

Research funded by the Ebba and Sven Schwartz Foundation

Stockholm Resilience Centre
Sustainability Science for Biosphere Stewardship



Scientific output, training and policy influence 2011-2015



Research at the Stockholm Resilience Centre and the Beijer
Institute of Ecological Economics funded by the Schwartz
Foundation (Ebba och Sven Schwartz Stiftelse)

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Chair's preface



Ebba and Sven Schwartz

Ebba and Sven Schwartz Foundation: from basic biological research to applied sustainability science

The founders, Ebba and Sven Schwartz, both had a great interest in ecology, particularly focused on animals and nature conservation. Ebba Schwartz had worked as a teacher and Sven Schwartz was a mining engineer, executive president of Boliden AB and twice elected chairman of The Employers Federation in Sweden. The foundation was initiated already in 1983 but did not distribute grants until 1996, after Ebba Schwartz had passed away. The first ten years were mostly devoted to funding projects within basic biological sciences, but the foundation has subsequently widened its scope to include more applied and societally relevant research.

Today, the foundation predominantly supports research that investigates the ecological interactions between plants, animals and people and thus enables the conservation of biodiversity and sustainable development. Against this backdrop, the foundation was very pleased to encounter Carl Folke who asked whether the foundation would be willing to support their research. Together with Carl the foundation identified the need for supporting mid-level scientists in a phase of their research careers where they often get caught in writing applications rather than doing research.

The three ambitious researchers who have received funding from the foundation all strive to produce knowledge that helps people take into account the dynamics of ecosystems in decision making, so that the biosphere's capacity to support

societal development can be secured. Anne-Sophie Crépin's research examines the policy impact of sudden changes in ecosystems (called regime shifts) for human welfare. Line Gordon focuses on the interactions between water, agriculture and ecosystem services, particularly in poor and dry parts of the world. Lisen Schultz explores how nature conservation can be designed to strengthen the capacity of ecosystems to produce goods and services in a changing world.

It is a great pleasure to learn that the funding has made possible important steps in these three women's individual careers and lead to major outputs in terms of outstanding scientific publications, education and policy relevant recommendations. In addition, the three researchers have made extra efforts to popularise and communicate their research results to a wide range of target groups outside academia.

All in all, the foundation takes great pleasure in having contributed to strengthen an integrated, ambitious and leading research and educational agenda during the past five years. May there be many more productive years to come.

Claes Felländer, Chairman of the board of Ebba and Sven Schwartz Foundation



Director's view



Carl Folke

To remain a leading hub in sustainability science, we must work to ensure that more young scholars not only excel academically, but also receive the early support needed to succeed in building their careers in a resilient fashion. In light of this, we are extremely grateful that the foundation Ebba och Sven Schwartz Stiftelse decided to support the Beijer Institute and Stockholm Resilience Centre (SRC) through a career grant to our three skilled mid-level researchers Anne-Sophie Crépin, Line Gordon and Lisen Schultz.

The overall focus of the grant is to find ways to allow people to account for biosphere support and ecosystem services in decision making. Concerning things like economic theory, freshwater in agriculture, and stewardship of ecosystem services in dynamic landscapes and seascapes the projects are both academically interesting and of significance for practice and policy. Everything from the climate resilience of Arctic ecosystems to the value of tropical mangrove forests for storm protection have been investigated by these three researchers. Not to mention the management and governance of cultural landscapes in Kristianstad, Sweden, and water and poverty in the Sahel.

Nowadays scholars, such as these researchers, recognise that the environment in all corners of the earth is shaped by people and that people at the same time are fundamentally dependent on the work of nature for wellbeing. This was not the case a few decades ago. At that time, many ecologists in their work acted as though humans did not exist and economists acted

as though nature did not exist. Nowadays, it has become obvious that our economies and societies are embedded parts of the biosphere and that the resilience of the forests, oceans and other ecosystems in sustaining our own development is at stake. As a consequence, stewardship reconnecting social-ecological systems to the biosphere is essential for prosperous societal development. This is at the heart of the research at the SRC and the Beijer Institute, which the Schwartz foundation has supported through their generous grant.

I am really impressed by these three researchers, how they, through the career grants from the Schwartz foundation, have contributed with deeper understanding of the interplay between ecological systems and social and economic development.

There is still a lot of unbroken ground to be explored and understood for improved knowledge generation with practice for policy. Our strength lies in combining a long-term research focus, providing new insights and forming new research frontiers, with selected efforts highlighting the new understanding and supporting its implementation in society. With the assistance of the Schwartz grant we hope to continue contributing to a better understanding of social-ecological systems in decision making.

Carl Folke, Science Director of the Stockholm Resilience Centre and the Director of the Beijer Institute of Ecological Economics



Research highlights

The research supported by the Schwartz grant aims to contribute to a better understanding of how to govern social-ecological systems. Below we highlight some of the research insights and their policy implications. Numbers in the text refer to scientific publications in the publication list.

Research funded by the Schwartz foundation is integrated in the overall research agenda of the Stockholm Resilience Centre (SRC) and the Beijer Institute. It is based on the understanding that our societies are integral parts of the *biosphere*, that relatively thin life-supporting layer of the Earth's surface. This means that people in all societies and across the globe are fundamentally dependent on the biosphere for development and wellbeing, and that we shape it in order to enhance the benefits (so called ecosystem services) we need, such as food, clean water and a hospitable climate.

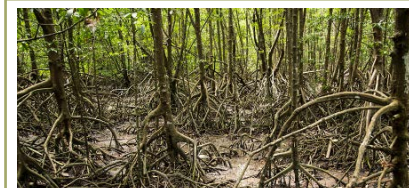
Reshaping the biosphere in these ways can cause unintentional trade-offs between the benefits we know we desire, and the benefits that we might not be aware that we depend on. Understanding the generation of ecosystem services, how they support human wellbeing, and how to deal with trade-offs is fundamental for societal development and therefore also in developing the agenda for how to address the recently adopted Sustainable Development Goals (**Box A**). The Schwartz funded research has developed tools to analyse how ecosystem services contribute to human well-being and deal with trade-offs related to different land use changes. A particular contribution has been tools for data poor regions with high levels of poverty and a strong direct dependence on the landscapes [2].

Demand for ecosystem services is globally increasing, whereas the reliability of the capacity of ecosystems to generate them in many areas and aspects has been decreasing. Rapid climate change, including increasing risk of droughts, floods and storms, highlights the importance to maintain ecosystem processes that build the resilience of ecosystem services. A resilient ecosystem is one that can withstand changes and continue to develop despite being disturbed, e.g. coastal mangrove forests that can cope with storms and protect coastal villages in the process (**Box B**) or an Arctic Ocean that can continue to provide essential ecosystem services like abundant



Box A: Biosphere stewardship key for successful global goals

The United Nation's global goals for sustainable development must embrace the concept of social-ecological systems, seeing people and the biosphere as integrated parts of a whole rather than as separate systems, study shows [1].



Box B: Mangroves – a good investment

Study proves that mangroves provide invaluable protection to houses in coastal villages that are hit by cyclonic winds, even relatively far away from mangroves and the coast. The value of mangroves in reducing house damage amounted to approximately US \$ 177 per hectare [4].

fisheries despite substantial sea ice melt and development of other economic activities [5, 6, 7].

Social-ecological systems (SES) is a term used to describe the integration of humans and nature – and how inextricably they are linked. SES are complex and adaptive and can change rapidly and irreversibly, in so called regime shifts. The risk of regime shifts require substantially different decision-making processes, institutions and management approaches (Box C).

Regime shifts have been shown to occur from local to global scales and across all types of systems. Consistent and strategic management of water resources is one of the keys for maintaining and enhancing the resilience of social-ecological systems and avoid negative regime shifts (Box D).

We now live in the Age of Humans (Anthropocene), where humans change the biosphere on a planetary scale (e.g. climate change) and where we increasingly need to be stewards of the whole biosphere (Box E). We also increasingly understand how human activities that alter ecosystems in one geographic location can affect humans and the environment in another. One so-called teleconnection, which has been studied within the Schwartz project, is when human-caused changes to landscapes in one country can significantly impact the amount of rain that falls in another country (Box F). Over 500 million people globally live in dry regions and rely solely on rainfall to grow their food. Any changes to this rainfall can trigger regime-shifts in the agricultural system and have dramatic consequences for their livelihoods [12, 13, 14].

Moreover, research within the project has shown that potential regime shifts in people's resource base tend to influence their ability to cooperate to manage resources (Box G). In particular if management itself can trigger a regime shift people tend to be more careful when they manage a particular resource collectively. When a resource can undergo a regime shift, people who are collective stewards of the resource can sometimes manage it better than if they just need to comply to a safe standard in the form of a harvest quota set by a regulator [16].

Implications for management and governance

Resilience is all about dealing with change and adapting and transforming in response to change. Because social-ecological systems are always in development there is a constant need to revise existing knowledge to enable adaptation to change and successful management of natural capital (Box H). Approaches like

Box C: Complexity motivates new management approaches

Economic models of management need to be revised to better integrate regime shifts and human behaviours [21]. Regime shifts in particular require management strategies that can improve ecosystem resilience as well as the resilience of the management system itself [22].

Box D: Humans need to better manage the full water cycle for resilience

By identifying and understanding how humans alter the water cycle we can find leverage points that improve both resilience and ecosystem services that provide prosperity for longer and for more people [1, 9, 10, 13, 23].

Box E: We must all become planetary stewards – no more business as usual

We are the first generation with the power and responsibility to change our relationship with the planet, study shows [11].



Box F: What goes up must come down

A new model was developed within the scope of a Schwartz-financed research project [14]. The model can estimate global water flows from land to atmosphere, and can be used for tracking land use change impact on rainfall [12].

Box G: Perceived risk of ecosystem regime shifts influences behaviour

Risk of regime shifts appears to have a positive effect on collective action. People are more careful and do not overexploit resources to the same extent as they do when there is no or low risk of a regime shift [15].

adaptive management, adaptive co-management and adaptive governance all focus on learning as an integral part of decision making and base their strategies on the fact that knowledge is incomplete and that uncertainty, change and surprise play an important part in managing social-ecological systems [6].

Research at the Stockholm Resilience Centre and the Beijer Institute has over the years shown that adaptive management and precautionary approaches are good strategies for dealing with uncertainty. Adaptive management is based on a learning process that aims to find the best short-term outcome whilst improving long-term management of a system. It is learning by doing through testing out alternative management approaches. Adaptive co-management focuses on learning by doing but has more explicit emphasis on knowledge sharing between different actors, often from communities and policy-making [18].

Broadened participation

Adaptive governance focuses on boosting learning through knowledge sharing across scales in order to bridge various organizations and institutions. This cross-scale focus on learning is pursued in order to develop new social norms and cooperation. There is a growing recognition of the importance of broader participation in order to stimulate learning among different groups in society [7].

Research done in “Kristianstads Vattenrike” clearly shows the importance of broad participation. This wetland area in the southern part of Sweden experienced growing developmental pressures and increasing degradation of what was considered a vast area of water logged swamps with low value. However, thanks to knowledge sharing and collaboration between local inhabitants and politicians, the perception of the wetlands changed. Values were restored in collaboration with farmers, and the area is now appreciated for a range of ecosystem services, including recreation [19].

All in all, insights from the research within the Schwartz funded projects show that learning and experimentation through adaptive and collaborative management is an important mechanism for building resilience in social-ecological systems. It ensures that different types and sources of knowledge are valued and considered when developing solutions, and leads to greater willingness to experiment and take risks. Resilience thinking is increasingly important in science, practice and policy. With a rapidly growing theoretical base the research at the SRC and the Beijer Institute has also been able to distil a set of key principles that builds resilience of ecosystem services (Box I).



Box H: Adaptive governance enhances natural capital

A comparison between governance of Kristianstads Vattenrike, The Great Barrier Reef, and Southern Ocean fisheries found similar keys to success, supporting both people and ecosystems [17].



Box I: Seven principles for resilient ecosystem services

The key principles for enhancing the resilience of ecosystem services in social-ecological systems are: Managing diversity, connectivity and feedbacks, fostering participation, learning and complex systems understanding, and promoting multiple centres of decision-making [20].



Interviews

Anne-Sophie Crépin

Anne-Sophie Crépin, PhD, Deputy Director at the Beijer Institute and theme leader at the Stockholm Resilience Centre

What has the Schwartz funding meant for you as a researcher?

The Schwartz funding has given me the opportunity to think about my own research with a longer term perspective and organize my different projects in a more coherent way. It has also allowed me to free some other funds that I could use to finance colleagues and PhD students working with me on common projects. Such a project studied for example how resource users behave when abrupt change can transform their resource base so that the resource does not grow as much as it used to.

How have you developed during these years?

I have evolved from being a researcher that mostly focused on my own research to leading several transdisciplinary research projects in collaboration with other researchers. I have also learned a lot about how to communicate research questions and results to a non-scientific audience. I have learned to package my research and findings in a much more coherent way, which is easier to motivate and communicate. I am very grateful for all the encouraging and constructive feedback that I received during the regular meetings we had with the board of the Schwartz Foundation.

What role has the SRC/Beijer played?

Both Beijer and the SRC have been instrumental for my development as a researcher. At the Beijer Institute I found a home where I could push forward research on interactions between socio-economic and ecological aspects together with other scientists interested in similar issues. Karl-Göran Mäler, the former director and my PhD supervisor, and Carl Folke have both introduced me to the top researchers in different fields including several Nobel Laureates. They helped me

build my own huge network of scientific acquaintances that I can leverage when needed. They also showed me that excellent research could be performed while still being kind to other people and having fun. My work at Beijer also enabled me to be part of the SRC and help form this new centre from the very beginning together with other scholars of my generation and under the leadership of two fantastic and stimulating leaders such as Carl Folke and Johan Rockström.

What do you view as the scientific highlight during these years?

The Schwartz project allowed me to take a huge step toward a more comprehensive theory of the role of regime shifts in ecosystems and how they affect people who use the goods and services that the ecosystems provide. Under the Schwartz project I have produced a comprehensive overview of the impacts of regime shifts on management and economics. I have contributed to building a new empirically based theory about people's behavior when faced with regime shifts. I have also contributed to the analysis of social-ecological interactions and the risk of regime shifts at the global level.

Which are the most policy-relevant results that have come out of your research?

- a) People faced with potential regime shifts tend to manage a common resource in a more efficient way than if such a threat did not exist.
- b) Based on my own research and other's findings, I have started compiling an overview of what kinds of policy instruments that perform best under different situations of regime shifts. I presented that overview at a seminar held at the Collège de France in Paris, in December 2015.



Line Gordon

Line Gordon, PhD, Associate Professor and Deputy Science Director at the Stockholm Resilience Centre

What has the Schwartz funding meant for you as a researcher?

It has been of fundamental importance as it has given me great freedom to evolve as a researcher and be more independent and innovative, doing research that perhaps has been a bit more risky. It has also meant that I have had my own salary secured and hence the opportunity to seek funding for PhD students and Post-Docs and, together with them, initiate own research projects.

How have you developed during these years?

I have had the privilege to develop my leadership skills during these years, becoming both a docent (associate professor) and Deputy Science Director at the SRC.

What role has the SRC/Beijer played?

The SRC provides a unique, international, multidisciplinary environment for collaborative research. Researchers from all over the world can work together in a very open and creative space, doing innovative things. The centre has numerous contacts with high-level institutions all over the world which means that many doors are open to us researchers. Also, in most other academic environments you are judged by a specific discipline. It can be very tiresome having to defend your transdisciplinary research against a specific field of research – although transdisciplinary research always has to have a firm connection to the findings in specific disciplines. At the SRC you are not judged in the same way and there are many degrees of freedom and an open attitude.

What do you view as the scientific highlight during these years?

I have developed research about moisture recycling, showing how land use affects rain patterns in different parts of the world. It is an extremely complex project trying to understand how large-scale land use change affects atmospheric processes and social-ecological resilience. I have established a fruitful collaboration with both Delft University of Technology and the Potsdam Institute of Climate Change, and with the help of my amazing PhD students, we have been able to analyse these really interesting topics. And then there is the Sahel project where we have looked at how people manage ecosystem services for enhanced livelihoods, in a region that really needs its resilience.

Which are the most policy-relevant results that have come out of your research?

I think both my involvement in the Stockholm Water Week, sitting on their Scientific Program Committee for several years, and the collaboration with the Stordalen Foundation and the EAT-initiative. I have over the last year been very engaged in the EAT-initiative that links science, policy and business in the fields of food, sustainability and health. The research we are starting in this initiative is of fundamental importance for ensuring healthy people while securing a sustainable planet.



Lisen Schultz

Lisen Schultz, PhD, Research Fellow at the Stockholm Resilience Centre

What has the Schwartz funding meant for you as a researcher?

Thanks to this long-term funding I have been given a unique chance to develop my own research niche, building on the questions that my PhD research generated as well as generating new ones. Not having to worry about my own employment has freed up time and energy to focus on the content of my research, to support my PhD student and my master students, to develop international collaborations, and to communicate our findings to policy-makers, practitioners and the public. The regular discussions with the Schwartz board has helped me stay on track with my research questions, maintain relevance to society, and sharpen my communication skills. Without the Schwartz grant I would not have been where I am today as a researcher.

How have you developed during these years?

I have improved my skills and competences with regards to research methods, such as comparative analyses, questionnaire development, interviewing, and workshop facilitation. I have also developed my teaching, my way of lecturing and supervising students. In essence, I have expanded my scope and developed my leadership skills, from leading my own research only, to facilitating and supporting a whole team of researchers.

What role has the SRC/Beijer played?

Working in a trans-disciplinary and collaborative research environment has helped me both define interesting, policy-relevant research questions, to develop innovative methods

of responding to these, and understanding my findings in a larger context. The SRC attracts top researchers from all over the world, bringing with them new insights and inspiration, and the advantage of having such a group of people to discuss your research with is enormous. Being part of the SRC has sharpened both the quality and the usefulness of my research.

What do you view as the scientific highlight during these years?

That would be the publication in PNAS (Proceedings of the National Academy of Sciences) which came out in June 2015, on adaptive governance, ecosystem management and natural capital. In it, we made a unique comparison between three cases across the world, where adaptive governance have emerged and evolved during several years. We showed that in these cases, adaptive governance increased both natural capital and the capacity to deal with new challenges.

Which are the most policy-relevant results that have come out of your research?

The seven principles that foster resilience in social-ecological systems, which came out of a process run by the Resilience Alliance Young Scholars that I was part of, have received a lot of attention and interest from practice and policy. For example, they have recently been used in a round-table discussion on EU innovation policy. I contributed to developing the overarching framework for these principles, and developed two of the principles further.



Lisen Schultz opening the yearly seminar of the Pontus Schultz Foundation, bringing together 300 CEOs, decision-makers, experts and change makers in Sweden to advance sustainability, diversity and gender equality in business. Photo: Peter Jönsson





Policy & Outreach

The funding from the Schwartz Foundation has not only lead to outputs in terms of scientific publications, it has also resulted in policy relevant recommendations and communication efforts to a wide range of target groups outside academia. These policy and outreach efforts are all part of an overall ambition at the SRC and the Beijer Institute

to bridge knowledge emerging from the scientific process with policy, society and practice. This engagement in science-policy-practice activities has increased steadily over the years, and range from high-level UN dialogues and courses for practitioners in UNESCO biosphere reserves via meetings with ministers to local resilience assessments.



In November 2013, Crown Princess Victoria of Sweden visited the SRC for a full day to learn about resilience and sustainability. Line Gordon and Lisen Schultz shared their research on food security and ecosystem management.



Anne-Sophie Crépin presenting her assessment of the report at the Dialogue on OECD's Environmental Performance Review of Sweden at the Swedish Ministry of the Environment, Rosenbad, with Lena Ek, Simon Upton, Michael Treschow, Per Engdahl, and Håkan Wirtén (not in picture), 11 June 2014.



Line Gordon during a presentation on water and resilience at the conference "Water for Food" 2013 in Nebraska, USA.



Stockholm Resilience Centre invited two ministers (Helene Hellemark Knutsson and Margot Wallström) and three business leaders (Leif Johansson, Hans Enocson and Johan Eliasson) for a dinner to discuss how to make Sweden a leader in Sustainability, 25 August 2015.



Anne-Sophie Crépin moderating a seminar session on Global Dynamics, Multiple Shocks and Resilience - Planetary Stewardship, catastrophic shifts and the Earth system 27 May 2013 at the Royal Swedish Academy of Sciences in Stockholm. The speaker is Jeroen van den Bergh from Universitat Autònoma de Barcelona in Spain.



During 2015, an EU high-level think tank focusing on innovation policy invited the SRC to contribute knowledge on resilience. Lisen Schultz shared her research in two round table discussions in Brussels and Stockholm.



Participants at the Inconvenient feedbacks in global dynamics Workshop II, September 14-15, 2011. Anne-Sophie Crépin organised the meeting together with Brian Walker and Steve Polasky. Line Gordon participated at the meeting.

Fostering a new generation

The grant from the Schwartz Foundation has not only benefitted the researchers funded directly. Fostering the next generation of sustainability scientists has been a core activity of the three researchers, including supervision of PhD and master's students as well as lecturing, teaching and developing courses in a number of different contexts.

Line Gordon has supervised four PhD-students (Hanna Sinare, Rebecka Malinga, Patrick Keys and Lan Wang Erlandsson) of which three are defending their theses in 2016. She has also been the supervisor of five master's student projects. Line has lectured in several different courses both at Stockholm University and elsewhere.

Anne-Sophie Crépin has supervised three doctoral students. Gustav Engström successfully defended his PhD thesis in 2012 at the department of Economics at Stockholm University. Caroline Schill successfully defended her Licenciante thesis in October 2015 and will defend her PhD thesis in 2017 at the Stockholm Resilience Centre. Daniel Ospina started his PhD work during the fall of 2014. Anne-Sophie Crépin has

also organized and lectured courses at the SRC's master's programme, the research school of Stockholm University's Economics department, two summer research schools on the Arctic, as well as two courses for researchers from developing countries.

Lisen Schultz is main supervisor of PhD student Simon West, who defended his licentiate June 5, 2015 and co-advisor of PhD student Anna Helgeson, who started in 2015. She is also main supervisor of master's student Claudia Florencio, who started in 2015. She has been the main supervisor of five master's students who have finished their theses and co-advisor of an additional four master's students who have finished their theses.

Her teaching involves developing and giving courses on resilience assessments, adaptive governance, and ecosystem services. She has lectured for students at all levels, from basic to PhD, and educated business leaders as well as policy-makers and biosphere reserve managers. She has also produced several short video lectures for the web.

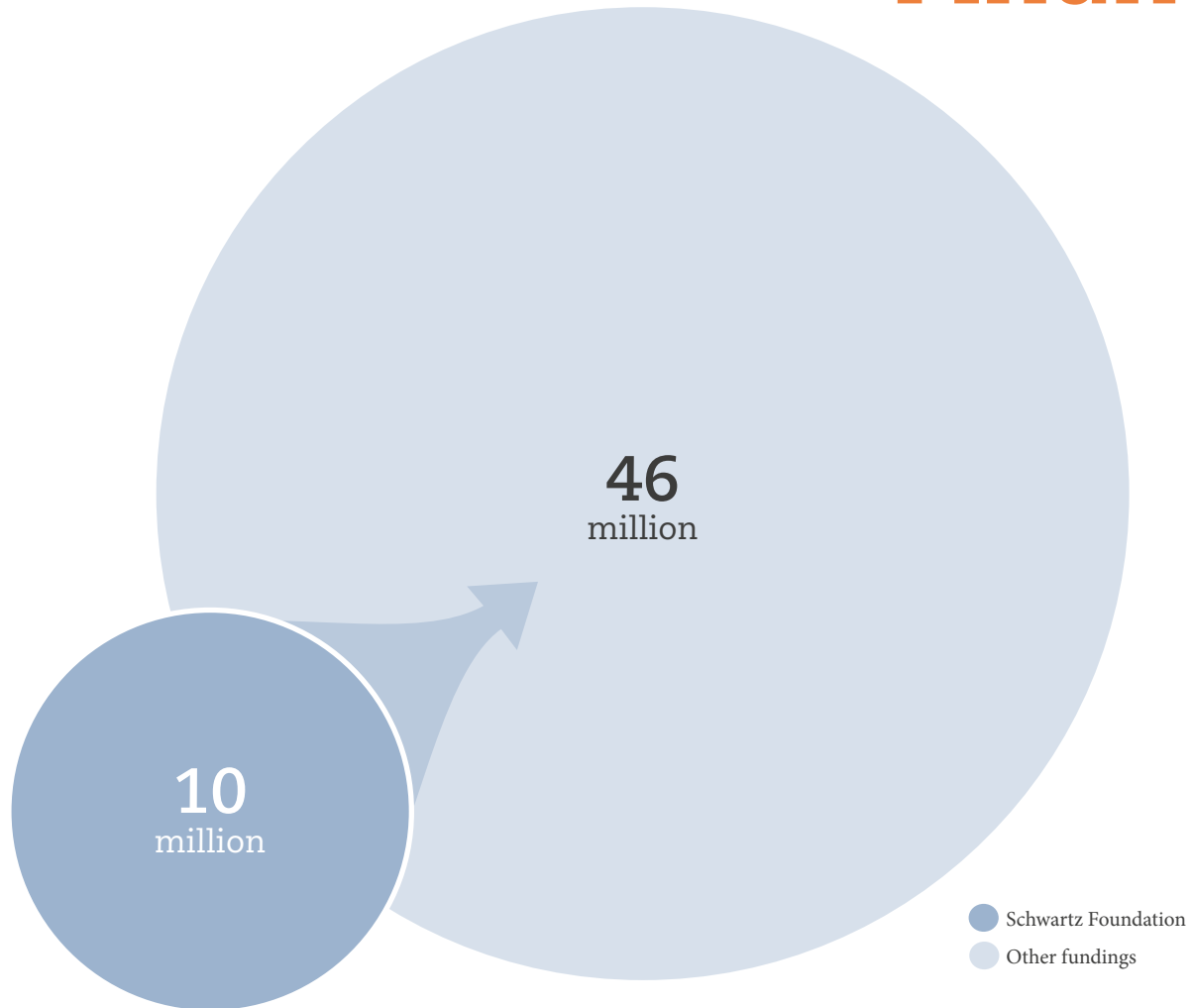


Anne-Sophie Crépin with course participants and teaching colleagues for the course Ecosystems, ecosystem services and economics, coorganised by Anne-Sophie and held in March 2014 at the Royal Swedish Academy of Sciences as part of the PhD programme in Environmental and climate economics at Gothenburg University.



Anne-Sophie Crépin leading a group exercise at the workshop on Policies for resilience and development in the Anthropocene, 20-21 October 2014, Dar es Salaam Tanzania.

Finance



The three researchers have received approximately 10 million SEK from the Schwartz Foundation and been involved in successful applications generating some 46 million SEK in additional funding from Vinnova, Vetenskapsrådet (Swedish Research Council), Naturvårdsverket (Swedish Environmental Protection Agency), Formas, Bioversity International, CGIAR Research Program on Water, Land and Ecosystems, European Commission, Riksbankens Jubileumsfond and SIDA.

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Line Gordon

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[5] Biggs R, Gordon, L. J., Raudsepp-Hearne, C., Schlüter, M. and B. Walker. 2015. Principle

3 – Manage slow variables and feedbacks. In *Principles for Building Resilience: Sustaining Ecosystem Services in Social-Ecological Systems*. R Biggs, M Schluter, ML Schoon (eds). Cambridge University Press.

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[11] Steffen, W., Persson, Å., Deutsch, L., Zalasiewicz, J., Williams, M., Richardson, K., Crumley, C., Crutzen, P., Folke, C., Gordon, L., et al. 2011. The Anthropocene: From Global Change to Planetary Stewardship. *Ambio* 0044-7447. Doi: 10.1007/s13280-011-0185-x.

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[10] Mård Karlsson, J., Bring, A. Peterson, G. D. Gordon L. J. and G. Destouni. 2011. Opportunities and limitations to detect climate-related regime shifts in inland Arctic ecosystems through eco-hydrological monitoring *Environ. Res. Lett.* 6

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Boelee, E., Atapattu, S., Barron, J., Bindraban, P., Bunting, S.W., Coates, D., Descheemaeker, K., Eriyagama, N., Finlayson, M., Gordon, L., Khaka, E., Lloyd, G.J., Molden, D., Muthuri, C., Nguyen-Khoa, S., Peden, D., Pert, P., Sinclair, F., Solowey, E., Sanford, L., Stentiford, D. and L. Thiombiano. 2011. Ecosystems for water and food security, Working Papers, World Agroforestry Centre, Library Department.

CGIAR Research Program on Water, Land and Ecosystems (WLE). 2014. Ecosystem services and resilience framework. Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Research Program on Water, Land and Ecosystems (WLE). 46p. doi: 10.5337/2014.229

Lisen Schultz

West, S., Cairns, R. and L. Schultz. What constitutes a successful biodiversity corridor? A Q-study in the Cape Floristic Kingdom, South Africa. Manuscript

West, S., Schultz, L. and S. Bekessy. Adaptive management as knowledge work: narrating the practice of learning-by-doing. Manuscript

[9] Schultz, L., Folke, C., Österblom, H. and P. Olsson. 2015. Adaptive governance, ecosystem management, and natural capital. *Proc. Natl. Acad. Sci. USA* 112 (24) 7369–7374

West S. and L. Schultz. 2015. Learning for resilience in the European Court of Human Rights: Adjudication as an adaptive governance practice. *Ecology and Society* 20(1): 31

[19] Green, Odom, O., Schultz, L., Nekoro, M. and A. S. Garmestani. 2015. The Role of Bridging Organizations in Enhancing Ecosystem Services and Facilitating Adaptive Management of Social-Ecological Systems. In Allen, C. and Garmestani, A. (eds) *Adaptive Management of Social-Ecological Systems*. Pp 107-122.

[6] Cundill, G., Leitch, A., Schultz, L. and D. Armitage. 2015. Principle 7. Encourage learning and experimentation. In Biggs, R. Schluter, M. and M. Schoones (eds) *Principles for Building Resilience. Sustaining Ecosystem Services in Social–Ecological Systems*. Cambridge University Press.

[7] Leitch A., Cundill G., Schultz L. and C. Meek. 2015. Principle 6. Broaden participation. In Biggs, R. Schluter, M. and M. Schoones (eds) *Principles for Building Resilience. Sustaining Ecosystem Services in Social–Ecological Systems*. Cambridge University Press.

[18] Plummer, R., Schultz, L., Armitage, D., Bodin, Ö., Crona, B. and J. Baird. 2014. Developing a diagnostic approach for adaptive co-management and considering its implementation in biosphere reserves. *Beijer Discussion Paper* 245.

[20] Norström, A. V., Dannenberg, A., McCarney, G., Milkoreit, M., Diekert, F., Engström, G., Fishman, R., Gars, J., Kyriakopoulou, E., Manoussi, V., Meng, K., Metian, M., Sanctuary, M., Schlüter, M., Schoon, M., Schultz, L. and M. Sjöstedt. 2014. Three necessary conditions for establishing effective Sustainable Development Goals in the Anthropocene. *Ecology & Society* 19.

Norström A.V., Metian, M., Schlüter, M., Schultz, L., Dannenberg, A., McCarney, G., Milkoreit, M., Diekert, F., Engström, G., Gars, J., Sanctuary, M., Fishman, R., Kyriakopoulou, E., Sjöstedt, M., Manoussi, V., Meng, K. and M. Schoon. 2013. Policy: Social change vital to sustainability goals. *Nature*, 498

Westley, F.R., Tjornbo, O., Schultz, L., Olsson, P., Folke, C., Crona, B. and Ö. Bodin. 2013. A theory of transformative agency in linked social-ecological systems. *Ecology and Society* 18(3): 27

[17] Biggs, R., Schlüter, M., Biggs, D., Bohensky, E. L., BurnSilver, S., Cundill, G., Dakos, V., Daw, T. M., Evans, L. M., Kotschy, K., Leitch, A. M., Meek, C., Quinlan, A., Raudsepp-Hearne, C., Robards, M. D., Schoon, M. L., Schultz, L., and P. C. West. 2012. Toward Principles for Enhancing the Resilience of Ecosystem Services. *Annual Review of Environment and Resources*, Vol. 37: 421–448

Carpenter, S.R., Folke, F., Norström, A., Olsson, O., Schultz, L., Agarwal, B., Balvanera, P., Campbell, B., Castilla, J.C., Cramer, W., DeFries, R., Eyzaguirre, P., Hughes, T.P., Polasky, S., Sanusi, Z., Scholes, R. and M. Spierenburg. 2012. Program on ecosystem change and society: an international research strategy for integrated social-ecological systems. *Current Opinion in Environmental Sustainability* 4:1-5

Schultz, L., Duit, A. and C. Folke. 2011. Participation, adaptive co-management and management performance in the World Network of Biosphere Reserves. *World Development* 39(4): 662–671

Selected presentations

Anne-Sophie Crépin

Invited/Keynote presentations at international conferences

2015 Invited Plenary lecture at the Luleå Technical University PhD workshop in economics, Sigtuna, Sweden. 17 January 2015

2014 Invited keynote lecture at the Efd conference in Dar es Salaam, Tanzania. 22 October 2014

2013 Invited seminar at the department of economics, University of Umeå, Sweden, 17 October 2013

Other oral presentations at conferences

2014 Dialogue on OECD:s Environmental Performance Review of Sweden, Swedish Ministry of the Environment, Rosenbad, Stockholm Panel participant with Lena Ek, Simon Upton, Michael Treschow, Per Engdahl, and Håkan Wirtén, 11 June 2014

2011 The Arctic and the EU, Stockholm. Invited presentation. Conference organized by the French Embassy in Sweden and Finland, the Stockholm Association of International Affairs and the University of Lapland, 31 May 2011

2011 Invited presentation at the Stakeholder workshop organized by Mistra Arctic Futures and the Canadian Embassy in Stockholm, March 2011

Active participation in international conferences and workshops

2015, 2014, 2012, 2011 EAERE-AERE (The European Association of Environmental and Resource Economists) in Rome, Prague, Istanbul, Helsinki.

2013, 2012 Ulvö conferences on Environmental Economics, Sweden.

2014 Askö meeting on "Social Norms, Multiple Equilibria, and the Environment", Askö, Sweden. 13-15 Sept 2014

2014 Workshop on Behaviour Economics and Nature Network, Stockholm Sweden. 2-5 June 2014

2014 Workshop on Complex systems, plenary presentation, Stockholm Sweden. 27-29 Apr 2014

2013 Askö meeting on "Geoengineering, Thresholds, and the Anthropocene", Askö Sweden. 14-16 Sept 2013

2013 Fourth workshop on Global dynamics and resilience, workshop organizer. 27-29 May 2013

2012 Askö meeting on "Diversity, simplification, and tipping points –efficiency versus security in global food production", Askö Sweden. 8-10 Sept 2012

2011 Third workshop on Global dynamics and resilience, workshop organizer. 21-22 Sept 2011

2011 Askö meeting on "Food security and aquaculture development in a globalized world - links and tradeoffs between marine and terrestrial production systems", Askö Sweden. 17-19 Sept 2011

2011 The Arctic and the EU, Stockholm. Invited presentation. 31 May 2011

2011 Stakeholder workshop organized by Mistra Arctic Futures and the Canadian Embassy in Stockholm, Plenary presentation. March 2011

2011 Arctic Frontiers conference on Arctic Tipping Points in Tromsø Norway, Invited presentation and part of the convening committee. 26-28 Jan 2011

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Invited/Keynote presentations at international conferences

2015 The essential role of ecology in the Anthropocene; a call for bridging disciplines. Session on Staying in The Same Place or Lagging Behind? Paths and Obstacles for Critical Innovation in Ecology at 13th European Ecological Federation (EEF) and 25th Italian Society of Ecology's conference Rome, 2015

2015 Opening Keynote on Design in the Anthropocene. At the conference Design Ecologies, Challenging anthropocentrism in the design of sustainable futures. Nordes conference. Konstfack – University College of Arts, Crafts and Design. Stockholm, Sweden 7 –10 June 2015

2012 Invited Keynote on Can ecosystem services help build resilience into agriculture in a session at British Ecological Society of America Annual Meeting in Brighton 19 December 2012

Other oral presentations at conferences

2015 Debate on sustainable intensification of agriculture. World Water Week, Stockholm, 23 August 2015

2015 Ecosystems and Society. SSEESS Conference on Future Earth in Sweden. 26 November 2015

2012 Transformations of water governance: implications of putting the bloodstream perspective in operation at Stockholm Water Week Symposium, special session on Safeguarding Water Resilience for Food Security in the Anthropocene, 26 August 2012

Active participation in international conferences and workshops

2015 Workshop on Social-ecological approaches to development planning. Stellenbosch, South Africa. 6-7 November 2015

2015 Askö meeting. Keystone Actors in the Anthropocene. Organised by Beijer Institute of Ecological Economics. 12-14 September 2015

2015 EAT Forum. Organised discussions in one of the Competence Forum. June 2015

2015 EAT Metrics workshop, Stockholm Resilience Centre, Stockholm. 29-30 June 2015

2015 NCEAS Workshop on Indicators for SDGs, Santa Barbara, USA. February 2015

2014 Stockholm Workshop on Natural Capital & Resilience: Frontiers in Research, Tools, Policy and Practice, Beijer Institute of Ecological Economics, Swedish Royal Academy of Sciences, Stockholm, 2-6 February 2014

2014 Workshop on "The link between trees, water and food security – Trade-off or synergy for livelihoods in complex tropical landscapes?". Organized by Swedish Agricultural University, November 2014

2014 Resilience and development in the Anthropocene Policies for resilience and development in the Anthropocene, Organised by Economics for Development, Tanzania, October 2014

2014 NCEAS Workshop on Indicators for SDGs, Santa Barbara, USA. September 2014

2014 Resilience 2014: Resilience and Development – Mobilizing for Transformation International Conference Resilience 2014, In Montpellier, 2014

2012 Inception workshop for Ecosystem Services and Resilience(ESSandR) group in the CGIAR Research Program on Water, Land and Ecosystem(WLE), Montpellier, 1-3 October 2012

2012 Lead rapporteur for the cross cutting theme on Human and Environmental Health at Stockholm Water Week, 26-31 August 2012

2012 Inception workshop for Rainfed Strategic Research Project in CGIAR Water Land and Ecosystems, in Nairobi, 12-15 June 2012

2012 Participant in the SAPECS workshop in Stellenbosch, 7 February 2012

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2015 Presentations at PECS conference 2015: "Biosphere Stewardship" and "Ecosystem Stewardship in Swedish biosphere reserves: from conflict to collaboration" Stellenbosch, South Africa, November 2015

2015 Presentation at Transformations 2015: "Collaborative transformations towards adaptive governance for ecosystem stewardship", Stockholm, October 2015

2015 Hosted workshop about creating a network for biosphere reserve scientists with Martin Price during EuroMAB 2015, Haapsalu, Estonia, 22 May 2015

2014 Invited panelist speaker in final reflections session, at SARAS conference "Imagining Resilience: Art-Science Collaborations for Sustainability", Uruguay, December 2014

2014 Three presentations at conference Resilience 2014: "A theory of transformative agency in linked social-ecological systems", " Diagnosing processes and outcomes of adaptive co-management in biosphere reserves", and " Principles for Building Resilience: Sustaining Ecosystem Services in Social-Ecological Systems", Montpellier, France, 2014

2013 Invited speaker in panel session on "Integrated science - How to build an inclusive and equitable development of science to benefit all?" arranged by Svenska Unescorådet and SSEESS, Royal Academy of Sciences, April 2013

2012 Conference presentation at Mobile HCI 2012. Tholander, J., Borgström, S., Jacobsson, M., Normark, M., Schultz, L., Ståhl, A., Vaara, E: But I don't trust my friends. Ecofriends - A mobile application for reflective grocery shopping, 2012

2012 Presented the GLEAN project at the Resilience Alliance Science Meeting, Camargue, January 2012

2012 Presented the PECS programme at Planet under Pressure conference, London, March 2012

2011 Three presentations at Resilience 2011, Arizona, US: "Learning for resilience? Exploring learning opportunities in biosphere reserves", "Social-ecological inventories: An approach for finding key actors and engaging them", "The role of learning for enhancing the resilience of ecosystem services", March 2011

2011 Presentation at workshop, BESRU, Ontario, Canada: "Social-ecological inventories: Building Resilience to Environmental Change within Biosphere Reserves", March 2011

2011 Presentation at ICSU General Assembly meeting, Rome, Italy: "Programme on Ecosystem Change and Society", September 2011



The Ebba and Sven Schwartz Foundation supports research that investigates the interactions between plants, animals and people and thus enables the conservation of biodiversity and sustainable development.

Stockholm Resilience Centre, at Stockholm university, advances research on the governance of social-ecological systems with a special emphasis on securing ecosystem services for human well-being and resilience for long-term sustainability.

The Beijer Institute of Ecological Economics carries out research and stimulates cooperation to promote a deeper understanding of the interplay between ecological systems and social and economic development.

Stockholm Resilience Centre
Sustainability Science for Biosphere Stewardship



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