

MERGE Strategy 2026-2030

Our vision for MERGE and the Research Questions we will address

The strategic research area (SRA) Modelling the Regional and Global Earth system (MERGE) brings together experts from four Swedish universities (Chalmers, GU, KTH and LU) and SMHI, to form a dynamic research environment with a focus on the interactions between the climate and the terrestrial biosphere, and on the development and application of detailed process models, climate models and Earth System models. It is coordinated from and hosted by CEC (MGeo from 1st Jan 2026) at the Faculty of Science, Lund University.

Our vision is to develop further as a multidisciplinary Swedish node providing world-leading understanding and modelling of climate-terrestrial biosphere interactions for the international Earth system modelling community and its science agenda.

MERGE conducts cutting-edge research and research education across interlinked Research Areas (RAs), developing the models, analyses and infrastructures necessary to deepen fundamental scientific understanding in our field. We seek to answer the following fundamental Research Questions (RQs):

- How sensitive is the global climate system to greenhouse gas emissions, aerosols and land-use change?
- How can the uncertainties relating to climate sensitivity be further reduced?
- How do Earth System feedbacks modify the global, regional and local climate responses to natural and anthropogenic climate forcing?
- How can uncertainties in descriptions of atmospheric short-lived climate forcers and pollutants be improved for science-based assessments of their combined effect on health and climate?
- How effective are land- and nature-based mitigation strategies when considering both biophysical and biogeochemical feedback mechanisms?

MERGE research is accompanied by societal dialogue in the spirit of social learning by both scientists and stakeholders, with a particular focus on the scientific basis for policy decisions relating to anthropogenic climate change.

GOALS AND VISIONS FOR MAINTAINING AND PURSUING EXCELLENCE IN RESEARCH

Where does MERGE stand today, and where it will stand in 5 years and in 10 years in relation to the development of the research field on a global level?

MERGE aims to develop “climate modelling” in a broad sense, aligning core activities to promote research excellence, enrich education, create societal impact, develop talent, and attract and leverage external funding.

By bringing together and funding leading experts in the fields of atmospheric and ecosystem sciences and climate modelling, and their unique combination of competence, infrastructure and tools, we have developed into a recognized, multidisciplinary Swedish node embedded in the international Earth system modelling community. Long-term planning and goals have been crucial to our success. Considerable funding success (national, EU) has **leveraged our modest base funding** and our long-term MERGE investments, and we have created impact locally, nationally and internationally.

By 2030 and beyond, to 2035, MERGE will have consolidated its position as a leading international hub for integrated Earth system science, recognized across Europe and beyond for its excellence. We will have **advanced** our modelling capabilities, our data infrastructures and analysis methods, and contributed to the development and evaluation of models that have the most advanced descriptions of vegetation, ecosystems, biodiversity and land-atmosphere interactions available.

We will continue to **support** activities that address the fundamental climate science underpinning proposed climate solutions, increase our policy engagement, and expand both our communication activities and the disciplinary and interdisciplinary education in the MERGE focus areas. Furthermore, our modelling and data infrastructures will be secure and more tightly integrated. A new generation of excellent young researchers will be key to this effort.

What actions are required for MERGE to stay at the absolute research frontiers?

Continued support for, and development of, the very best data infrastructures, models and analysis methods are crucial to maintain and strengthen our position nationally and internationally, to ensure we remain competitive in EU funding calls, and to increase the impact of our science.

MERGE maintains that deeper **internal integration** is central to the creation of a vibrant research environment. We will constantly strive to encourage and reward risk taking regarding new research directions and interdisciplinary initiatives, keeping MERGE at the forefront of our field.

MERGE will continue to fund **short projects and workshops** with the aim of fostering and generating dynamic interactions across our Research Areas (Ras) and with external actors, with call themes that are often based on knowledge gaps identified at the MERGE meetings. MERGE will also allocate funding for open meetings with a focus on addressing **specific research questions**, technical challenges, or analysis.

MERGE will stay at the forefront of research by continuously engaging with its Scientific Advisory Board and Stakeholder Reference Group to make the best use of external opinions and knowledge.

We will strengthen international collaboration through our continued commitment to host European-scale gatherings of climate science experts, e.g. Horizon Europe general assemblies, EC-Earth, LPJ-GUESS, ICOS and NOSA community meetings.

We will commit to develop and renew our infrastructures. This includes continued support for the physical infrastructures providing data vital for fundamental understanding and model development, including ICOS. Furthermore, we pledge continued support for the software and modelling infrastructures upon which we depend, such as hosting LPJ-GUESS at LU, and maintenance of EC-Earth at SMHI. We will also work with national and international partners to secure the computing and data storage resources necessary for contributions to international modelling efforts such as CMIP.

Research excellence will be promoted by deepening our RA activities, and by supporting novel interactions between them. To this end, we will continue to fund attractive, bi-annual MERGE meetings to encourage and create novel interactions. Furthermore, we will fund additional RA meetings (at least one per year) to address specific themes, research questions, technical issues or research questions that deepen disciplinary interactions, and we will fund additional workshops for our PhD students.

MERGE also wants its RAs to be dynamic in structure and theme, able to respond rapidly to the need for new fundamental climate science knowledge and to global scientific and policy agendas (e.g. UNFCCC). Internal discussions among our experts have led to the identification of a number of strategic research priorities to be pursued in the coming years, which will keep MERGE at the research frontier. The agreed priorities are summarized in more detail in the **Appendix**, and they include a commitment to:

- Further development and application of key ecosystem models, regional climate models and Earth System Models, with a key goal being to promote their use across all RAs and in global initiatives, where we aspire to play more leading roles;
- Development and model integration of high-quality and high-precision datasets of climate proxies and climate variability throughout history for model testing and improvement;
- Greater integration of field, laboratory and modelling studies on vegetation feedbacks as they relate to aerosols and other short-lived climate forcers (SLCF) and pollutants, the atmospheric oxidation capacity, greenhouse gases and cloud processes;
- Greater emphasis on combining our existing strengths in statistical and mathematical modelling with an increased use of AI/ML in line with broader trends in climate science and modelling.

Strategic scientific goals will be revisited and refined in line with new knowledge and policy requirements.

How will MERGE work to secure increased funding from the EU?

Our recent success in attracting EU funding, where we are active in, or lead, multiple Horizon projects, builds on our long-term commitment to renewal and excellence.

To attract increased EU research funding, MERGE will focus on alignment with key European priorities such as the European Green Deal. Horizon funding and cluster priorities (e.g. climate impacts, mitigation and the costs of mitigation inaction) align with and inform these policies, so it is important that we remain recognized as leading experts in fundamental climate, ecosystem and atmospheric science, and can provide the best data, models and analysis tools. Such expertise will ensure that MERGE members continue to be regarded as attractive partners in large consortia.

We will cooperate with Research Services at LU, BECC and other SRAs, and the Nature-based Future Solutions profile area at LU, to identify, at an early stage, opportunities to **influence cluster texts** (which inform the specific call texts in each cluster) and promote **funding opportunities** (early call draft analyses and sharing, identification and nudging of suitable researchers), horizon and policy scanning in Brussels, peer-to-peer sharing of knowledge and know-how. MERGE will also investigate the feasibility of co-funding a **grant manager** with other research environments.

MERGE will allocate resources in its budget to improve the conditions for those intending to write substantial grant applications. This will include launching internal calls for **proposal workshops and writing retreats** involving senior researchers and ECRs. We will also support outreach and communication elements of EU applications. By investing in early-career researchers and their leadership skills, MERGE will ensure that a growing pool of researchers is ready to lead and participate in EU-funded projects, so MERGE will seek to make **mentorship** and guidance from senior staff available during the proposal planning and writing stages.

How will MERGE work to increase the number of publications in the top-tier journals in its field?

We will achieve this through a sharper research focus, more prominence in national and international networks, and an organization that supports excellence and **renewal**. MERGE research is aligned with a global research agenda, so that if there is a change of focus or if urgent related societal challenges emerge (e.g. recent “net-zero” policies), we are well placed to address them and publish results in top-tier journals. We will remain committed to developing and renewing our infrastructures, our models, our climate-related data, and our analysis methods (e.g. with a greater AI focus). This will continue to make us attractive partners in large consortia.

MERGE will allocate budget resources to support members that coordinate the type of regional and global **collaborative study** (e.g. model intercomparison studies (MIPs) etc.) that often results in high-impact publications.

MERGE can swiftly adapt to new scientific questions and societal needs by restructuring around evolving research themes. We will invest in competitive internal project funding focusing on novel and interdisciplinary research ideas, enabling researchers to take risks to achieve groundbreaking results. Our seed funding mechanism for **short projects** (SPs) is intended to stimulate cross-disciplinary research directions that can eventually result in larger grants, which in turn will produce high-profile publications. MERGE pledges continued support for SPs, but with regular reviews of the effectiveness and structure of the funding mechanism.

Finally, we will set and annually review “top 10” publication goals in our annual workplan with the purpose of increasing the number of MERGE publications in the highest-ranking journals. We will analyse publication statistics with other environments and LU Research Services

Describe how MERGE will work with relevant Sustainable Development Goals (SDGs).

MERGE research informs actions relating to achieving the targets associated with multiple SDGs, especially SDG 13 (Climate Action: Impacts of climate change on biodiversity and vice versa), SDG 15 (Life on Land: Conserving terrestrial ecosystems and biodiversity) and SDG 3 (good health and well-being; e.g. the link between climate and health through short lived climate forces and pollutants). Crucially, our models and data can be used to assess the efficacy of proposed actions intended to achieve the SDG targets, accounting for multiple feedbacks and interactions that could be missed when considering any one SDG alone. Our fundamental science provides policymakers with the most up to date scientific foundation upon which to make informed decisions.

EDUCATION

MERGE pledges to continue to actively integrate research and education to foster a strong, dynamic academic environment.

A key MERGE ambition is to be a source of **climate expertise** on courses and programmes across partners, and to improve the climate-related knowledge of students at all levels. MERGE will regularly review and document the extent to which its research is intertwined with educational programmes.

MERGE considers support for the **ClimBEco** graduate school to have been one of its greatest achievements. We will continue to provide long-term support for it both through our annual budgeting, and through our members’ active involvement in teaching. Furthermore, MERGE will continue to strongly support ClimBEco’s cooperation with other strategically chosen graduate schools, such as COMPUTE, the Bolin Climate Research School (in place since 2020), and Hamburg’s School of Integrated Climate and Earth System Sciences (CLICCS).

Through its members' direct teaching duties and leadership on courses and programmes across partners, MERGE will ensure that **undergraduate and postgraduate** education remains relevant and up to date in the fields of climate change, ecosystem sciences, mathematical analysis and atmospheric physics. MERGE supports thematic climate science aspects within the engineering programmes, the MSc degree in Computational Science and a related PhD program at LU (both of which it has been directly involved in establishing) and for the 2-year master's program within the ACE (Atmosphere, Climate, Ecosystems) research environment jointly created with BECC at GU. MERGE will also develop clear goals to increase the number of **theses** (BSc and MSc) directly related to our research, and to develop a MERGE labelling together with awarding institutions. By 2030 MERGE will have integrated its CMIP-class models (e.g. EC-Earth) in PhD and MSc courses and theses.

SOCIETAL IMPACT

We will create societal impact with trustworthy research that informs climate policy and improves public understanding, with sustained investment in novel communication and outreach activities

Investment in **fundamental climate science**, including data, models and analyses, is at the very core of MERGE, and crucial to our leading position in our field. This science is necessary to understand and address climate and environmental change worldwide. Increasingly, through long-term investment and prioritization, we are able to use our data-informed, well-evaluated models to investigate solutions to environmental and societal problems. Our publications and results are cited by international reports and syntheses like UN IPCC reports, where MERGE researchers have also been active as co-authors. MERGE pledges to continue these activities in Phase 3.

MERGE researchers coordinate or are partners in multiple EU-Horizon projects with significant stakeholder involvement, e.g. forest owners, authorities and NGOs, and which communicate their results to the EU Commission. We view continued investment in existing and novel modelling tools, data infrastructures, and analysis methods as essential to maintaining our competitive advantage in this respect.

MERGE will prioritize activities that facilitate the provision of **key scientific input underpinning Swedish and international climate policy** (e.g. the UNFCCC, the Paris Agreement, Sweden's Climate Policy Framework) and will support author contributions to the 7th IPCC Assessment Reports (2027-29). We will prioritize active participation in **CMIP7** (incl. PMIP4) with EC-Earth, and through the provision of climate forcing data for CMIP7 and PMIP experiments. We will also initiate a process involving all Swedish partners that carry out CMIP and CORDEX experiments to promote these contributions as a vital **service** to Swedish society, and one which should therefore be prioritized for computing power, storage and support services.

MERGE pledges continued support for the high-level **Stakeholder Reference Group** it shares with SRA BECC. We will hold annual meetings to discuss what knowledge needs there are in society, what future policy needs can be addressed by our environment, and how national and EU policy affect the work of the authorities. We will use these discussions to inform our internal research and funding priorities, ensuring both societal relevance and a solid foundation for impactful publications and funding proposals.

MERGE will continue to support the **LU Land** thematic platform, and to deepen our engagement through climate-relevant contributions and activities, reaching LU Land's large network of relevant stakeholders.

MERGE will continue to employ, and provide support for, a **Communicator** who will initiate and coordinate internal and external communication activities, including public seminars, policy briefs, stakeholder meetings, and outreach activities, making our complex science accessible and actionable.

MERGE views the hosting of national and international conferences and meetings as a valuable and successful way of promoting excellence and raising visibility for MERGE and its partner universities. We pledge continued financial and logistical support for such activities. A particular priority will be continued support for the biennial **Swedish Climate Symposium**, which MERGE, BECC and the Bolin Centre initiated in 2022.

Co-operation with other parts of the university (including the other SRAs), other higher education institutes, and relevant external societal actors.

MERGE will continue to support the SFO-Kollegiet and its activities at LU, including but not limited to leadership education and interdisciplinary seed funding projects.

As a response to the creation of the new Department of Earth and Environmental Sciences (DEES/MGeo) at LU, MERGE pledges to cooperate with BECC and the Nature-based Future Solutions Profile area to ensure an efficient and synergistic allocation of resources to support staff, outreach and other collaborative activities.

MERGE pledges continued support for the Memorandum of Understanding with the Bolin Centre, and to cooperate and find synergies with new SRAs funded from 2026 onwards.

MERGE will join forces with other universities and SMHI to secure computing and data storage resources necessary to fulfil our project and CMIP commitments, and to pitch to the government the benefits to Swedish society and research of prominence in global climate modelling activities.

Collaborations with industry and the private sector.

To date, many MERGE-related and supervised theses (BSc and MSc) have been produced in collaboration with industry and the private sector, e.g. in mathematical sciences in relation to climate change and associated risks. MERGE pledges to explore opportunities to increase the number of theses produced in this way.

Finally, MERGE will regularly evaluate its societal impact, including the extent to which its research is featured in policy documents, and set goals for increasing impact in Phase 3.

RECRUITMENTS AND RENEWAL

We strive to retain our best talent, attract new talent in strategic initiatives, while operating and making decisions in a way that respects and values gender equality and diversity.

MERGE will foster new talent and improve **talent retention** by cultivating a vibrant, inclusive and supportive research environment characterized by collaboration across disciplines, partners and institutions, where early-career scientists can grow into future leaders.

Internal communication and coordination will be strengthened to ensure members **identify** with and value MERGE. We believe that member engagement is a crucial ingredient to the retention of key staff, so we will prioritize regular thematic meetings, joint planning sessions, member input to call themes, and transparent governance, actions we regard as vital in a multi-partner SRA such as MERGE.

MERGE will continue to operate with a gender-balanced **coordination** group from 2026-2030. MERGE will also continue to operate with a gender-balanced **Board** consisting of representatives from all partners and all LU departments that receive MERGE funding. This enables us to identify and empower new talents to take on leadership roles.

MERGE has no direct means of creating positions at BUL, senior lecturer or professorial levels, but pledges to improve cooperation with institutional, faculty and university management to this end, including regular negotiations with institutional and faculty leadership to identify opportunities to recruit BULs or senior lecturers. Furthermore, we will continue to partly fund (sometimes with other SRAs) **start-up packages** for strategically important researchers (BULs and senior lecturers).

MERGE will also continue to identify opportunities to wholly or partly finance the recruitment of **postdoctoral researchers** for identified strategic purposes.

MERGE has identified the need for strategic recruitment at the interface between advanced data generation from ICOS and ACTRIS measurements and their utilization in process-based models and the EC-Earth ESM. We will lobby for a BUL or senior lectureship position in this area in Phase 3.

MERGE will identify and actively pursue recruitment opportunities related to VR and MISTRA BUL recruitment initiatives. MERGE will also identify and actively pursue opportunities to attract **guest professors** to our environment, with concrete goals in our annual work plan.

MERGE will continue to nominate outstanding researchers to the SFO Kollegiet's leadership course. MERGE researchers that have participated to date are now members of the MERGE leadership, after having distinguished themselves through their research excellence and active engagement in MERGE. Our younger researchers will continuously be encouraged to take such active roles as we consider this a clear path to seniority, and one which increases the chances of permanent employment and/or promotion.

Finally, MERGE will continue to support the structured mentorship and career guidance offered by ClimBEco, helping early-career scientists develop **leadership skills** in interdisciplinary contexts.

Appendix – Research Area Strategic Priorities

- Across and between all research areas within MERGE, the highest priority is to provide an integrating, inclusive research environment enabling our researchers to collectively contribute to excellent science and superior training of early-career scientists. A particular scientific goal is to improve the ability to assess ecosystem vulnerability, resilience and potential feedbacks to climate change, extremes, and natural and anthropogenic disturbance.
- Working closely with the wider international **LPJ-GUESS** community, we will support the development of the software infrastructure, improve existing features and regularly add new features, ensuring that the model continues to be recognized as one of the leading models of its type worldwide. MERGE also recognizes that certain developments will require deepened interdisciplinarity and the use of new data and methods, such as data assimilation and machine learning, requiring stronger cooperation with MERGE experts in this area.
- MERGE also pledges to support participation in large international modelling studies (so-called MIPs) with LPJ-GUESS, ensuring that the model remains recognized as a leading model of its type.
- MERGE will continue to support the development of the **regional climate models** (RCM) RCA-GUESS, HCLIM and WRF, and promote more detailed coupling to LPJ-GUESS. To this day, few RCMs have dynamic vegetation as a feature, so we view it as a priority to maintain our research advantage in this field. RCMs will also be used for studies of paleoclimate, further strengthening RA ties.
- MERGE pledges continued support for **EC-Earth** development and application, and to continue to play leading roles in its Working Groups, with both fundamental science questions and CMIP commitments in focus. LPJ-GUESS developments will be ported to EC-Earth, facilitating more detailed studies of ecosystem climate feedbacks, and increasing focus on analyses of proposed climate solutions such as carbon capture and storage, renewable energy, etc. Additionally, EC-Earth will be promoted as a common tool in MERGE, spanning all RAs.
- Further key ambitions are to lead the development of next-generation models that integrate biophysical and socio-economic dynamics at both regional and global scales, and to tighten the links between Integrated Assessment Models (IAMs), vegetation and climate models.
- We will continue to develop and apply the **LeCA** model and will support joint studies with LPJ-GUESS to improve model integration and cross-fertilization of model strengths.
- MERGE will continue to develop high-quality **datasets** of past climate variability, benefitting from recent developments in climate proxies and methodology for climate field reconstructions, including better handling of dating uncertainties.
- MERGE will concentrate on activities on extreme events from modelling and paleoclimate perspectives.
- We will also support method developments that include new high-precision dendrophysiology-based climate proxies, advancements in interpretation of the isotope signal in tree-ring cellulose, and improved signal-to-noise ratio and more correct variance in climate field reconstructions. Links between **dendrochronology** research and LPJ-GUESS modelling will be strengthened.
- MERGE will ensure that we retain and strengthen our broad capacity, competence and expertise in field, laboratory and modelling studies on **greenhouse gases, short lived climate forcers and pollutants including aerosol and cloud processes** in relation to vegetation feedbacks, also considering their combined effect on both health and climate. A particular competence MERGE will support and encourage will continue to be process and global earth system modelling, including the utilization of common tools (e.g. EC-Earth) and data (e.g. ICOS and ACTRIS), and we will pursue strategic recruitments in this area.
- The launch of the VR infrastructure ACTRIS Sweden and other advanced observation platforms provides much more advanced and comprehensive datasets than previously available, opening completely new research questions that can be addressed and integrated using advanced modelling tools. This will advance MERGE research in this area but will also be a challenge, since the use of machine learning based models (LML) will have a more prominent role while the understanding of large data and complex observations will also be a critical component. MERGE will explore recruitment possibilities at the interface between advanced data generation and utilization of ML for atmospheric applications.
- MERGE has identified **AI/ML** as a vital tool to support going forward, in line with broader trends in climate science and modelling generally, and our RA naming will be updated to reflect this novel focus. We will support ML algorithm development across our modelling tools, and the use of ML for data analysis and

model calibration, collaborating with AI/ML experts from other SRAs, the LU profile area on *Natural and artificial cognition*, and departments where synergies can be achieved.

- Advanced **mathematical methods** will be applied to develop more efficient numerical coupling between models (e.g. in EC-Earth), feeding back to improved climate projections. We will continue to promote developments in which pollen and archeological data are combined using advanced mathematical statistics to improve assessments of past anthropogenic influence on climate.
- MERGE will target calls requiring integrated studies on the effects of climate change and mitigation actions, requiring participants from all RAs and a suite of MERGE-developed models and data.
- In addition to our long-standing strong commitment towards support and engagement with IPCC actions, MERGE will partly contribute to promote action for enhance utilization of our research for the new Intergovernmental Science-Policy Panel on Chemicals, Waste and Pollution (ISP-CWP) in a similar way as MERGE has previously done to support the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services ([IPBES](#)). Thus, MERGE will strive to contribute to integrated assessments of the triple planetary crisis.