



# ICOS SWEDEN Strategic Plan and suggested activities to meet the strategic aims

# 2019- 2024

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# ICOS Sweden Strategic Plan 2019-2024

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*This plan is compiled by the ICOS Sweden Coordination Office and is based on discussions with and recommendations by the ICOS Sweden Board, the ICOS Sweden Scientific Advisory Committee and the ICOS Sweden Station Coordination Group. The plan was endorsed by the ICOS Sweden Board on 2018-11-06.*

This document contains a revision of the ICOS Sweden strategic plan 2016-2020. The ICOS Sweden Board has made reoccurring revisions of the plan over the years. The revision at this time is motivated by the coming application for renewed funding for the time period 2021-2024, to be submitted in early 2019. Furthermore, the ICOS ERIC General Assembly is at present revising the strategy of the full European ICOS RI, which also influences the update of the ICOS Sweden strategy.

*(c) 2018 ICOS Sweden, Center for Environmental and Climate Research, Lund University, Lund, Sweden.*

*The ICOS Sweden Coordination Office prepared this document.*

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# ICOS Sweden Strategic Plan 2019-2024

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# ICOS Sweden Strategic Plan 2019-2024

# 1. Scientific and societal framing of the infrastructure

Climate is changing faster at higher latitudes than anywhere else on Earth. Because of Sweden's latitudinal extent and topography, many of our sensitive ecosystems will change too and some are at risk of being damaged irreversibly. Sweden's geography however also provides an opportunity, probably unique world-wide, to study climate system interactions and the impact of climate change on these sensitive ecosystems. ICOS Sweden is essential for the wider ICOS project as it represents a number of important ecosystems at high latitudes including one sub-arctic site.

The existence and mission of ICOS Sweden is determined by the European Union's as well as the Swedish government's strategic investments in research infrastructures. Furthermore, the ICOS Sweden station hosts, mainly Swedish universities, fund at least 50% of the cost for running their respective station, including costs for purchasing and install expensive equipment. The usefulness of the data and sites for science as well as the societal use of the results is thus a prerequisite for the financing of the infrastructure. The development of the scientific and political outlines for research and infrastructures is framing the strategic decisions for ICOS Sweden.

The overall aim of ICOS is to facilitate biogeoscience to understand the Earth system and to derive applied knowledge that supports 'climate action'. Scientific knowledge on carbon emissions, sinks and trends advances the fulfilment of the UN Sustainable Development Goals and EU Societal Challenges, especially the ones concerning climate change. It also supports efforts to comply with the COP23 Paris Agreement resolutions with its ambitious targets to reduce the anthropogenic impact on the global climate and, for the Swedish case, to comply with the Swedish Climate Policy Framework. The Framework is decided upon by the parliament and aims for a net zero emission of GHGs in 2045 and includes a road map to reach the goal that will be annually evaluated.

ICOS enable, through its long term, standardized and high quality data, better understanding of the annual variations in the GHG exchange processes that determines the sources and sinks. To quantify these is important for national commitment negotiations in general, and, in Sweden, also as an evaluation tool for the emission roadmap stated in the policy framework. In combination with other high quality data sources from other ground based measurements and from satellites, ICOS enables estimations of GHG emissions using atmospheric transport

models. The development of such top-down methods will improve the accuracy and usefulness of the current IPCC emission guidelines, based on carbon inventories, for estimating GHG emissions. Such development requires that the ICOS data is not only of high quality but also interoperable with other environmental measurement systems.

ICOS observations will be an important source for climate policy research in Europe, large cities and regions. Some topics have been identified by ICOS RI to drive the future development of the ICOS observational network:

- The quantification of GHG emissions and sinks in urban areas require estimates of emission baselines and changes.
- ICOS has the utility for detecting the temporal and spatial variations of the greenhouse gas exchanges between the three earth reservoirs and to understand their drivers and can by this contribute to the detection of trends and the understanding of the drivers in land and ocean sinks.
- The ICOS network comprises a multitude of ecosystem sites providing long-term data sets for supporting scientists to improve the best practice guidelines for terrestrial ecosystem management between food production, bioenergy and GHG gas mitigation.

For all these uses, long-term data from a multitude of ecosystems are needed, which is provided by the international ICOS RI, in which ICOS Sweden is a part.

## 2. Mission

The mission of ICOS Sweden is to make accurate high quality measurements of greenhouse gas concentrations in water, air, and soil as well as surface exchange fluxes of these gases. These are the drivers relevant to land-lake-atmosphere exchange processes from which we derive understanding of the processes of climate change in this region. All sites within ICOS Sweden are using measurement systems of the same design and adhering to the measurement protocols and quality control procedures decided upon by ICOS RI. This makes data highly comparable and consistent and such data are keys to developing models and estimation methods for characterizing source/sink distributions from local to global scales and from seasons to decennia, and to assessing and monitoring the effectiveness of mitigation activities. ICOS Sweden as an integral part of ICOS RI will provide such data with a focus on Nordic ecosystems. By being a member of ICOS RI and the ERIC, ICOS Sweden provides access to extensive knowledge in the field of greenhouse gas observations from the full European ICOS

related measurements and research network. ICOS Sweden will, likewise ICOS RI, develop towards increased collaboration and interoperability with other in-situ environmental networks and satellite measurement programs, in order to widen the research and societal usefulness of the data.

### 3. Vision

The ICOS Sweden network for greenhouse gas measurements is a world class research infrastructure that provides advanced research sites, data, and services from typical northern ecosystems as a basis for enhancing knowledge and informing models of the interactions between land surface processes, including human activities, and the climate system. ICOS Sweden sites are equipped with the best instrumentation available, have well-trained personnel and deliver first class services to scientists using its facilities. ICOS Sweden has a central role in the support of Swedish biogeochemistry research, provide test sites for national inventory systems, and sites and databases for advanced research. ICOS Sweden is fully integrated with and play an important role in the pan-European ICOS (ICOS RI), and collaborate and is interoperable with other environmental in-situ and satellite based infrastructures. ICOS Sweden is a key resource for climate impact research, earth system modeling and for supporting climate action.

### 4. Strategic objectives

The strategy of ICOS Sweden to achieve the goals of the Vision is outlined below.

#### **4.1 To maintain and improve the performance and highest quality of the measurements by:**

- Following the established ICOS protocols and instructions and contribute to the development of these in collaboration with ICOS RI.
- Ensuring the expertise of the personnel in ICOS Sweden through education at internal workshops and courses on handling of data and instruments.
- Ensuring governance and coordination of ICOS Sweden in order to maintain and strengthen both the internal cooperation and quality of the products, and the external contacts and collaborations.

**4.2 To develop and optimize the usefulness of the data for research within biogeosciences by:**

- Identifying possible extension of measurements in order to facilitate research within other disciplines (e.g. boundary layer meteorology, physiological ecology, atmospheric physics and chemistry) and thereby enable better understanding of related physical processes.
- Contributing to development and evaluation of new instruments that have potential for superior measurement capabilities, allowing the network measurement systems to evolve with major shifts in technology.
- Collaborating with other environmental RIs, both in-situ and satellite platforms and working on making ICOS Sweden interoperable with them.
- Observing and assessing needs for measurements in ecosystems/regions complementing the existing ICOS Sweden RI.

**4.3 To strengthen ICOS Sweden's role in Swedish and international biogeosciences research by:**

- Promoting, encouraging, and supporting research utilizing and enhancing ICOS data, e.g. GHG inverse modelling, at the national or Nordic level, and garnering the results as input to synthesis reports, for example, by providing data for an annual greenhouse gas index and an emission verification system for Sweden.
- Promoting, encouraging, and supporting education utilizing and ICOS in the field of biogeoscience, e.g. by contributing to under-graduate and doctoral courses using the data and sites.
- Engaging in dialogue with other national or international observation networks, by arranging and participating in meetings and workshops and by establishing long time collaborations.
- Ensuring high visibility of and accessibility to ICOS Sweden's and ICOS RI's data products by communicating with users to facilitate and encourage their use in high-profile scientific papers.
- Ensuring and strengthening scientific and societal benefits of ICOS Sweden's activities and output through outreach efforts like information meetings, workshops, webinars, and training courses.

- Encouraging other research groups and industry to utilize the sites to develop and test new environmental measurement technologies.

## 5. Activities

The buildup of the ICOS Sweden organization and its functions is finished except for the full implementation of the User's Group. ICOS Sweden already deliver pre-ICOS data (before stations become certified ICOS stations) from 2014 and forward through the ICOS Carbon Portal. All ICOS Sweden atmospheric sites and one ecosystem site are certified ICOS stations since spring 2018 and four more ecosystem sites and the marine site are expected to become certified in late 2018 or early 2019. The Abisko-Stordalen ecosystem site is delayed due to financial problems and is expected to be certified in late 2019. ICOS Sweden is furthermore planning to incorporate marine ICOS measurement performed on a boat line in the Baltic Sea (VOS Tavastland). ICOS Sweden has over the years arranged annual workshops to promote the use of ICOS Sweden data and, since last year, started the Nordic ICOS symposiums together with the other Nordic ICOS RIs as the main information campaign. During winter 2018-2019, ICOS Sweden runs an information campaign that will visit universities, institutes and authorities to inform about the usefulness of ICOS Sweden. In early 2019, ICOS Sweden will apply for renewed funding during 2021-2024.

Over the coming six-year period (2019-2024), there are three activities that we will focus on in order to fulfil the objectives:

- Maintaining the scientific and technical expertise of the personnel and promoting highest quality of the station equipment
- Foster collaboration and interoperability with other in-situ environmental measurement networks and satellite programs
- Stimulating scientific studies and modelling efforts aiming at increasing the knowledge on carbon emissions, sinks and trends to enable evaluation of the Swedish emission targets

### **5.1 Maintaining the scientific and technical expertise of the personnel and promoting highest quality of the station equipment**

ICOS Sweden is both a national research resource and a partner of the international ICOS Research Infrastructure. To fulfil our obligations towards the international body, we will continue engaging qualified technical personnel and PIs at our sites. We will see to that they

always will be updated on the quality and improvements of the measurements and systems by encouraging participation in meetings, courses, and education. We will also continue our internal support functions of scientific and technical expertise concerning measurement systems.

To fulfil our aims concerning the quality of the network and its management, we will continue to engage scientific expertise, mainly with a high research profile, from all consortium partners. These scientific experts (SEs) are also essential for the outreach and collaboration activities and they will participate by initiating national and international collaborations and research activities, and through other outreach efforts. To strengthen the role of the consortium partners in the scientific development of the RI as well as its connection to the partner universities, the SEs will form a group within the management team that will support the Director on scientific matters.

In order to fulfil our obligations to ICOS RI and maintain the quality of our network, we will continuously follow and participate in ICOS RIs development of the instrumentation and protocols, e.g. by participation in research and development projects initiated by ICOS ERIC. The routines for external projects at the sites will be further developed and we will setup a data policy for use of non-ICOS data. We will also continuously follow on the human resources strategy when it comes to fair working conditions and security rules.

ICOS Sweden is planning to incorporate marine ICOS marine measurement performed on a boat line in the Baltic Sea as a class 1 ICOS ocean site. Furthermore, ICOS Sweden will promote that a number of complementary flux measurements performed within the SITES<sup>1</sup> infrastructure will be accepted as ICOS associated sites. Work on identifying new sites, new instrumentation and possible extension of the measurements are also done in collaboration with ICOS RI.

For the 2016-2020 funding period, we did not have any funding for renewal of equipment. A plan for a general renewal of all instruments and funding of this will be set up and included in the application for the next funding period, 2020-2027.

## **5.2 Foster collaboration and interoperability with other in-situ environmental measurement networks and satellite programs**

At the international level, ICOS RI aims at being the European pillar of a global GHG observation

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<sup>1</sup> SITES – a nationally co-ordinated infrastructure for terrestrial and limnological field research.  
<http://www.fieldsites.se/en-GB>

system. ICOS RI has this clear role in the European Research Area and the ensemble of European Environmental Research Infrastructures (ENVRIs) and acts in this role towards GCOS and global organizations and networks such as UNFCCC, WMO, UNESCO, UNEP, and GEO. ICOS also cooperates with similar research infrastructures in other regions, and thus, actively supports global integration of research on GHG and the carbon cycle.

ICOS Sweden collaborates and will continue collaborating with other national and international in situ ENVRIs active in Sweden such as SITES, ACTRIS<sup>2</sup>, eLTER<sup>3</sup>, AnaEE<sup>4</sup> and NordSpec<sup>5</sup>. The aim is to co-locate measurements and make the systems interoperable in order to widen the use of the data, e.g. for earth system modelers, that needs a number of variables from a specific site to validate and constrain their models. ACTRIS is now on the Swedish roadmap for RIs and will apply for funding in early 2019. The SRCs Council for RIs identified ACRTIS and the cooperation and co-location of ICOS and ACTRIS measurements as being of high scientific value.

Furthermore, the interoperability with satellite data and e.g. the Copernicus program is a prerequisite for the integration of ICOS into a global observational system and for enabling top-down approaches to assess the GHG cycles, sources and sinks. Such approaches require measurements from ground-based stations or aircrafts and remote sensing data. In the aim of widening the use of the data, evaluation of the possible extension of new measurements within the ICOS Sweden measurement program, as well as technical development of the instruments, is taken into account.

### **5.3 Stimulating scientific studies and modelling efforts aiming at increasing the knowledge on carbon emissions, sinks, and trends to enable evaluation of the Swedish emission targets.**

As all present ICOS Sweden stations are becoming certified ICOS stations during 2018-2019 and data and elaborated products will start to be delivered through the ICOS Carbon Portal, outreach activities directed towards the scientific community will be increasingly important for ICOS Sweden. To ensure ICOS' long-term contributions, ICOS Sweden will mainly target information on the usefulness of ICOS Sweden for Swedish research towards the funders - the

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<sup>2</sup> ACTRIS – the European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases.  
<https://www.actris.eu>

<sup>3</sup> eLTER – the Integrated European Long-Term Ecosystem & Socio-Ecological Research Infrastructure.  
<http://www.lter-europe.net/elter>

<sup>4</sup> AnaEE – AnaEE offers access to experimental platforms on terrestrial and aquatic ecosystems across Europe.  
<https://www.anaee.com>

<sup>5</sup> NordSpec - a research network for spectral data collection, inspired by SpecNet. <https://nordspec.nateko.lu.se>

Swedish Research Council (SRC) and the station hosting universities and institutions. Activities will include further development of a user group and continued outreach activities as workshops, webinars, news-letters and information meetings.

The main task is to approach and motivate the funders even though industry and authorities will also be targeted. Scientific and societal usefulness and relevance will be addressed by compiling data and synthesis products. Standard outputs from the ICOS Carbon portal and ICOS RI will be adapted for national use. Showcases on how ICOS Sweden data can be used to improve the understanding of ecosystem functioning, carbon budgets and trends in greenhouse gas concentrations will be identified and featured. Furthermore, ICOS Sweden will actively promote research contributing to improvements of the carbon emission accounting and development of adequate methods to evaluate the Swedish emission roadmap stated in the Swedish Climate Policy Framework. Ongoing research using ICOS Sweden and ICOS RI data will be compiled and spread through outreach channels mentioned above.

#### **Evaluation of the outcome**

The outcome of the activities will be quantified in line with the required key numbers from the Swedish Research Council and adapted to the suggested key numbers in the ICOS RI Impact report 2018 and other relevant information. This will be revisited in spring 2019.