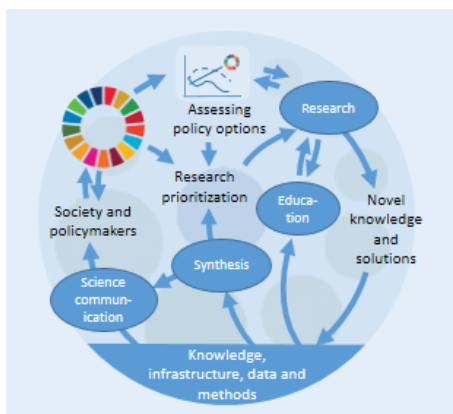


# Biodiversity and Ecosystem services in a Changing Climate



## Research Strategy 2020-2025

### The BECC strategic research area



The strategic research area (SRA) BECC develops research that targets sustainable management of ecosystem services in a world undergoing rapid change and loss of biodiversity. BECC researchers study how direct and indirect human impacts on the climate and ecosystems influence biodiversity and ecosystem functioning from local to global scales, and how knowledge about these dynamics may inform mitigation and adaptation decisions in the face of such changes.

BECC is a young research environment encompassing more than 250 researchers across a wide range of fields at Lund University and the University of Gothenburg (UGOT). BECC is coordinated by the Centre for Environmental and Climate Research (CEC) at Lund University (LU).

In the last five years, BECC has harnessed strong development within and across the participating disciplines, including biology, economics, environmental science, geology, political science and physical geography. BECC has actively built an interdisciplinary environment by integrating ecosystem studies and modelling with research on economics, policy and governance processes, promoting collaboration among researchers that are carrying out empirical studies, modelling and development of theories. An increasing proportion of our research is transdisciplinary, carried out in cooperation with non-academic stakeholders to enhance mutual learning and societal relevance.

BECC is creating a vibrant and ground-breaking academic environment bringing together multiple successful research groups across a diverse array of disciplines, which act as the engine for collaboration and initiatives that drive our reputation as an internationally leading knowledge centre on global environmental change. BECC has channelled funding towards the creation of common resources to facilitate societal interactions, meeting places and opportunities for interdisciplinary interactions, including financial support for new research, such as pilot studies ahead of new external project proposals, strategic recruitments and a platform for postgraduate training and networking. These various investments have spawned developments expected to support and enhance the quality and relevance of the collective output of BECC for many years to come. The output increasingly aligns our research with the needs of Swedish and global societies for scientific knowledge to guide decision-making in the face of a rapidly changing environment.

## Vision & Mission

The vision of BECC is to provide a world-leading research environment that brings together excellent research and training at Lund University (LU) and the University of Gothenburg (UGOT) to address our society's need for knowledge about the dynamics between biodiversity and ecosystem services in a rapidly changing world<sup>1,2</sup>. The knowledge generated by BECC serves the integration of biodiversity and ecosystem services into policy development, decision-making and praxis, from local to global levels:

1. **BECC focuses on three grand challenges that must be tackled** to assess the combined consequences of anthropogenic emissions, climate and land-use change on biodiversity and ecosystem services and provide a basis for informed societal responses, with a focus on critical changes in forest, agricultural, urban and arctic ecosystems, including interactions between terrestrial and aquatic systems.
2. **BECC develops world-leading research**, which creates synergies and added value to global change research by *developing and bringing together theories and methods* from different disciplines such as biology, economics, environmental science, geology, political science and physical geography.
3. **BECC catalyses transdisciplinary research** supporting local, national and global policymakers through the scientific evaluations of policy options, including adaptation and mitigation strategies to global change, the conservation of biodiversity and resilience of ecosystems and their services.
4. **BECC fosters the next generation of researchers and professionals**, by training and teaching initiatives that integrate research on interactions between biodiversity, ecosystems, climate and human welfare into existing and new graduate and undergraduate education programmes.
5. **BECC is a dynamic bridging organisation**, currently spanning 11 departments at two universities, and BECC researchers continuously discuss and evaluate research approaches, identify and address challenges, expand on strengths, exploit new opportunities, and consider potential risks.

### Box 1. BECC Guiding Principles

**Equality, Diversity and Inclusion:** BECC is committed to inclusion across gender, ethnicity, age, belief and identity. We ensure that equality and diversity are considered in all decisions at all levels.

**Dialogue and Dissemination:** BECC builds and nurtures a culture that integrates basic and applied research and excellent education with stakeholder interaction. This implies dissemination of our concepts and findings, but also the recurrent review of our research goals and processes from the perspective of societal concerns and discussions, without compromising scientific integrity and independence.

**Freedom and Career Development:** BECC supports and protects the freedom of inquiry of its members, whose independence is a major source of inspiration for setting and revisiting our research agenda. BECC promotes a creative environment where researchers and teachers find ideal opportunities for collaboration and career development.

**Relevance and Urgency:** BECC aims to be at the forefront of establishing new research directions at the interface of biodiversity, ecosystem services and global change. We continuously identify novel and urgent research topics and address these in concerted processes across disciplines to provide cutting-edge and targeted results.

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<sup>1</sup> IPCC 2019. Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse gas fluxes in Terrestrial Ecosystems.

<sup>2</sup> IPBES 2019. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES secretariat, Bonn, Germany.

## 1. BECC addresses grand challenges

To generate cutting-edge research increasing the ability of societies to reach the UN Sustainability Development Goals, BECC currently focuses on three *grand challenges* (Box 2) arising from the combined consequences of climate change and land-use on biodiversity, ecosystem functions and services:

- BECC identifies thematic and cross-cutting research areas with a high potential for scientific advancement, where novel research excellence is critical to tackle overarching, ecological and societal challenges.
- BECC fosters a dynamic and intellectually exciting research environment that stimulates interactions between research groups and disciplines. To create such an environment, BECC organises cross-cutting challenge-driven research themes that attract researchers from different backgrounds and reach out to a variety of stakeholders.
- BECC invites a broad discussion on identifying and addressing challenges, by providing spaces and opportunities to meet, discuss and develop inter- and transdisciplinary collaboration by supporting guest researcher visits, innovative action groups, and by arranging topical workshops and seminars.
- BECC enhances the ability to tackle grand challenges by contributing to recruitment of researchers, and by supporting and coordinating efforts to increase external funding, with a particular focus on start-up and advancement funding for early-career researchers and large inter- and transdisciplinary projects.

### BOX 2. BECC's current three grand challenges tackled by its research themes

**Climate Change.** One major challenge is to reduce the currently high uncertainty about how the carbon cycle responds to anthropogenic and biophysical drivers, including long-term effects of slow-responding processes of vegetation and soils. This requires a combination of analyses of human behaviour and decision-making, empirical ecology and modelling, informed by studies of past ecosystems, using approaches that account for links across scales from the local to global. It is central to accurately quantify and project changes in carbon balance across compartments and sectors, and to account for links between biogeochemical cycles (e.g. carbon, nitrogen, phosphorous and base cations). Only based on these insights can we understand and project climate change and its impacts on ecosystems and biodiversity, and provide the necessary basis for the design of ecosystem-based mitigation strategies to sequester greenhouse gases from the atmosphere.

**Biodiversity.** A second key challenge is to develop a scientific basis for effective and biologically meaningful biodiversity conservation strategies across scales under global change. While protected areas are important for conservation, alternative options need to be considered when facing climate change, including mainstreaming biodiversity in production landscapes. To propose efficient strategies to conserve biodiversity for ethical and functional reasons, we need to better understand how interacting communities of organisms respond to the combined effects of climate change and habitat deterioration on ecological and evolutionary time scales, but also to better account for the effect of conservation strategies on social livelihoods. Closing these knowledge gaps would allow the development of cost-efficient, future-proof conservation strategies.

**Ecosystem Services.** A third critical challenge is to integrate different private and public values of ecosystem services into environmental policies and management, while accounting for the projected impacts of climate, land-use and other drivers of change. The design and assessment of strategies to mitigate and adapt to global change needs to build on projections of climate and land-use changes, including associated uncertainties. Currently, impact models often fail to account for the full range of such mechanistic links between climate, land-use, biodiversity and ecosystem services across scales. Furthermore, given conflicting perspectives and goals across actors over the use of ecosystem services, there is an urgent need to improve the understanding of how policies, institutions and power relations affect the governance of these services.

## 2. BECC develops world-leading research, theories and methods

The conceptual and theoretical foundations of biodiversity-ecosystem-climate-human welfare research is rapidly developing. To continue expanding the international horizons in this field, BECC researchers engage in methodological pluralism to develop new theoretical and empirical approaches that span from intradisciplinary studies of ecological and societal processes to interdisciplinary studies of changes of integrated social-ecological systems:

- BECC improves the ability to understand the relationship between biodiversity and linked ecosystem services under novel situations involving climate, land-use and policy changes, by developing modelling approaches that integrate process knowledge with observational data. In this way, BECC relates drivers to impacts, describes underlying mechanisms and exposes knowledge gaps. To achieve this, BECC promotes collaboration between researchers using empirical approaches and modelling.
- BECC's research relies on theoretical foundations of biology, physical geography, economics, political science and environmental science as well as other relevant and supporting disciplines. BECC therefore stimulates both the development of relevant basic theoretical research, as well as the integration of such theoretical advancements into impact and forecasting research.
- BECC emphasizes the need to develop excellent interdisciplinary research approaches to tackle the complexities of social-ecological systems in a world affected by global change. To enhance relevance of research and the efficient use of knowledge to inform management and policy relating to climate-biodiversity-ecosystem service relationships, BECC develops transdisciplinary research methodologies.
- BECC pursues the development of integrated models, such as coupled ecological-economic models, allowing for integrated assessments of future scenarios. With a combination of cutting-edge methods, BECC provides a strong basis for generating credible projections of ecosystem and societal impacts caused by climate change, shifts in management practices, and policy options on biodiversity and ecosystem services.
- BECC promotes key research endeavours, large-scale facilities and infrastructures suitable to tackle urgent societal challenges. These include, to give but a few examples, synchrotron radiation to study soil processes, next generation sequencing to study evolutionary processes, network analysis to analyse systems of political institutions, and artificial intelligence to interpret information from remote sensing.
- BECC supports the development and efficient use of a range of state-of-the-art research infrastructures, including monitoring of biodiversity, vegetation and greenhouse gases and those supporting field and laboratory work<sup>3</sup>. Efficient use of existing research infrastructures is generated by project-specific support and user guidance. In parallel, BECC continuously monitors the infrastructure needs across the research area and supports research groups with further infrastructure development, by actively pursuing funding options at faculty and university levels and supporting the application for external funds.
- BECC participates in university-wide and national evaluations of its research and regularly carries out internal evaluations, supported by a scientific advisory board, to identify weaknesses and strengths, and to take appropriate action. In this way, BECC ensures that research remains at the international forefront, while maintaining our ability to respond to changing societal needs and challenges. This includes considering the need for dynamic adjustment of the composition of BECC and the availability of relevant competences to achieve the envisaged research goals.

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<sup>3</sup> E.g. Skogaryd Research Catchment and the alpine Latnjajaure Field Station, Integrated Carbon Observation System (ICOS) stations hosted by ULUN and UGOT, and the long-term monitoring of biodiversity by Svensk häckfågeltaxering and Svensk dagfjärilsövervakning.

### **3. BECC as a transdisciplinary research environment**

BECC is a comprehensive challenge-driven research environment, which constitutes a strong foundation for interactions with stakeholders. BECC provides a highly visible contact point and has an ability and capacity to react to input and demands from societal actors:

- BECC provides, together with its sister SRA MERGE and the collaborative initiative LU-Land, a platform for the science-stakeholder dialogue on the dynamics between biodiversity, ecosystem services, climate change and human welfare. BECC, MERGE and LU-Land activities are coordinated by CEC to achieve efficient use of resources.
- BECC contributes to key conceptual debates, produces research syntheses and interacts with a diversity of stakeholders. This gives us crucial feedback on the suitability and usefulness of specific research activities for key social contexts, management efforts and policy processes.
- BECC builds transdisciplinary interactions through mutual learning, ensuring that solutions to societal challenges are grounded in scientific evidence and allow for a 'reality check' of methods and results.
- The BECC-stakeholder dialogue also serves to identify relevant research issues and needs for syntheses of current knowledge and identification of knowledge gaps, thereby stimulating joint collaborations and research projects.
- BECC takes initiatives to develop research in interaction with national and regional stakeholders, including commissioned research where relevant, for example by stimulating increased mobility of staff and PhD students between universities, authorities, businesses and civil society.
- BECC maintains an internal and open discussion about the deeper purpose of stakeholder interactions, as a way to ensure that the principles of academic independence and critical thinking permeate the science-stakeholder dialogue.
- BECC's communication strategy aims to coordinate information about research developments in a way that supports a diversity of stakeholders, e.g. through online portals, social media, and physical meetings.
- BECC encourages and supports the services of its researchers as experts in national and regional bodies, such as IPCC, IPBES, governmental inquiries, and sectoral and industrial advisers.

### **4. BECC fosters the next generation of researchers and professionals**

As a comprehensive research environment, BECC has a special responsibility to support the education and career development of the next generation of researchers and professionals. BECC PIs are involved as course coordinators and teachers over a wide range of basic and advanced courses at LU and UGOT, across involved disciplines. With timely and critical topics not widely covered within intradisciplinary departmental programs, these courses contribute to BECC's profile and discussion of societally relevant issues. In these ways, BECC enhances cross-faculty collaboration and strengthens links between research and education:

- ClimBEco, the shared graduate student research school of BECC and MERGE, is instrumental in promoting inter- and transdisciplinary research needed to tackle societal challenges associated with climate, biodiversity and ecosystem services in a changing world. ClimBEco develops a series of graduate courses and offers a comprehensive mentorship program. The courses offer students a large variety of important skills and tools, ranging from traditional and disciplinary education on specific environmental problems to training in communication and collaboration across research fields, and to support stakeholder interaction and communication.
- BECC interacts with the existing educational organisation at LU and UGOT to contribute to the reinvigoration, renewal, and development of new and existing undergraduate courses and educational programs.

- BECC plays a key role in developing education at the Master level. This includes identifying suitable supervisors and relevant Master thesis subjects in-house and in collaboration with external stakeholders. BECC's ambition is to contribute, together with MERGE, to the development of a new international Master programme on sustainable land-use in a world affected by global change.
- BECC makes use of its stakeholder network to identify interaction points (e.g. course projects, thesis subjects and internships) and career opportunities for its students in the public sector, at private actors and NGOs.

## **5. BECC complements and bridges the existing line organisation**

BECC is an organisation bridging divides across universities, faculties and departments, and thus complements the involved universities' existing line organisations. While formal decisions regarding recruitment, infrastructure and education are mostly taken by the line organisations, BECC acts across them to identify opportunities and support the development of BECC-relevant research, education and collaboration by the line organisations. By having this special position among the two Universities' line organisations, BECC has the flexibility necessary to adapt its research to a continuously changing world, to stay at the constantly evolving research frontier:

- BECC interacts closely with the leaderships at LU and UGOT, as well as with involved faculties and departments, to advance BECC as a long-term profile area at the highest international level of excellence. These interactions include joint discussions regarding recruitment, infrastructure development and development of PhD, graduate and undergraduate programmes, which are managed by the line-organisations.
- BECC and the line organizations, including faculties and departments, work in close collaboration to enhance challenge-driven research, education and stakeholder interactions, by ensuring the structural, organizational and financial conditions required for BECC to support such developments at the universities.
- BECC uses its funding mechanisms (e.g. for projects, positions for postdocs and PhD students, Action Groups) to encourage its PIs to initiate and develop collaborative initiatives, including interdisciplinary research projects across universities, faculties and departments, as well as broad initiatives to interact with stakeholders.
- As a large and highly visible research platform, BECC is both dependent on and supportive of the recruitment of talented scientists. To this end, BECC identifies long-term recruitment needs, and works closely with the existing line organizations to implement its recruitment strategy. This strategy considers both the need to develop relevant research areas and the need for future educational capacity.
- The two SRAs BECC and MERGE, both coordinated by CEC at the Faculty of Sciences, LU, have complementary expertise, with MERGE focusing on modelling of the regional and global earth system, with the goal to increase climate-related knowledge. Joint BECC-MERGE spring meetings facilitate the knowledge exchange and the development of joint research projects.
- As an SRA, BECC is particularly dependent on highly qualified leadership. Thus, BECC has a special responsibility to contribute to leadership development, by supporting young researchers. BECC supports leadership and career development of its researchers by mentoring, support to leadership education, and engagement of young researchers in leadership positions.
- BECC strives to contribute to an inclusive work environment free from discrimination based on gender, ethnicity, age, belief and identity. To this end, BECC aspires to remove any overt, covert, and subtle mechanisms of discrimination in its activities by ensuring that equality and diversity are considered in all decisions at all levels.