J. & McPhearson, T. 2021. Environmental justice implications of siting criteria in urban green infrastructure planning. *Journal of Environmental Policy & Planning* 23(5, SI), 665–682.

Jarzebski, M.P., Elmqvist, T., Gasparatos, A., Fukushi, K., Eckersten, S., Haase, D., Goodness, J., Khoshkar, S., Saito, O., Takeuchi, K., Theorell, T., Dong, N., Kasuga, F., Watanabe, R., Sioen, G.B., Yokohari, M. & Pu, J. 2021. Ageing and population shrinking: Implications for sustainability in the urban century. *npj Urban Sustainability* 1(1), 17.

Jerico-Daminello, C., Schroeter, B., Garcia, M.M. & Albert, C. 2021. Exploring perceptions of stakeholder roles in ecosystem services coproduction. *Ecosystem Services* 51, 101353.

Johansson, L.-G. 2021. Induction, experimentation and causation in the social sciences. *Philosophies* 6(4), 105.

Jones, L., Constas, M.A., Matthews, N. & Verkaart, S. 2021. Advancing resilience measurement. *Nature Sustainability* 4(4), 288–289.

Kahiluoto, H., Pickett, K.E. & Steffen, W. 2021. Global nutrient equity for people and the planet. *Nature Food* 2(11), 857–861.

Karle-Bhat, S.J., Bunge, A.C. & Dally, E.R. 2021. Insights into a planetary health journey in Germany. *Creative Nursing* 27(4), 285–289.

Kimanzu, N., Schulte-Herbruggen, B., Clendenning, J., Chiwona-Karltun, L., Krogseng, K. & Petrokofsky, G. 2021. What is the evidence base linking gender with access to forests and use of forest resources for food security in low- and middle-income countries? A systematic evidence map. *Forests* 12(8), 1096.

Klose, A.K., Wunderling, N., Winkelmann, R. & Donges, J.F. 2021. What do we mean, 'tipping cascade'? *Environmental Research Letters* 16(12), 125011.

Kohler, J., Wunderling, N., Donges, J.F. & Vollmer, J. 2021. Complex networks of interacting stochastic tipping elements: Cooperativity of phase separation in the large-system limit. *Physical Review* E 104(4), 044301.

Kozlov, V., Radosavljevic, S., Tkachev, V. & Wennergren, U. 2021. Global stability of an age-structured population model on several temporally variable patches. *Journal of Mathematical Biology* 83(6–7), 68.

Kronenberg, J., Andersson, E., Barton, D.N., Borgstrom, S.T., Langemeyer, J., Bjorklund, T., Haase, D., Kennedy, C., Koprowska, K., Laszkiewicz, E., McPhearson, T., Stange, E.E. & Wolff, M. 2021. The thorny path toward greening: Unintended consequences, trade-offs, and constraints in green and blue infrastructure planning, implementation, and management. *Ecology and Society* 26(2), 36.

Labeyrie, V., Antona, M., Baudry, J., Bazile, D., Bodin, O., Caillon, S., Leclerc, C., Le Page, C., Louafi, S., Mariel, J., Massol, F. & Thomas, M. 2021. Networking agrobiodiversity management to foster biodiversity-based agriculture: A review. *Agronomy for Sustainable Development* 41(1), 4.

Lade, S.J., Fetzer, I., Cornell, S.E. & Crona, B. 2021. A prototype Earth system impact metric that accounts for cross-scale interactions. *Environmental Research Letters* 16(11), 115005.

Lade, S.J., Wang-Erlandsson, L., Staal, A. & Rocha, J.C. 2021. Empirical pressure-response relations can benefit assessment of safe operating spaces. *Nature Ecology & Evolution* 5(8), 1078–1079.

Lambraki, I.A., Majowicz, S.E., Parmley, E.J., Wernli, D., Leger, A., Graells, T., Cousins, M., Harbarth, S., Carson, C., Henriksson, P., Troell, M. & Jorgensen, P.S. 2021. Building social-ecological system resilience to tackle antimicrobial resistance across the One Health spectrum: Protocol for a mixed methods study. *Jmir Research Protocols* 10(6), e24378.

Lavery, T.H., Morgain, R., Fitzsimons, J.A., Fluin, J., Macgregor, N.A., Robinson, N.M., Scheele, B.C., Selwood, K.E., Spindler, R., Vuong, H., West, S., Wintle, B.A. & Lindenmayer, D.B. 2021. Impact indicators for biodiversity conservation research: Measuring influence within and beyond academia. *Bioscience* 71(4), 383–395.

van der Leeuw, S. & Folke, C. 2021. The social dynamics of basins of attraction. *Ecology and Society* 26(1), 33.

Leger, A., Lambraki, I., Graells, T., Cousins, M., Henriksson, P.J.G., Harbarth, S., Carson, C., Majowicz, S., Troell, M., Parmley, E.J., Jorgensen, P.S. & Wernli, D. 2021. 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* 76(1), 1–21.

Leger, A., Lambraki, I., Graells, T., Cousins, M., Henriksson, P.J.G., Harbarth, S., Carson, C.A., Majowicz, S.E., Troell, M., Parmley, E.J., Jorgensen, P.S. & Wernli, D. 2021. Characterizing social-ecological context and success factors of antimicrobial resistance interventions across the One Health spectrum: Analysis of 42 interventions targeting E. coli. *BMC Infectious Diseases* 21(1), 873.

Lemos, C.M.G., Andrade, P.R., Rodrigues, R.R., Hissa, L. & Aguiar, A.P.D. 2021. Combining regional to local restoration goals in the Brazilian Atlantic forest. *Regional Environmental Change* 21(3), 68.

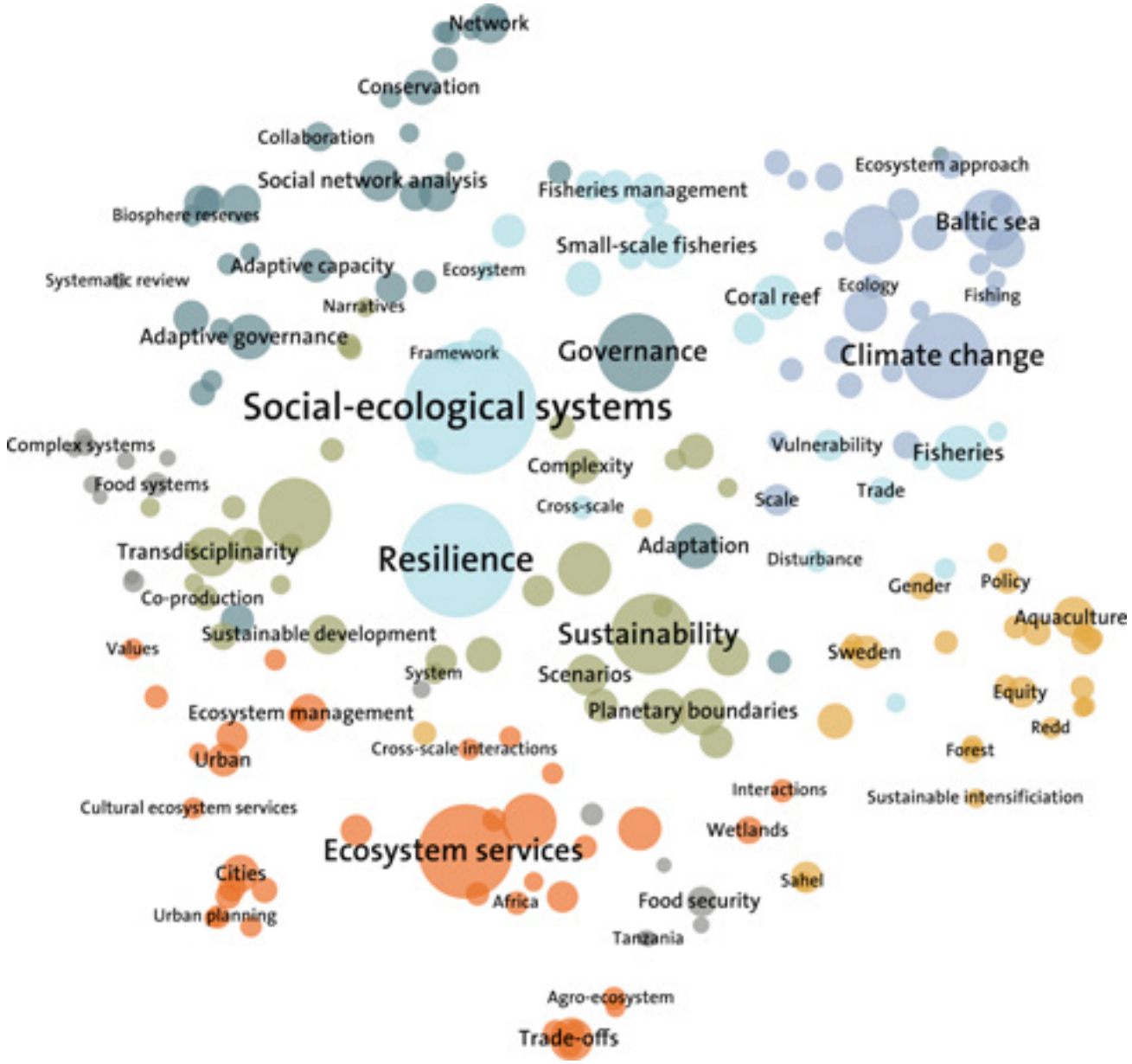
Lin, B.B., Ossola, A., Alberti, M., Andersson, E., Bai, X., Dobbs, C., Elmqvist, T., Evans, K.L., Frantzeskaki, N., Fuller, R.A., Gaston, K.J., Haase, D., Jim, C.Y., Konijnendijk, C., Nagendra, H., Niemela, J., McPhearson, T., Moomaw, W.R., Parnell, S., Pataki, D., Ripple, W.J. & Tan, P.Y. 2021. Integrating solutions to adapt cities for climate change. *Lancet Planetary Health* 5(7), E479–E486.

Linder, N., Rosenthal, S., Sorqvist, P. & Barthel, S. 2021. Internal and external factors' influence on recycling: Insights from a laboratory experiment with observed behavior. *Frontiers in Psychology* 12, 699410.

Liu, J., Dietz, T., Carpenter, S.R., Taylor, W.W., Alberti, M., Deadman, P., Redman, C., Pell, A., Folke, C., Ouyang, Z. & Lubchenco, J. 2021. Coupled human and natural systems: The evolution and applications of an integrated framework. *Ambio* 50(10, SI), 1778–1783.

Lopez, B., Kennedy, C., Field, C. & McPhearson, T. 2021. Who benefits from urban green spaces during times of crisis? Perception and use of urban green spaces in New York City during the COVID-19 pandemic. *Urban Forestry & Urban Greening* 65, 127354.

Love, D.C., Allison, E.H., Asche, F., Belton, B., Cottrell, R.S., Froehlich, H.E., Gephart, J.A., Hicks, C.C., Little, D.C., Nussbaumer, E.M., da



Publication keywords 2017-2021(source: Web of Science)

Silva, P.P., Poulain, F., Rubio, A., Stoll, J.S., Tlusty, M.F., Thorne-Lyman, A.L., Troell, M. & Zhang, W. 2021. Emerging COVID-19 impacts, responses, and lessons for building resilience in the seafood system. *Global Food Security-Agriculture Policy Economics and Environment* 28, 100494.

Lundquist, C., Hashimoto, S., Denboba, M.A., Peterson, G., Pereira, L. & Armenteras, D. 2021. Operationalizing the Nature Futures Framework to catalyze the development of nature-future scenarios. Sustainability Science 16(6), 1773–1775.

Malmborg, K., Enfors-Kautsky, E., Queiroz, C., Norström, A. & Schultz, L. 2021. Correction to: Operationalizing ecosystem service bundles for strategic sustainability planning: A participatory approach. *Ambio* 50(2), 332–334.

Malmborg, K., Enfors-Kautsky, E., Queiroz, C., Norström, A. & Schultz, L. 2021. Operationalizing ecosystem service bundles for strategic sustainability planning: A participatory approach. *Ambio* 50(2), 314–331.

Marcinko, C.L.J., Nicholls, R.J., Daw, T.M., Hazra, S., Hutton, C.W., Hill, C.T., Clarke, D., Harfoot, A., Basu, O., Das, I., Giri, S., Pal, S. & Mondal, P.P. 2021. The development of a framework for the integrated assessment of SDG trade-offs in the Sundarban Biosphere Reserve. *Water* 13(4), 528.

Martin, M.A., Alcaraz Sendra, O., Bastos, A., Bauer, N., Bertram, C., Blenckner, T., Bowen, K., Brando, P.M., Rudolph, T.B., Buchs, M., Bustamante, M., Chen, D., Cleugh, H., Dasgupta, P., Denton, F., Donges, J.F., Donkor, F.K., Duan, H., Duarte, C.M., Ebi, K.L., Edwards, C.M., Engel, A., Fisher, E., Fuss, S., Gaertner, J., Gettelman, A., Girardin, C.A.J., Golledge, N.R., Green, J.F., Grose, M.R., Hashizume, M., Hebden, S., Hepach, H., Hirota, M., Hsu, H.-H., Kojima, S., Lele, S., Lorek, S., Lotze, H.K., Matthews, H.D., McCauley, D., Mebratu, D., Mengis, N., Nolan, R.H., Pihl, E., Rahmstorf, S., Redman, A., Reid, C.E., Rockstrom, J., Rogelj, J., Saunois, M., Sayer, L., Schlosser, P., Sioen, G.B., Spangenberg, J.H., Stammer, D., Sterner, T.N.S., Stevens, N., Thonicke, K., Tian, H., Winkelmann, R. & Woodcock, J. 2021. Ten new insights in climate science 2021: a horizon scan. *Global Sustainability* 4, E25.

Marwan, N., Donges, J.F., Donner, R., V. & Eroglu, D. 2021. Nonlinear time series analysis of palaeoclimate proxy records. *Quaternary Science Reviews* 274, 107245.

Mascarenhas, A., Langemeyer, J., Haase, D., Borgström, S. & Andersson, E. 2021. Assessing the learning process in transdisciplinary research through a novel analytical approach. *Ecology and Society* 26(4), 19.

Mazzero, H., Perrotton, A., Ka, A. & Goffner, D. 2021. Unpacking decades of multi-scale events and environment-based development in the Senegalese Sahel: Lessons and perspectives for the future. *Land* 10(7), 755.

McPhearson, T., M. Raymond, C., Gulsrud, N., Albert, C., Coles, N., Fagerholm, N., Nagatsu, M., Olafsson, A.S., Soininen, N. & Vierikko, K. 2021. Radical changes are needed for transformations to a good Anthropocene.

npj Urban Sustainability 1(1), 5.

Mustafa, A., Ebaid, A., Omrani, H. & McPhearson, T. 2021. A multi-objective Markov Chain Monte Carlo cellular automata model: Simulating multi-density urban expansion in NYC. *Computers Environment and Urban Systems* 87, 101602.

Naylor, R.L., Hardy, R.W., Buschmann, A.H., Bush, S.R., Cao, L., Klinger, D.H., Little, D.C., Lubchenco, J., Shumway, S.E. & Troell, M. 2021. A 20-year retrospective review of global aquaculture. *Nature* 591(7851), 551-563. Author correction: *Nature* 593(7858), E12, Publisher Correction: *Nature* 595(7868), E36.

Naylor, R.L., Kishore, A., Sumaila, U.R., Issifu, I., Hunter, B.P., Belton, B., Bush, S.R., Cao, L., Gelcich, S., Gephart, J.A., Golden, C.D., Jonell, M., Koehn, J.Z., Little, D.C., Thilsted, S.H., Tigchelaar, M. & Crona, B. 2021. Blue food demand across geographic and temporal scales. *Nature Communications* 12(1), 5413.

Nyberg, O., Rico, A., Guinee, J.B. & Henriksson, P.J.G. 2021. Characterizing antibiotics in LCA-a review of current practices and proposed novel approaches for including resistance. *International Journal of Life Cycle Assessment* 26(9), 1906–1907.

O'Connor, J.C., Dekker, S.C., Staal, A., Tuinenburg, O.A., Rebel, K.T. & Santos, M.J. 2021. Forests buffer against variations in precipitation. *Global Change Biology* 27(19), 4686–4696.

Orach, K. & Schlüter, M. 2021. Understanding the dynamics of fish politics: The role of diverse actor interactions in transformations towards co-management. *Environmental Science & Policy* 124, 195–205.

Österblom, H. & Paasche, O. 2021. Earth altruism. *One Earth* 4(10), 1386–1397.

Palm, C., Cornell, S.E. & Häyhä, T. 2021. Making resilient decisions for sustainable circularity of fashion. *Circular Economy and Sustainability* 1(2), 651–670.

Palomo, I., Locatelli, B., Otero, I., Colloff, M., Crouzat, E., Cuni-Sanchez, A., Gomez-Baggethun, E., Gonzalez-Garcia, A., Gret-Regamey, A., Jimenez-Aceituno, A., Martin-Lopez, B., Pascual, U., Zafra-Calvo, N., Bruley, E., Fischborn, M., Metz, R. & Lavorel, S. 2021. Assessing nature-based solutions for transformative change. *One Earth* 4(5), 730–741.

Pan, H., Page, J., Cong, C., Barthel, S. & Kalantari, Z. 2021. How ecosystems services drive urban growth: Integrating nature-based solutions. *Anthropocene* 35, 100297.

Pellowe, K.E. & Leslie, H.M. 2021. Ecosystem service lens reveals diverse community values of small-scale fisheries. *Ambio* 50(3), 586–600.

Pereira, L., Kuiper, J.J., Selomane, O., Aguiar, A.P.D., Asrar, G.R., Bennett, E.M., Biggs, R., Calvin, K., Hedden, S., Hsu, A., Jabbour, J., King, N., Koberle, A.C., Lucas, P., Nel, J., Norstrom, A.V., Peterson, G., Sitas, N., Trisos, C., van Vuuren, D.P., Vervoort, J. & Ward, J. 2021. Advancing a toolkit of diverse futures approaches for global environmental assessments. *Ecosystems and People* 17(1), 191–204.

Pereira, L., Asrar, G.R., Bhargava, R., Fisher, L.H., Hsu, A., Jabbour, J., Nel, J., Selomane, O., Sitas, N., Trisos, C., Ward, J., van den Ende, M., Vervoort, J. & Weinfurter, A. 2021. Grounding global environmental assessments through bottom-up futures based on local practices and perspectives. *Sustainability Science* 16(6), 1907–1922.

Pereira, L.M., Morrow, D.R., Aquila, V., Beckage, B., Beckbesinger, S., Beukes, L., Buck, H.J., Carlson, C.J., Geden, O., Jones, A.P., Keller, D.P., Mach, K.J., Mashigo, M., Moreno-Cruz, J.B., Visioni, D., Nicholson, S. & Trisos, C.H. 2021. From fairplay to climate wars: making climate change scenarios more dynamic, creative, and integrative. *Ecology and Society* 26(4), 30.

Piemontese, L., Kamugisha, R.N., Tukahirwa, J.M.B., Tengberg, A., Pedde, S. & Jaramillo, F. 2021. Barriers to scaling sustainable land and water management in Uganda: a cross-scale archetype approach. *Ecology and Society* 26(3), 6.

Pineda-Pinto, M., Herreros-Cantis, P., McPhearson, T., Frantzeskaki, N., Wang, J. & Zhou, W. 2021. Examining ecological justice within the social-ecological-technological system of New York City, USA. *Landscape and Urban Planning* 215, 104228.

Porkka, M., Wang-Erlandsson, L., Destouni, G., Ekman, A.M.L., Rockstrom, J. & Gordon, L.J. 2021. Is wetter better? Exploring agriculturally-relevant rainfall characteristics over four decades in the Sahel. *Environmental Research Letters* 16(3), 035002.

Preiser, R., Biggs, R., Hamann, M., Sitas, N., Selomane, O., Waddell, J., Clements, H. & Hichert, T. 2021. Co-exploring relational heuristics for sustainability transitions towards more resilient and just Anthropocene futures. *Systems Research and Behavioral Science* 38(5, SI), 625–634.

Qiu, J., Queiroz, C., Bennett, E.M., Cord, A.F., Crouzat, E., Lavorel, S., Maes, J., Meacham, M., Norstrom, A.V., Peterson, G.D., Seppelt, R. & Turner, M.G. 2021. Land-use intensity mediates ecosystem service tradeoffs across regional social-ecological systems. *Ecosystems and People* 17(1), 264–278.

Queiroz, C., Norstrom, A.V., Downing, A., Harmackova, Z.V., De Coning, C., Adams, V., Bakarr, M., Baedeker, T., Chitate, A., Gaffney, O., Gordon, L., Hainzelin, E., Howlett, D., Krampe, F., Loboguerrero, A.M., Nel, D., Okollet, C., Rebermark, M., Rockström, J., Smith, M., Wabbes-Candotti, S. & Matthews, N. 2021. Investment in resilient food systems in the most vulnerable and fragile regions is critical. *Nature Food* 2(8), 546–551.

Radosavljevic, S., Haider, L.J., Lade, S.J. & Schlüter, M. 2021. Implications of poverty traps across levels. *World Development* 144, 105437.

Raymond, C.M., Kaaronen, R., Giusti, M., Linder, N. & Barthel, S. 2021. Engaging with the pragmatics of relational thinking, leverage points and transformations – Reply to West et al. *Ecosystems and People* 17(1), 1–5.

Remme, R.P., Frumkin, H., Guerry, A.D., King, A.C., Mandle, L., Sarabu, C., Bratman, G.N., Giles-Corti, B., Hamel, P., Han, B., Hicks, J.L., James, P., Lawler, J.J., Lindahl, T., Liu, H., Lu, Y., Oosterbroek, B., Paudel, B., Sallis, J.F., Schipperijn, J., Sosic, R., de Vries, S., Wheeler, B.W., Wood, S.A., Wu, T. & Daily, G.C. 2021. An ecosystem service perspective on urban nature, physical activity, and health. *Proceedings of the National Academy of Sciences of the United States of America* 118(22), e2018472118.

Riechers, M., Loos, J., Balazsi, A., Garcia-Llorente, M., Bieling, C., Burgos-Ayala, A., Chakroun, L., Mattijssen, T.J.M., Muhr, M.M., Perez-Ramirez, I., Raatikainen, K.J., Rana, S., Richardson, M., Rosengren, L. & West, S. 2021. Key advantages of the leverage points perspective to shape human-nature relations. *Ecosystems and People* 17(1), 205–214.

Rockström, J., Gupta, J., Lenton, T.M., Qin, D., Lade, S.J., Abrams, J.F., Jacobson, L., Rocha, J.C., Zimm, C., Bai, X., Bala, G., Bringezu, S., Broadgate, W., Bunn, S.E., DeClerck, F., Ebi, K.L., Gong, P., Gordon, C., Kanie, N., Liverman, D.M., Nakicenovic, N., Obura, D., Ramanathan, V., Verburg, P.H., van Vuuren, D.P. & Winkelmann, R. 2021. Identifying a safe and just corridor for people and the planet. *Earth's Future* 9(4), e2020EF001866.

Rockström, J., Beringer, T., Hole, D., Griscom, B., Mascia, M.B., Folke, C. & Creutzig, F. 2021. We need biosphere stewardship that protects carbon sinks and builds resilience. *Proceedings of the National Academy of Sciences* 118(38), e2115218118.

Röös, E., Bajzelj, B., Weil, C., Andersson, E., Bossio, D. & Gordon, L.J. 2021. Moving beyond organic: A food system approach to assessing sustainable and resilient farming. *Global Food Security* 28, 100487.

Rosenzweig, B.R., Herreros Cantis, P., Kim, Y., Cohn, A., Grove, K., Brock, J., Yesuf, J., Mistry, P., Welty, C., McPhearson, T., Sauer, J. & Chang, H. 2021. The value of urban flood modeling. *Earth's Future* 9(1), e2020EF00173.

Rosier, S.H.R., Reese, R., Donges, J.F., De Rydt, J., Gudmundsson, G.H. & Winkelmann, R. 2021. The tipping points and early warning indicators for Pine Island Glacier, West Antarctica. *Cryosphere* 15(3), 1501–1516.

Roth, N., Jaramillo, F., Wang-Erlandsson, L., Zamora, D., Palomino-Angel, S. & Cousins,

S.A.O. 2021. A call for consistency with the terms 'wetter' and 'drier' in climate change studies. *Environmental Evidence* 10(1), 8.

Roura-Pascual, N., Leung, B., Rabitsch, W., Rutting, L., Vervoort, J., Bacher, S., Dullinger, S., Erb, K.-H., Jeschke, J.M., Katsanevakis, S., Kuehn, I., Lenzner, B., Liebhold, A.M., Obersteiner, M., Pauchard, A., Peterson, G.D., Roy, H.E., Seebens, H., Winter, M., Burgman, M.A., Genovesi, P., Hulme, P.E., Keller, R.P., Latombe, G., McGeoch, M.A., Ruiz, G.M., Scalera, R., Springborn, M.R., von Holle, B. & Essl, F. 2021. Alternative futures for global biological invasions. *Sustainability Science* 16(5), 1637–1650.

Rubio, I., Hileman, J. & Ojea, E. 2021. Social connectivity and adaptive capacity strategies in large-scale fisheries. *Ecology and Society* 26(2), 42.

Samuelsson, K., Chen, T.-H.K., Antonsen, S., Brandt, S.A., Sabel, C. & Barthel, S. 2021. Residential environments across Denmark have become both denser and greener over 20 years. *Environmental Research Letters* 16(1), 014022.

Samuelsson, K., Barthel, S., Giusti, M. & Hartig, T. 2021. Visiting nearby natural settings supported wellbeing during Sweden's "soft-touch" pandemic restrictions. *Landscape and Urban Planning* 214, 104176.

Sanga, U., Sidibe, A. & Olabisi, L.S. 2021. Dynamic pathways of barriers and opportunities for food security and climate adaptation in Southern Mali. *World Development* 148, 105663.

Sanga, U., Park, H., Wagner, C.H., Shah, S.H. & Ligmann-Zielinska, A. 2021. How do farmers adapt to agricultural risks in northern India? An agent-based exploration of alternate theories of decision-making. *Journal of Environmental Management* 298, 113353.

Saraux, C., Sydeman, W.J., Piatt, J.F., Anker-Nilssen, T., Hentati-Sundberg, J., Bertrand, S., Cury, P.M., Furness, R.W., Mills, J.A., Österblom, H., Passuni, G., Roux, J.-P., Shannon, L.J. & Crawford, R.J.M. 2021. Seabird-induced natural mortality of forage fish varies with fish abundance: Evidence from five ecosystems. *Fish and Fisheries* 22(2), 262–279.

Schlüter, M., Lindkvist, E. & Basurto, X. 2021. The interplay between top-down interventions and bottom-up self-organization shapes opportunities for transforming self-governance in small-scale fisheries. *Marine Policy* 128, 104485.

Schneider, F., Tribaldos, T., Adler, C., Biggs, R.O., de Bremond, A., Buser, T., Krug, C., Loutre, M.-F., Moore, S., Norström, A.V., Paulavets, K., Urbach, D., Spehn, E., Wülser, G. & Zondervan, R. 2021. Co-production of knowledge and sustainability transformations: A strategic compass for global research networks. Current Opinion in *Environmental Sustainability* 49, 127–142.

Sellberg, M.M., Quinlan, A., Preiser, R., Malmborg, K. & Peterson, G.D. 2021 Engaging with complexity in resilience practice. *Ecology and Society* 26(3), 8.

Sellberg, M.M., Cockburn, J., Holden, P.B. & Lam, D.P.M. 2021. Towards a caring transdisciplinary research practice: Navigating science, society and self. *Ecosystems and People* 17(1), 292–305.

Shepon, A., Gephart, J.A., Golden, C.D., Henriksson, P.J.G., Jones, R.C., Koehn, J.Z. & Eshel, G. 2021. Exploring sustainable aquaculture development using a nutrition-sensitive approach. *Global Environmental Change* 69, 102285.

Short, R.E., Gelcich, S., Little, D.C., Micheli, F., Allison, E.H., Basurto, X., Belton, B., Brugere, C., Bush, S.R., Cao, L., Crona, B., Cohen, P.J., Defeo, O., Edwards, P., Ferguson, C.E., Franz, N., Golden, C.D., Halpern, B.S., Hazen, L., Hicks, C., Johnson, D., Kaminski, A.M., Mangubhai, S., Naylor, R.L., Reantaso, M., Sumaila, U.R., Thilsted, S.H., Tigchelaar, M., Wabnitz, C.C.C. & Zhang, W. 2021. Harnessing the diversity of small-scale actors is key to the future of aquatic food systems. *Nature Food* 2(9), 733-741. Author Correction: *Nature Food* 2(10), 828.

Short, R.E., Cox, D.T.C., Tan, Y.L., Bethel, A., Eales, J.F. & Garside, R. 2021. Review of the evidence for oceans and human health relationships in Europe: A systematic map. *Environment International* 146, 106275.

Sigwart, J.D., Blasiak, R., Jaspars, M., Jouffray, J.-B. & Tasdemir, D. 2021. Unlocking the potential of marine biodiscovery. *Natural Product Reports* 38(7), 1235–1242.

Silva Junior, C.H.L., Carvalho, N.S., Pessoa, A.C.M., Reis, J.B.C., Pontes-Lopes, A., Doblas, J., Heinrich, V., Campanharo, W., Alencar, A., Silva, C., Lapola, D.M., Armenteras, D., Matricardi, E.A.T., Berenguer, E., Cassol, H., Numata, I., House, J., Ferreira, J., Barlow, J., Gatti, L., Brando, P., Fearnside, P.M., Saatchi, S., Silva, S., Sitch, S., Aguiar, A.P., Silva, C.A., Vancutsem, C., Achard, F., Beuchle, R., Shimabukuro, Y.E., Anderson, L.O. & Aragao, L.E.O.C. 2021. Amazonian forest degradation must be incorporated into the COP26 agenda. *Nature Geoscience* 14(9), 634–635.

Spijkers, J., Merrie, A., Wabnitz, C.C.C., Osborne, M., Mobjork, M., Bodin, O., Selig, E.R., Le Billon, P., Hendrix, C.S., Singh, G.G., Keys, P.W. & Morrison, T.H. 2021. Exploring the future of fishery conflict through narrative scenarios. *One Earth* 4(3), 386–396.

Spijkers, J., Singh, G.G., Wabnitz, C.C.C., Österblom, H., Cumming, G.S. & Morrison, T.H. 2021. Identifying predictors of international fisheries conflict. *Fish and Fisheries* 22(4), 834–850.

Spotswood, E.N., Benjamin, M., Stoneburner, L., Wheeler, M.M., Beller, E.E., Balk, D., McPhearson, T., Kuo, M. & McDonald, R.I. 2021. Nature inequity and higher COVID-19 case rates in less-green neighbourhoods in the United States. *Nature Sustainability* 4(12), 1092-1098.

Stenvinkel, P., Avesani, C.M., Gordon, L.J., Schalling, M. & Shiels, P.G. 2021. Biomimetics provides lessons from nature for contemporary ways to improve human health. *Journal of Clinical and Translational Science* 5(1), e128.

Sumaila, U.R., Walsh, M., Hoareau, K., Cox, A., Teh, L., Abdallah, P., Akpalu, W., Anna, Z., Benzaken, D., Crona, B., Fitzgerald, T., Heaps, L., Issifu, I., Karousakis, K., Lange, G.M., Leland, A., Miller, D., Sack, K., Shahnaz, D., Thiele, T., Vestergaard, N., Yagi, N. & Zhang, J. 2021. Financing a sustainable ocean economy. *Nature Communications* 12(1), 3259.

Sylla, M., Harmáčková, Z.V., Grammatikopoulou, I., Whitham, C., Pártl, A. & Vačkářová, D. 2021. Methodological and empirical challenges of SEEA EEA in developing contexts: Towards ecosystem service accounts in the Kyrgyz Republic. *Ecosystem Services* 50, 101333.

Tengö, M., Austin, B.J., Danielsen, F. & Fernández-Llamazares, Á. 2021. Creating synergies between citizen science and indigenous and local knowledge. *BioScience* 71(5), 503–518.

Virdin, J., Vegh, T., Jouffray, J.-B., Blasiak, R., Mason, S., Österblom, H., Vermeer, D., Wachtmeister, H. & Werner, N. 2021. The Ocean 100: Transnational corporations in the ocean economy. *Science Advances* 7(3), eabc8041.

Warszawski, L., Kriegler, E., Lenton, T.M., Gaffney, O., Jacob, D., Klingenfeld, D., Koide, R., Costa, M.M., Messner, D., Nakicenovic, N., Schellnhuber, H.J., Schlosser, P., Takeuchi, K., Van Der Leeuw, S., Whiteman, G. & Rockström, J. 2021. All options, not silver bullets, needed to limit global warming to 1.5 °C: A scenario appraisal. *Environmental Research Letters* 16(6), 064037.

Wernli, D., Clausin, M., Antulov-Fantulin, N., Berezowski, J., Biller-Andorno, N., Blanchet, K., Böttcher, L., Burton-Jeangros, C., Escher, G., Flahault, A., Fukuda, K., Helbing, D., Jaffé, P.D., Søgaard Jørgensen, P., Kaspiarovich, Y., Krishnakumar, J., Lawrence, R.J., Lee, K., Léger, A., Levrat, N., Martischang, R., Morel, C.M., Pittet, D., Stauffer, M., Tediosi, F., Vanackere, F., Vassalli, J.-D., Wolff, G. & Young, O. 2021. Building a multisystemic understanding of societal resilience to the COVID-19 pandemic. *BMJ Global Health* 6(7), e006794.

West, S., Haider, L.J., Stålhammar, S. & Woroniecki, S. 2021. Putting relational thinking to work in sustainability science: Reply to Raymond et al. *Ecosystems and People* 17(1), 108–113.

Wolf, S., Pham, M., Matthews, N. & Bubeck, P. 2021. Understanding the implementation gap: policy-makers' perceptions of ecosystem-based adaptation in Central Vietnam, *Climate and Development*, 13(1), 81-94.

Woodhead, A.J., Graham, N.A.J., Robinson,

J.P.W., Norström, A.V., Bodin, N., Marie, S., Balett, M. & Hicks, C.C. 2021. Fishers perceptions of ecosystem service change associated with climate-disturbed coral reefs. *People and Nature* 3(3), 639–657.

Wunderling, N., Donges, J.F., Kurths, J. & Winkelmann, R. 2021. Interacting tipping elements increase risk of climate domino effects under global warming. *Earth System Dynamics* 12(2), 601–619.

Wunderling, N., Krönke, J., Wohlfarth, V., Kohler, J., Heitzig, J., Staal, A., Willner, S., Winkelmann, R. & Donges, J.F. 2021. Modelling nonlinear dynamics of interacting tipping elements on complex networks: The PyCascades package. *The European Physical Journal Special Topics* 230(14–15), 3163–3176.

Wyatt, K.H., Arkema, K.K., Wells-Moultrie, S., Silver, J.M., Lashley, B., Thomas, A., Kuiper, J.J., Guerry, A.D. & Ruckelshaus, M. 2021. Integrated and innovative scenario approaches for sustainable development planning in The Bahamas. *Ecology and Society* 26(4), 23.

Zhou, W., Pickett, S.T.A. & McPhearson, T. 2021. Conceptual frameworks facilitate integration for transdisciplinary urban science. *npj Urban Sustainability* 1(1), 1.

Ziervogel, G., Enqvist, J., Metelerkamp, L. & van Breda, J. 2021. Supporting transformative climate adaptation: community-level capacity building and knowledge co-creation in South Africa. *Climate Policy*, 1–16.

Journal articles published online in 2021, with an official publication date in 2022

Ammar, Y., Voss, R., Niiranen, S. & Blenckner, T. 2021. Quantifying socio-economic novelty in fisheries social-ecological systems. *Fish and Fisheries* doi.org/10.1111/faf.12626

Barthel, S., Colding, J., Hiswåls, A.-S., Thalén, P. & Turunen, P. 2021. Urban green commons for socially sustainable cities and communities. *Nordic Social Work Research* doi.org/10.1080/21 56857X.2021.1947876

Calderon-Contreras, R., Balvanera, P., Trimble, M., Langle-Flores, A., Jobbagy, E., Maass Moreno, M., Marcone, J., Mazzeo, N., Muñoz Anaya, M.M., Ortiz-Rodríguez, I.A., Perevochtchikova, M., Avila-Foucat, S., Bonilla-Moheno, M., Clark, L.B., Equihua, M., Ayala-Orozco, B., Bueno, I., Hensler, L., Leyva Aguilera, J.C., Martinez Ramos, M., Mercon, J., Azahara Mesa-Jurado, M., Österblom, H., Pacheco-Vega, R., Perez Alcantara, B., Perez-Maqueo, O., Porter-Bolland, L., Quijas, S., Quiroz Rosas, L.E., Rios Patron, E., Rocha-Gordo, J.C., Rojo Negrete, I.A., Piedad Romero-Duque, L., Rosell, J.A., Scheffer, M., Vazquez, L.-B., Villada Canela, M. & Velazquez, M. 2021. A regional PECS node built from place-based social-ecological sustainability research in Latin America and the Caribbean. *Ecosystems and People* doi.org/10.10 80/26395916.2021.2000501

Chaigneau, T., Coulthard, S., Daw, T.M., Szaboova, L., Camfield, L., Chapin III, F.S., Gasper, D., Gurney, G.G., Hicks, C.C., Ibrahim, M., James, T., Jones, L., Matthews, N., McQuistan, C., Reyers, B. & Brown, K. 2021. Reconciling well-being and resilience for sustainable development. *Nature Sustainability* doi.org/10.1038/s41893-021-00790-8

Chambers, J.M., Wyborn, C., Klenk, N.L., Ryan, M., Serban, A., Bennett, N.J., Brennan, R., Charli-Joseph, L., Fernandez-Gimenez, M.E., Galvin, K.A., Goldstein, B.E., Haller, T., Hill, R., Munera, C., Nel, J.L., Österblom, H., Reid, R.S., Riechers, M., Spierenburg, M., Tengo, M., Bennett, E., Brandeis, A., Chatterton, P., Cockburn, J.J., Cvitanovic, C., Dumrongrojwatthana, P., Duran, A.P., Gerber, J.-D., Green, J.M.H., Gruby, R., Guerrero, A.M., Horcea-Milcu, A.-I., Montana, J., Steyaert, P., Zaehringer, J.G., Bednarek, A.T., Curran, K., Fada, S.J., Hutton, J., Leimona, B., Pickering, T. & Rondeau, R. 2021. Co-productive agility and four collaborative pathways to sustainability transformations. *Global Environmental Change* doi.org/10.1016/j.gloenvcha.2021.102422

Colding, J., Barthel, S., Ljung, R., Eriksson, F. & Sjöberg, S. 2021. Urban Commons and Collective Action to Address Climate Change. *Social Inclusion* doi.org/10.17645/si.v10i1.4862

Enqvist, J., Ziervogel, G., Metelerkamp, L., van Breda, J., Dondi, N., Lusithi, T., Mdunyelwa, A., Mgwigwi, Z., Mhlalisi, M., Myeza, S., Nomela, G., October, A., Rangana, W. & Yalabi, M. 2021. Informality and water justice: Community perspectives on water issues in Cape Town's low-income neighbourhoods. *International Journal of Water Resources Development* doi.org/10.1080/0 7900627.2020.1841605.

Falkenmark, M. 2021. Planning of Africa's land/water future: Hard or soft landing? *Ambio* doi.org/10.1007/s13280-021-01527-9

Felipe-Lucia, M.R., Guerrero, A.M., Alexander, S.M., Ashander, J., Baggio, J.A., Barnes, M.L., Bodin, Ö., Bonn, A., Fortin, M.-J., Friedman, R.S., Gephart, J.A., Helmstedt, K.J., Keyes, A.A., Kroetz, K., Massol, F., Pocock, M.J.O., Sayles, J., Thompson, R.M., Wood, S.A. & Dee, L.E. 2021. Conceptualizing ecosystem services using social–ecological networks. *Trends in Ecology and Evolution* doi.org/10.1016/j.tree.2021.11.012.

Folke, C. & Kautsky, N. 2021. Aquaculture and ocean stewardship *Ambio* doi.org/10.1007/s13280-021-01528-8

Frantzeskaki, N. & McPhearson, T. 2021. Mainstream Nature-Based Solutions for Urban Climate Resilience. *BioScience* doi.org/10.1093/biosci/biab105

Grabowski, Z.J., McPhearson, T., Matsler, A.M., Groffman, P. & Pickett, S.T.A. 2021. What is green infrastructure? A study of definitions in US city planning. *Frontiers in Ecology and the Environment* doi.org/10.1002/fee.2445

Hebinck, A., Diercks, G., von Wirth, T., Beers, P.J., Barsties, L., Buchel, S., Greer, R., van Steenbergen, F. & Loorbach, D. 2021. An actionable understanding of societal transitions: The X-curve framework. *Sustainability Science* doi.org/10.1007/s11625-021-01084-w

Koh, N.S., Ituarte-Lima, C. & Hahn, T. 2021. Mind the compliance gap: How insights from international human rights mechanisms can help to implement the convention on biological diversity. *Transnational Environmental Law* doi.org/10.1017/S2047102521000169

Levin, S.A., Anderies, J., Adger N., Barrett, S., Bennett, E., Cardenas, J.C., Carpenter, S.R., Crepin, A.-S., Ehrlich, P.R., Fischer, J., Folke, C., Kautsky, N., Kling, C., Nyborg, K., Polasky, S., Scheffer, M., Segerson, K., Shogren, J., van den Bergh, J., Walker, B.H., Weber, E.U., and Wilen, J. 2021. Governance in the face of extreme events: Lessons from evolutionary processes for structuring interventions and the need to go beyond. *Ecosystems* doi.org/10.1007/s10021-021-00680-2.

Linder, N., Giusti, M., Samuelsson, K. & Barthel, S. 2021. Pro-environmental habits: An underexplored research agenda in sustainability science. *Ambio* doi.org/10.1007/s13280-021-01619-6

Luthman, O., Jonell, M., Rönnbäck, P. & Troell, M. 2021. Strong and weak sustainability in Nordic aquaculture policies. *Aquaculture* doi.org/10.1016/j.aquaculture.2021.737841

Maasri, A., Jähnig, S.C., Adamescu, M.C., Adrian, R., Baigun, C., Baird, D.J., Batista-Morales, A., Bonada, N., Brown, L.E., Cai, Q., Campos-Silva, J.V., Clausnitzer, V., Contreras-MacBeath, T., Cooke, S.J., Datry, T., et al. 2021. A global agenda for advancing freshwater biodiversity research. *Ecology Letters* doi.org/10.1111/ele.13931

Mangano, M.C., Berlino, M., Corbari, L., Milisenda, G., Lucchese, M., Terzo, S., Bosch-Belmar, M., Azaza, M.S., Babarro, J.M.F., Bakiu, R., Broitman, B.R., Buschmann, A.H., Christofoletti, R., Dong, Y., Glamuzina, B., Luthman, O., Makridis, P., Nogueira, A.J.A., Palomo, M.G., Dineshram, R., Sanchez-Jerez, P., Sevgili, H., Troell, M., AbouelFadl, K.Y., Azra, M.N., Britz, P., Carrington, E., Celic, I., Choi, F., Qin, C., Dionisio, M.A., Dobroslavic, T., Galli, P., Giannetto, D., Grabowski, J.H., Helmuth, B., Lebata-Ramos, M.J.H., Lim, P.T., Liu, Y., Llorens, S.M., Mirto, S., Pecarevic, M., Pita, C., Ragg, N., Ravagnan, E., Saidi, D., Schultz, K., Shaltout, M., Tan, S.H., Thiyagarajan, V. & Sara, G. 2021. The aquaculture supply chain in the time of covid-19 pandemic: Vulnerability, resilience, solutions and priorities at the global scale. *Environmental Science & Policy* doi: 10.1016/j.envsci.2021.10.014.

Noon, M.L., Goldstein, A., Ledezma, J.C., Roehrdanz, P.R., Cook-Patton, S.C., Spawn-Lee, S.A., Wright, T.M., Gonzalez-Roglich, M., Hole,

D.G., Rockström, J. & Turner, W.R. 2021. Mapping the irrecoverable carbon in Earth's ecosystems. *Nature Sustainability* doi.org/10.1038/s41893-021-00803-6

Ortiz, L., Gamarro, H., Gonzalez, J.E. & McPhearson, T. 2021. Energy burden and air conditioning adoption in New York City under a warming climate. *Sustainable Cities and Society* doi.org/10.1016/j.scs.2021.103465

Palomino-Ángel, S., Vázquez, R.F., Hampel, H., Anaya, J.A., Mosquera, P.V., Lyon, S.W. & Jaramillo, F. 2021. Retrieval of Simultaneous Water-Level Changes in Small Lakes With InSAR. *Geophysical Research Letters* doi.org/10.1029/2021GL095950

Pereira, L.M. 2021. Follow the 'Ting: sorghum in South Africa. *Food, Culture & Society* doi.org/10.1080/15528014.2021.1984631

Pranindita, A., Wang-Erlandsson, L., Fetzer, I. & Teuling, A.J. 2021. Moisture recycling and the potential role of forests as moisture source during European heatwaves. *Climate Dynamics* doi.org/10.1007/s00382-021-05921-7

Rocha, J., Lanyon, C. & Peterson, G. 2021. Upscaling the resilience assessment through comparative analysis. *Global Environmental Change* doi.org/10.1016/j.gloenvcha.2021.102419

Sara, G., Mangano, M.C., Berlino, M., Corbari, L., Lucchese, M., Milisenda, G., Terzo, S., Azaza, M.S., Babarro, J.M.F., Bakiu, R., Broitman, B.R., Buschmann, A.H., Christofoletti, R., Deidun, A., Dong, Y., Galdies, J., Glamuzina, B., Luthman, O., Makridis, P., Nogueira, A.J.A., Palomo, M.G., Dineshram, R., Rilov, G., Sanchez-Jerez, P., Sevgili, H., Troell, M., AbouelFadl, K.Y., Azra, M.N., Britz, P., Brugere, C., Carrington, E., Celic, I., Choi, F., Qin, C., Dobroslavic, T., Galli, P., Giannetto, D., Grabowski, J., Lebata-Ramos, M.J.H., Lim, P.T., Liu, Y., Llorens, S.M., Maricchiolo, G., Mirto, S., Pecarevic, M., Ragg, N., Ravagnan, E., Saidi, D., Schultz, K., Shaltout, M., Solidoro, C., Tan, S.H., Thiyagarajan, V. & Helmuth, B. 2021. The Synergistic Impacts of Anthropogenic Stressors and COVID-19 on Aquaculture: A Current Global Perspective. *Reviews in Fisheries Science & Aquaculture* doi.org/10.1080/23308249.2021.1876633

Soininen, N., Raymond, C.M., Tuomisto, H., Ruotsalainen, L., Thoren, H., Horcea-Milcu, A.-I., Stojanovic, M., Lehtinen, S., Mazac, R., Lamuela, C., Korpelainen, N., Vainio, A., Toivanen, R., McPhearson, T. & Nagatsu, M. 2021. Bridge over troubled water: managing compatibility and conflict among thought collectives in sustainability science. *Sustainability Science* doi.org/10.1007/s11625-021-01068-w

Stange, E.E., Barton, D.N., Andersson, E. & Haase, D. 2021. Comparing the implicit valuation of ecosystem services from nature-based solutions in performance-based green area indicators across three European cities. *Landscape and Urban Planning* doi.org/10.1016/j.landurbplan.2021.104310

Stetkiewicz, S., Norman, R.A., Allison, E.H., Andrew, N.L., Ara, G., Banner-Stevens, G., Belton, B., Beveridge, M., Bogard, J.R., Bush, S.R., Coffee, P., Crumlish, M., Edwards, P., Eltholth, M., Falconer, L., Ferreira, J.G., Garrett, A., Gatward, I., Islam, F.U., Kaminski, A.M., Kjellevold, M., Kruijssen, F., Leschen, W., Mamun, A.-A., McAdam, B., Newton, R., Krogh-Poulsen, B., Pounds, A., Richardson, B., Roos, N., Röös, E., Schapper, A., Spence-McConnell, T., Suri, S.K., Thilsted, S.H., Thompson, K.D., Tlusty, M.F., Troell, M.F., Vignola, R., Young, J.A., Zhang, W. & Little, D.C. 2021. Seafood in Food Security: A Call for Bridging the Terrestrial-Aquatic Divide. *Frontiers in Sustainable Food Systems* doi.org/10.3389/fsufs.2021.703152

Tengö, M. & Andersson, E. 2021. Solutions-oriented research for sustainability: Turning knowledge into action: *Ambio* doi.org/10.1007/s13280-020-01492-9.

Tomczak, M.T., Müller-Karulis, B., Blenckner, T., Ehrnsten, E., Eero, M., Gustafsson, B., Norkko, A., Otto, S.A., Timmermann, K. & Humborg, C. 2021. Reference state, structure, regime shifts, and regulatory drivers in a coastal sea over the last century: The Central Baltic Sea case. *Limnology and Oceanography* doi.org/10.1002/lno.11975

Uusitalo, L., Blenckner, T., Puntila-Dodd, R., Skyttä, A., Jernberg, S., Voss, R., Müller-Karulis, B., Tomczak, M.T., Möllmann, C. & Peltonen, H. 2021. Integrating diverse model results into decision support for good environmental status and blue growth. *Science of The Total Environment* doi.org/10.1016/j.scitotenv.2021.150450

Books

Biggs, R., de Vos, A., Preiser, R., Clements, H., Maciejewski, K. & Schlüter, M. 2021. The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group.

Book chapters

Baird, J., Quinlan, A., Plummer, R., Moore, M.-L. & Krievins, K. 2021. Capacities for Watershed Resilience: Persistence, Adaptation, and Transformation. In: Baird, J. & Plummer, R. eds. Water Resilience: Management and Governance in Times of Change, Springer International Publishing, New York.

Biggs, R., Clements, H., Vos, A. de, Maciejewski, K., Preiser, R. & Schlüter, M. 2021. How to use this handbook. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp. 64–79.

Biggs, R., Clements, H., de Vos, A., Folke, C., Manyani, A., Maciejewski, K., Martín-López, B., Preiser, R., Selomane, O. & Schlüter, M. 2021. What are social-ecological systems and social-ecological systems research? In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp 3–26.

Biggs, R.O., de Vos, A., Preiser, R., Clements, H., Maciejewski, K. & Schlüter, M. 2021. Preface, xxvi–xxviiip. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group.

Clements, H., Esler, K., Henry, D.A.W., Mograbi, P., Norström, A. & Reynolds, C. 2021. Ecological field data collection, In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, 95–106p.

Colding, J., Marcus, L. & Barthel, S. 2021. Promoting partnership between urban design and urban ecology through social-ecological resilience building. In Ph.D. Marita Wallhagen and Dr. Mathias Cehlin (editors). Urban Transition – Perspectives on Urban Systems and Environments, IntechOpen.

Collste, D. 2021. Modeling Korpi and Palme's 'Paradox of Redistribution and Strategies of Equality'. In Cavana, R.Y., Dangerfield, B.C., Pavlov, O.V., Radzicki, M.J. & Wheat, I.D. eds. Feedback Economics: Economic Modeling with System Dynamics: Springer International Publishing.

Deutsch, L. & Troell, M. 2021. Flow and impact analysis, In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group 412–425p.

Diemer, A., Nedelciu, C.E. & Hinton, J. 2021. Social and Solidarity Economy or How Not-for Profit Organizations Participate to SDGs' Implementation? In Partnerships for the Goals (eds. W. Leal Filho, A. M. Azul, L. Brandli, A. Lange Salvia, & T. Wall), pp. 1–11. Encyclopedia of the UN Sustainable Development Goals, Springer International Publishing.

Drimie, S., Magner, C., Pereira, L., Charli-Joseph, L., Moore, M.-L., Olsson, P., Siqueiros-Garcia, J.M. & Zgambo, O. 2021. Facilitated dialogues. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.136–147.

Enqvist, J. & Ziervogel, N. 2021. Multilevel Governance for Urban Water Resilience in Bengaluru and Cape Town. In: Baird, J. & Plummer, R. eds. Water Resilience: Management and Governance in Times of Change, Springer International Publishing, New York.

Fetzer, I., Piemontese, L., Rocha, J.C. & Martín-López, B. 2021. Statistical analysis, In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.252–269.

Hichert, T., Biggs, R. & de Vos, A. 2021. Futures analysis. In: Biggs et al. (eds.) The Routledge

Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.148–162.

Hichert, T., Biggs, R., de Vos, A. & Peterson, G. 2021. Scenario development. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.163–175.

Iwaniec, D.M., Berbés-Blázquez, M., Cook, E.M., Grimm, N.B., Mannetti, L.M., McPhearson, T. & Muñoz-Erickson, T.A. 2021. Positive Futures. In: Z.A. Hamstead, D.M. Iwaniec, T. McPhearson, M. Berbés-Blázquez, E.M. Cook, & T.A. Muñoz-Erickson (eds) Resilient Urban Futures, Springer, pp.85–97.

Kininmonth, S., Gray, S. & Kok, K. 2021. Expert modelling. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.231–240.

Lade, S.J., Anderies, J.M., Currie, P. & Rocha, J.C. 2021. Dynamical systems modelling. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp. 359–370.

Lindahl, T., Janssen, M.A. & Schill, C. 2021. Controlled behavioural experiments. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.295–306.

McPhearson, T., Iwaniec, D.M., Hamstead, Z.A., Berbés-Blázquez, M., Cook, E.M., Muñoz-Erickson, T.A., Mannetti, L. & Grimm, N. 2021. A Vision for Resilient Urban Futures. In: Z.A. Hamstead, D.M. Iwaniec, T. McPhearson, M. Berbés-Blázquez, E.M. Cook, & T.A. Muñoz-Erickson (eds) Resilient Urban Futures, Springer, pp.173–186.

Ortiz, L., Mustafa, A., Rosenzweig, B. & McPhearson, T. 2021. Modeling Urban Futures: Data-Driven Scenarios of Climate Change and Vulnerability in Cities. In: Z.A. Hamstead, D.M. Iwaniec, T. McPhearson, M. Berbés-Blázquez, E.M. Cook, & T.A. Muñoz-Erickson (eds) Resilient Urban Futures, Springer, pp.129–144.

Preiser, R., Schlüter, M., Biggs, R., García, M.M., Haider, J., Hertz, T. & Klein, L. 2021. Complexity-based social-ecological systems research: philosophical foundations and practical implications. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp. 27–46.

Preiser, R., García, M.M., Hill, L. & Klein, L. 2021. Qualitative content analysis. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.270–281.

Quinlan, A., Sellberg, M. & Perrotton, A. 2021. Resilience assessment. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.205–216.

Rocha, J.C. & Daume, S. 2021. Data mining and pattern recognition. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.241–251.

Sauter, D., Randhawa, J., Tomateo, C. & McPhearson, T. 2021. Visualizing Urban Social–Ecological–Technological Systems. In: Z.A. Hamstead, D.M. Iwaniec, T. McPhearson, M. Berbés-Blázquez, E.M. Cook, & T.A. Muñoz-Erickson (eds) Resilient Urban Futures, Springer, pp.145–157.

Schlüter, M., Lindkvist, E., Wijermans, N. & Polhill, G. 2021. Agent-based modelling. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp. 383–397.

Schlüter, M., Biggs, R., Clements, H., de Vos, A., Maciejewski, K. & Preiser, R. 2021. Synthesis and emerging frontiers in social-ecological systems research methods. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp.453–479.

Scholz, G., Eberhard, T., Ostrowski, R. & Wijermans, N. 2021. Social Identity in Agent-Based Models: Exploring the State of the Art. In Springer Proceedings in Complexity, pp. 59–64.

Sitas, N., Ryan, P. & Schultz, L. 2021. Systems scoping. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp. 83–94.

Vos, A. de, Maciejewski, K., Bodin, Ö., Norström, A., Schlüter, M. & Tengö, M. 2021. The practice and design of social-ecological systems research. In: Biggs et al. (eds.) The Routledge Handbook of Research Methods for Social-Ecological Systems, Taylor & Francis Group, pp. 47–63.

Wijermans, N., Verhagen, H. & Lytter, A. 2021. An Online Implementation of a Virtual Agent-Based Experiment Tool—An Exploration. In Advances in Social Simulation (eds. P. Ahrweiler & M. Neumann), Springer Proceedings in Complexity, Springer International Publishing, pp.291–297.

Policy, practice, pre-prints, commentaries and outreach papers

Blasiak, R. 2021. Check your pockets. *Nature*, d41586-021-01808-z.

Blasiak, R. 2021. Family first. *Science* 372(6545), 1006–1006.

Blasiak, R. 2021. My first pet. *Nature*, d41586-021-02965–x.

Cornell, S. & Downing, A. 2021. Environment, absolute? The quality infrastructure of the planetary boundaries, Stockholm Resilience Centre Discussion Paper.

Folke, C. et al. 2021. Our Future in the Anthropocene Biosphere. White Paper Brief Statement. The Nobel Prize Summit 2021.

Österblom, H. & Blasiak, R. 2021. Oil licences undermine Norway's ocean leadership. Nature 590(7847), 551.

Sumaila, U.R. et al. 2021. WTO must ban harmful fisheries subsidies. Science 374(6567), 544.

Blasiak, R. 2021. Family first. Science 372(6545), 1006–1006.

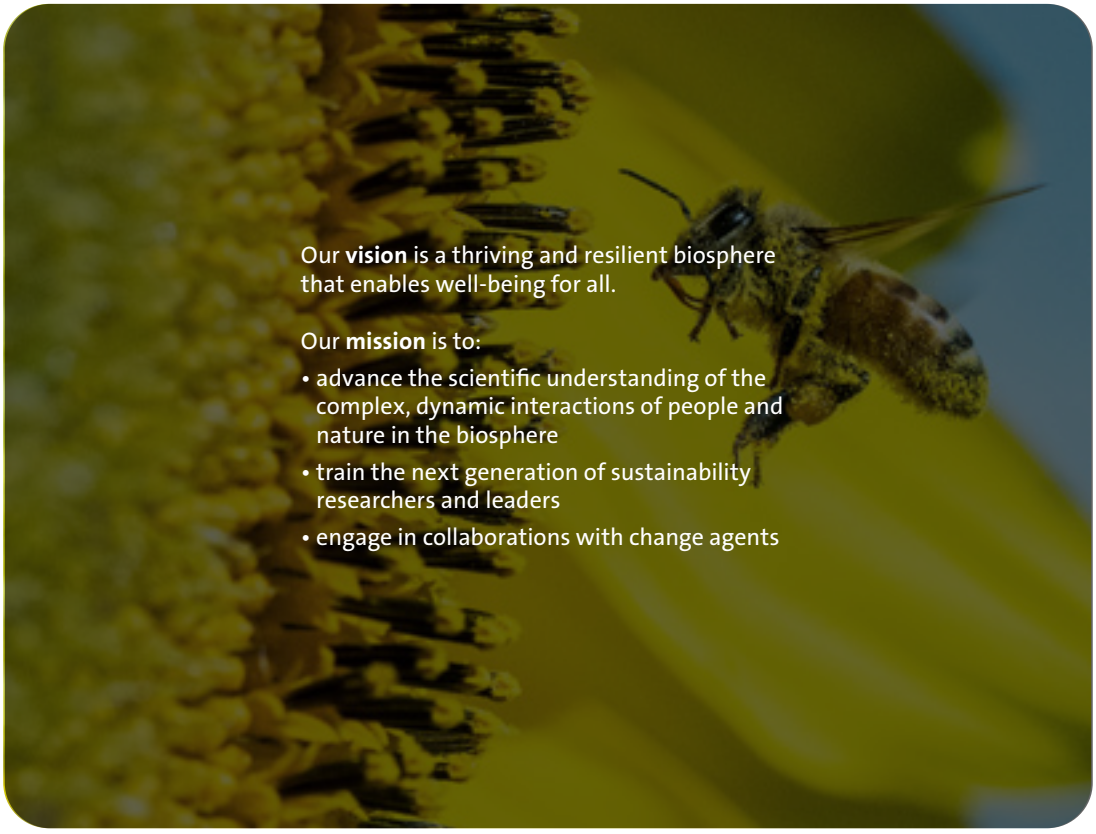
Blasiak, R. 2021. My first pet. Nature, d41586-021-02965–x.

Cornell, S. & Downing, A. 2021. Environment, absolute? The quality infrastructure of the planetary boundaries, Stockholm Resilience Centre Discussion Paper.

Folke, C. et al. 2021. Our Future in the Anthropocene Biosphere. White Paper Brief Statement. The Nobel Prize Summit 2021.

Österblom, H. & Blasiak, R. 2021. Oil licences undermine Norway's ocean leadership. *Nature* 590(7847), 551.

Sumaila, U.R. et al. 2021. WTO must ban harmful fisheries subsidies. *Science* 374(6567), 544.



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