



# ICOS SWEDEN - user statistics 2025

**ICOS** |  National  
Network  
Sweden



## **Statistics on the usage of the ICOS Sweden RI based on the keynumbers defined in the “Acceptance of terms and conditions” (DNo 2023-00172) between the Swedish Research Council and Lund University as fund manager of ICOS Sweden**

The Integrated Carbon Observation System Sweden, ICOS Sweden<sup>1</sup> is a part of the pan-European distributed research infrastructure ICOS<sup>2</sup> that promotes fundamental understanding of carbon cycle, greenhouse gas (GHG) budgets and perturbations and their underlying processes by providing consistent and persistent measurement data from *in situ* networks. The overall aim of ICOS Sweden is to produce harmonized, high-quality data on GHG exchanges, atmospheric GHG concentrations and their defining state variables within typical Swedish ecosystems (both terrestrial and marine) and regions. These activities are critical to enable quantification of the Swedish GHG balance and the feed backs of these ecosystems to a changing climate. Swedish ICOS stations contribute data that are critical for a continental scale understanding of the GHG balance of Europe.

ICOS Sweden and its data products is an infrastructure which is open to everyone. As research infrastructure, it is meant to be used by scientists to address different research questions. By organizing open door events or preparing easy to understand teaching material, it can even reach out to the general public to arouse interest and enlarge knowledge on ecosystem related climate issues. Elaborated products will be available for all the interested social stakeholders such as citizens, decision makers and media.

Scientific users of the infrastructure are researchers using the data produced by the measurement stations to address their research question. According to the download statistics provided by the ICOS Carbon portal, more than 48000 datasets of final quality-controlled data sets (level 2) from Swedish ICOS stations have been downloaded via the Carbon Portal.

Scientific users of the ICOS Sweden infrastructure are also researchers coming to the stations for field experiments to answer their specific research question. During 2025, 105 projects were taking advantage of using ICOS Sweden infrastructure for own field research or by using data, many of them using several stations for their studies. An increasing number of projects related to modelling activities were registered.

The users of ICOS infrastructure divide into two partially overlapping classes, data users and users of the physical station infrastructure with the data and the sites being available to all.

The academic users of ICOS data can be divided into three main groups. 1) Modelers working with both bottom-up and top-down type models from different disciplines, e.g., soil science, ecophysiology, biogeochemistry, hydrology, meteorology, climate science, atmospheric science. 2) Remote sensing (RS) community that is interested in ground truth data for validation of different RS products. 3) Researchers synthesizing empirical data from different types of ecosystems and climatic regions to understand the processes regulating exchange of matter and energy between ecosystems and the

<sup>1</sup> [www.icos-sweden.se](http://www.icos-sweden.se)

<sup>2</sup> [www.icos-ri.eu](http://www.icos-ri.eu)

climate system. We have listed projects making use of the infrastructure on our website (<https://www.icos-sweden.se/researchonsite> and <https://www.icos-sweden.se/projectsdata>).

Users taking advantage of the physical access to the measurement stations benefit from station infrastructure, including laboratory space, technical support, power supply, internet and other services, and high-quality auxiliary data provided by ICOS Sweden. These users perform on site research consisting of measurement programs that are in addition to the ongoing ICOS measurement program. They, in turn, benefit directly from the context of the long term ICOS measurements. The users use and process ICOS data while integrating it into their own scientific research topics. They publish scientific papers in high-impact journals, make presentations at international workshops and conferences, and develop novel measurement methods that may become operational within ICOS in future.

Table 1 comprises the summary of the key numbers since the start of the 2nd ICOS Sweden funding period 2016. The results are analyzed in more detail below. ICOS Sweden defined targets for the keynumbers in its most recent Strategic Plan. These are included in the last row of Table 1. The number of peer-reviewed publications generated either from data provided by the infrastructure or through its direct physical use has continued to rise and is now well above the target. Also, the total numbers of research projects slightly increased, showing an increasing interest of the earth system modelling community in the data.

*Table 1. Summary of the key numbers for the annual reporting of the infrastructure activities. Data downloads include all levels of data products (Level 0: raw data to level 3: elaborated products without excluding whitelisted IP addresses). \*courses visiting the sites are no longer counted as site days + only Level 2 data*

year	general key numbers		Project Pis		Number of site days	Data repository downloads	
	number of publications peer-reviewed	phd theses	Inter-national	national	national	Inter-national	national
<b>2016</b>	44	-	17	52	-	--	--
<b>2017</b>	64	-	15	39	-	2	752
<b>2018</b>	60	-	28	26	-	3728	1397
<b>2019</b>	26	-	16	82	-	10483	2776
<b>2020</b>	87	-	13	76	-	50467	2296
<b>2021</b>	71	-	24	75	7928	44978	2111
<b>2022</b>	55	4	18	63	14819	52026	1752
<b>2023</b>	63	4	21	89	11264	45051	2822
<b>2024</b>	64	7	29	60	8310*	56026	3561
<b>2025</b>	76	18	33	67	4977	45900+	2230+
<b>target</b>	>60		>15	>50	>5000	>40000	>2000

## Physical Users of the infrastructure

The motivation for users that come in person to the ICOS Sweden RI facilities is broad. National and international scientists use ICOS Sweden stations for their own research project related field work. ICOS Sweden facilities are also used for education at university level during excursions and field courses. Table 2 includes the updated numbers for each group of physical users. The category “general public” has been renamed to “other users” and includes shorter visits by guest researchers, excursions as part of conferences or project meetings.

The total number of visitors connected to research projects reported by the stations is on approximately the same level as in 2023. Also, the total number of scientific visitors is at approximately the same level, however, having in mind that the reported number does not include conference visitors any longer, the development can be counted as an increase of usage for scientific projects.

*Table 2. User numbers for project PIs, Scientific visitors (site visitors related to university courses and projects) and other visitors (visits as part of conferences or other opportunities). \*excursions during conferences no longer counted as scientific visitors; +courses not counted as projects; <sup>‡</sup>visitors as part of conferences counted as “other visitors”*

year	Project PIs		Scientific visitors		Other visitors
	male	female	male	female	not divided by gender
<b>2016</b>	50	19	355	277	245
<b>2017</b>	40	14	166	227	21
<b>2018</b>	42	12	72	67	32
<b>2019</b>	63	25	163	94	14
<b>2020</b>	49	35	129	64	10
<b>2021</b>	40	30	134	92	10
<b>2022</b>	68	35	407	208	128
<b>2023</b>	78	38	323	245	n/a
<b>2024</b>	59 <sup>+</sup>	33 <sup>+</sup>	229 <sup>*</sup>	144 <sup>*</sup>	n/a
<b>2025</b>	75	30	306	264	449 <sup>‡</sup>

As in previous years, all projects that wanted to come to the stations could be granted access (Fig. 1); about one third of all registered projects were classified as competence building projects. The PI:s for about half of all projects came from the respective host institution of the station, the other half came from the international research community, partners within the consortium or other Swedish research performing organizations. As in the previous year, there was a strong interest from international groups to use Abisko-Stordalen for their field research. With the increasing number of site years available on the ICOS Carbon Portal, we see an increased interest from the modelling community in the usage of data from the Ecosystem stations.

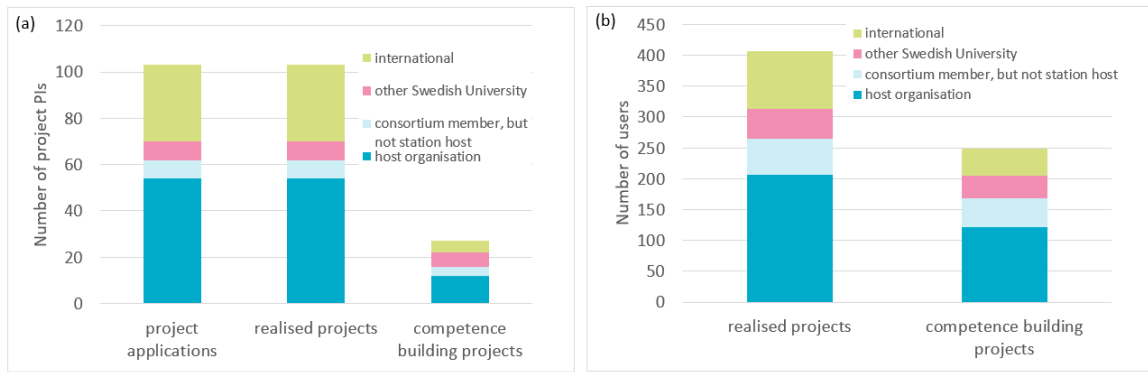


Fig. 1: Number of (a) academic projects and (b) academic users in 2025 divided into their respective academic residence. Host organisations refers to the host of the respective station.

### Users of the data produced by the infrastructure

All data from the ICOS stations are available under a Creative Commons Attribution 4.0 International License. The statistics for downloaded data from the ICOS Carbon Portal (CP) provided by the CP is heavily influenced by non-relevant downloads which could not yet been filtered out. Figure 2 and table 3 are based on downloads of level 2 data, but only give a rough overview which needs to be interpreted with care. We thus do not describe the figure and table in detail.

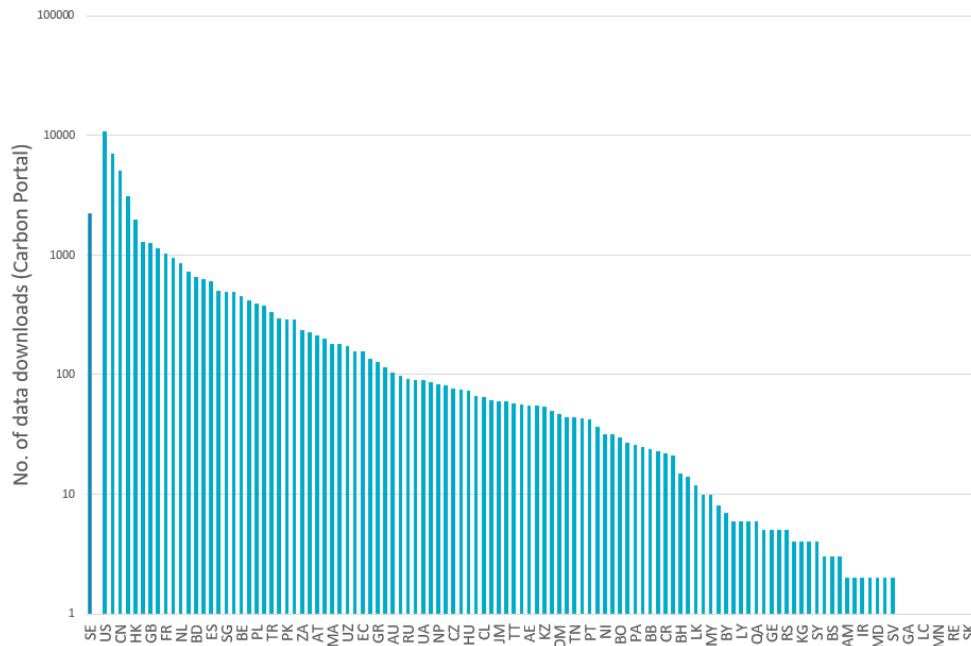


Fig. 2: Origin of international data users – derived from downloading IP address - of the ICOS Sweden data products in 2025 (level 2); data downloads from the ICOS Carbon Portal (white listed IPs included due to technical reasons).

It can be assumed that the download numbers and distribution of countries from where data are downloaded compares to earlier years. In general, data downloads from the Atmosphere Stations are higher than from the Ecosystem stations (Table 3). This can be explained by the structure of the data products (single variables in Atmosphere station data vs. collection of parameters in Ecosystem station data). Also, the user behaviour is different for the different communities: whereas the Atmosphere station community often accesses the data by demand during model runs which results in multiple downloads for multiple model runs, the typical Ecosystem station data user downloads a dataset and

works offline with the data (single data download). The latter is expected to with the increasing number of users from the earth system modelling community.

Table 3. Downloads of data (Level 1 to 3; 2025: only Level 2 data) from the ICOS Carbon Portal since 2018 per station excluding white-listed IPs. "n/a" indicates stations where no level 2 data is available yet.

	Ecosystem Stations								Atmosphere Stations			Ocean Stations		Total
	SE-Sto	SE-Svb	SE-Deg	SE-Nor	SE-Lnn	SE-Myc	SE-Oes	SE-Htm	SVB	NOR	HTM	Tav	Oes	
2018	0	1046	25	590	124	n/a	n/a	1012	153	185	218	n/a	n/a	3 323
2019	5	2337	133	1381	451	n/a	n/a	1775	1294	1280	1901	n/a	n/a	10 557
2020	15	1071	378	613	289	n/a	n/a	838	1622	1618	1811	n/a	n/a	8 255
2021	249	899	378	580	167	n/a	n/a	657	2877	2902	3086	n/a	n/a	11 795
2022	538	1212	629	791	280	n/a	n/a	1023	4084	3792	3983	n/a	n/a	16 332
2023	470	876	679	626	137	n/a	n/a	695	7953	7833	8005	n/a	n/a	27 274
2024	1581	1831	1554	1631	191	n/a	n/a	1731	4656	5496	5075	n/a	n/a	23 746
2025	3142	4077	3701	4099	183	n/a	n/a	4069	9630	9475	9933	n/a	5	48 131

### Publication and Citation statistics for peer-reviewed publications related ICOS Sweden stations

The full list of peer-reviewed scientific publications published in 2025 that the ICOS Sweden infrastructure has contributed to through data measured at the stations or support of field research at the stations is included in Appendix A and available on <http://www.icos-sweden.se/publications>. Google scholar was used to compile the citations related to publications over the last five years. Theses we are aware of on graduate and undergraduate level using data from ICOS Sweden stations are listed in Appendix B.

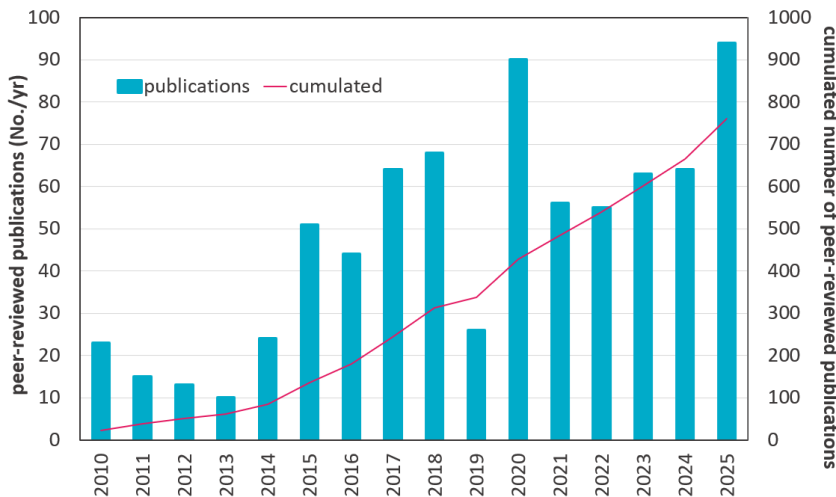
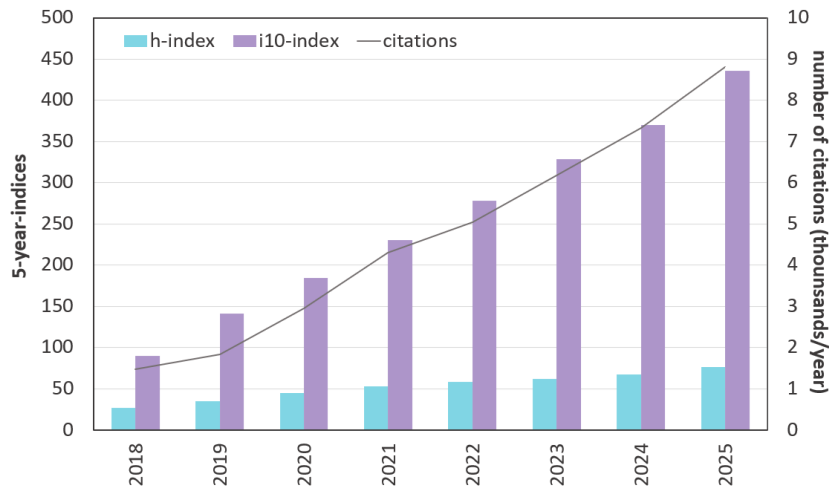


Fig. 3. Number of publications and citation statistics (google citations, 2026-02-13) of publications related to ICOS Sweden stations and ICOS Sweden activities. The publication list of included papers is available on [www.icos-sweden.se](http://www.icos-sweden.se).



*Fig. 4. Time series of citation indices (google citations, 2026-02-13) and number of citations per year derived from publications related to ICOS Sweden stations and ICOS Sweden activities.*

## Appendix A: List of peer-reviewed publications

- Aalto, T., Tsuruta, A., Mäkelä, J., Müller, J., Tenkanen, M., Burke, E., Chadburn, S., Gao, Y., Mannisenaho, V., Kleinen, T., Lee, H., Leppänen, A., Markkanen, T., Materia, S., Miller, P. A., Peano, D., Peltola, O., Poulter, B., Raivonen, M., Saunio, M., Wårlind, D. & Zaehle, S. 2025. Air temperature and precipitation constraining the modelled wetland methane emissions in a boreal region in northern Europe, *Biogeosciences*, 22, 323–340. doi:10.5194/bg-22-323-2025
- Basso, L. S., Georgievski, G., Brovkin, V., Beer, C., Rödenbeck, C., & Göckede, M. 2025. A top-down evaluation of bottom-up estimates to reduce uncertainty in methane emissions from Arctic wetlands. *EGUsphere*. doi:10.5194/egusphere-2025-4467 [PREPRINT]
- Benson, V., Bastos, A., Reimers, C., Winkler, A. J., Yang, F., & Reichstein, M. 2025. Atmospheric transport modeling of CO<sub>2</sub> with neural networks. *Journal of Advances in Modeling Earth Systems*, 17(2), e2024MS004655. doi:10.1029/2024MS004655
- Biegel, S., Schindler, K., & Stocker, B. D. 2025. Unrecognised water limitation is a main source of uncertainty for models of terrestrial photosynthesis, *Biogeosciences*, 22, 7455–7481. doi:10.5194/bg-22-7455-2025
- Brown, L. A., Fernandes, R., Verrelst, J., Morris, H., Djamai, N., Reyes-Muñoz, P., ... & Meier, C. 2025. GROUNDED EO: Data-driven Sentinel-2 LAI and FAPAR retrieval using Gaussian processes trained with extensive fiducial reference measurements. *Remote Sensing of Environment*, 326, 114797. doi:10.1016/j.rse.2025.114797
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- Chi, J., Klosterhalfen, A., Nilsson, M. B., Laudon, H., Wallerman, J., Larson, J., ... & Peichl, M. 2025. A managed boreal forest landscape in northern Sweden is a persistent net carbon sink despite large inter-annual weather anomalies. *Agricultural and Forest Meteorology*, 373, 110758. doi:10.1016/j.agrformet.2025.110758
- Cronin, D. R., Holland-Moritz, H., Smith, D. A., Aroney, S. T., Hodgkins, S. B., Borton, M., ... & Rich, V. I. 2025. Stable states in an unstable landscape: microbial resistance at the front line of climate change. *bioRxiv*, 2025-02. [PREPRINT]
- Davidson, S. J., Malhotra, A., Jassey, V. E., Strack, M., Aitova, E., Anderson, R., ... & Wegener, E. 2025. The PeatPic project: predicting plot-scale green leaf phenology across peatlands. *Environmental Research Letters*, 20(11), 114002. doi:10.1088/1748-9326/ae0658
- DiMaria, C. A., Jones, D. B., Ferracci, V., Bloom, A. A., Worden, H. M., Seco, R., ... & Mak, J. E. 2025. Optimizing the temperature sensitivity of the isoprene emission model MEGAN in different ecosystems using a Metropolis-Hastings Markov Chain Monte Carlo method. *Journal of Geophysical Research: Biogeosciences*, 130(5), e2025JG008806. doi:10.1029/2025JG008806
- Duan, W., Wu, M., Peichl, M., He, H., Roulet, N., Noumonvi, K. D., ... & Jansson, P. E. 2025. Seasonal and diurnal patterns of methane emissions from a northern pristine peatland in the last decade. *Global Biogeochemical Cycles*, 39(8), e2025GB008518. doi:10.1029/2025GB008518

- Dubois, K., Nilsson, E., & Rutgersson, A. 2025. Assessing future changes in Baltic sea extreme wave heights using a machine learning approach. *Theoretical and Applied Climatology*, 156(10), 1-21. doi:10.1007/s00704-025-05758-8
- Eriksson Stenström, K., & Mattsson, S. 2025. Current trends in radiocarbon in Skagerrak and Kattegat assessed by brown algae from Swedish coastal waters. *Radiation Protection Dosimetry*, 201(13-14), 1006-1016. doi:10.1093/rpd/ncaf032
- Escobar, D., Manzoni, S., Tapasco, J., Vestin, P., Belyazid, S. 2025. Evaluation of long-term carbon dynamics in a drained forested peatland using the ForSAFE-Peat model. *Biogeosciences* 22, 2023-2047. doi:10.5194/bg-22-2023-2025
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- Gómez-Ortiz, C., Monteil, G., Basu, S., & Scholze, M. 2025. A CO<sub>2</sub>-Δ<sup>14</sup>CO<sub>2</sub> inversion setup for estimating European fossil CO<sub>2</sub> emissions. *Atmospheric Chemistry and Physics*, 25(1), 397-424. doi:10.5194/acp-25-397-2025
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- Guo, Z., Zhang, H., Martínez-García, E., Lv, X., Laudon, H., Nilsson, M. B., & Peichl, M. 2025. Spatio-temporal dynamics and controls of forest-floor evapotranspiration across a managed boreal forest landscape. *Agricultural and Forest Meteorology*, 361, 110316. doi:10.1016/j.agrformet.2024.110316
- Guzinski, R., Nieto, H., Barrios, J. M., Ghariani, W., Gellens-Meulenberghs, F., De Pue, J., & Lacaze, R. 2025. Towards a global actual evapotranspiration product for the Copernicus Land Monitoring Service. *EGUsphere*, 2025, 1-63. doi:10.5194/egusphere-2025-4342[PREPRINT]
- Harris, S. J., Schwietzke, S., France, J. L., Velandia Salinas, N., Meixus Fernandez, T., Randles, C., ... & Zhang, Y. 2025. Methane emissions from the Nord Stream subsea pipeline leaks. *Nature*, 637(8048), 1124-1130. doi:10.1038/s41586-024-08396-8
- Högberg, P., Klatt, C., Franklin, O., Henriksson, N., Lim, H., Inselsbacher, E., ... & Högberg, M. N. 2025. Improved methodology for tracing a pulse of <sup>13</sup>C-labelled tree photosynthate carbon to ectomycorrhizal roots, other soil biota and soil processes in the field. *Tree Physiology*, 45(1), tpae169. doi:10.1093/treephys/tpae169
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## Appendix B: List of published theses

### PhD Theses

- Bizjak-Johansson, T. 2025. Some aspects on boreal forest microbiotas and nitrogen. Acta Universitatis Agriculturae Sueciae Umeå, SE. [phd thesis](#)
- Chen, Z. 2025. A Study on Process-based Modeling of Monoterpene Emission from Terrestrial Ecosystem, Hokkaido University, Japan. [phd thesis](#)
- Cronin, D.R. 2025. Unraveling permafrost peatland microbial dynamics across temporal and spatial scales. Ohio State University, USA. [phd thesis](#)
- Dubois, K. 2025. On Coastal Hazards in the Baltic Sea. Uppsala University, SE. [phd thesis](#)
- De Gruyter, J. 2025. The soil microbial community as a whole: compositional changes in soil bacterial and eukaryotic communities through time and in times of perturbations. University of Antwerp, BE. [phd thesis](#)
- Freire Zapata, V.E. 2025. Soil Microbial Adaptations to Climate Disturbance: Integrated Multi-Omics Insights from Permafrost and Arid Ecosystems. University of Arizona, USA. [phd thesis](#)
- Gachkivskyi, M. 2025. Assessing fossil CO<sub>2</sub> emissions in Europe: how reliably do ICOS <sup>14</sup>CO<sub>2</sub> and CO observations constrain atmospheric inversions? Heidelberg University, GER. [phd thesis](#)
- Gómez-Ortiz, C. 2025. Top-Down Methods for Estimating the European Carbon Budget: Towards Independent Monitoring and Verification of Carbon Emissions. Lund University, SE. [phd thesis](#)
- Hermanns, F. 2025. Improving Hyperspectral Monitoring of Ecosystem Functioning with Novel Latent Variable Transformations. Humboldt-University Berlin, GER. [phd thesis](#)
- Leistner, T. 2025. Modelling and Linking Radar Backscatter and Stem Water Content in a Boreal Forest. Chalmers University, SE. [phd thesis](#)
- Li, X. 2025. Improving crop yield prediction in Sweden using satellite remote sensing and the ecosystem model LPJ-GUESS. Lund University, SE. [phd thesis](#)
- Logan, M.N. 2025. Unraveling Biogeochemical Cycling of Carbon, Sulfur and Nitrogen With High Resolution Mass Spectrometry: From California Vineyards to Thawing Permafrost in Sweden. Colorado State University, USA. [phd thesis](#)
- Müller, M. 2025. Mapping Vegetation Dynamics Under Drought Stress: Integrating Satellite, Meteorological, and Terrestrial Geospatial Data. Lund University, SE. [phd thesis](#)
- Noumonvi, K. D 2025. Methane emissions from high latitude peatlands: controls of their spatio-temporal dynamics across a mire complex. Acta Universitatis Agriculturae Sueciae Umeå, SE. [phd thesis](#)
- Petersen, R. 2025. Emission of biogenic volatile organic compounds from intact & clearcut boreal forest: Multi-year observations of BVOC fluxes at a Swedish boreal forest and the ecosystem-scale BVOC impacts of clearcut forestry. Lund University, SE. [phd thesis](#)
- Smeds, S. 2025. Peat properties and mercury methylation in drained and restored boreal peatlands. Acta Universitatis Agriculturae Sueciae Umeå, SE. [phd thesis](#)
- Tenkanen, M. 2025. Methane emissions at high northern latitudes estimated by an atmospheric inversion model. University of Helsinki, FIN. [phd thesis](#)
- Vettikkat, L. 2025. Ecosystem-scale Emissions of Biogenic and Agricultural Aerosol Precursors Into the Boreal Atmosphere. University of Eastern Finland, FIN. [phd thesis](#)

***MSc theses***

DeFelice, H. 2025. Impacts of Permafrost Thaw and Methane Cycling in a Northern Peatland. MSc College of Science at Rochester Institute of Technology, Rochester, New York, USA.

Hirth, L. 2025. Seasonal carbon flux variations in temperate forests in southern Sweden. MSc Lund University

Ingvarsson, E. 2025. Soil organic carbon distribution across climatic and topographic gradients in sub-Arctic northern Sweden. MSc Umeå University, SE

Liljeberg, C. 2025. Impact of clearcutting on forest carbon fluxes. MSc Lund University

Oikarinen, T.S. 2025. Creating Belonging and Community on a Multisite Blended Field Course. MSc University of Helsinki, FIN

Pikas, Y. 2025. Snowmelt Modeling and Energy Balance Characterization of a Boreal Snowpack: Comparing an Open and a Forested Site. MSc SLU

Päffgen, E. 2025. A turbulence based description of the air-sea gas transfer in the Baltic Sea. MSc University of Bonn, Germany

Staudt, X. 2025. A Comparative Analysis of the Forest-Atmosphere Carbon Dioxide Exchange of European Scots Pine Ecosystems. MSc University of Innsbruck, AUT

***BSc theses***

Wilcox, M. 2025. Investigating the Microbial Communities in Freshwaters of Northern Sweden. BSc University Honors Capstones, USA.