

RESEARCH & DEVELOPMENT REPORT 2023

FACULTY OF BIOECONOMY



Heidi Barman-Geust (edit), Novia University of Applied Sciences, Research & Development Report 2023. Faculty of Bioeconomy

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RESILIENCE - IN REAL LIFE

Thinking back on 2023 I see many things that did not go according to plan. I think there was an idea that things should only get better, and widespread disappointment and frustration that they were not. For instance, the covid pandemic is over. Right? Yet we seem quite frustrated when we get covid again, maybe for the third time already, and we are still quite ill and must stay home to recover. Somehow the expectation is that the problem should be solved, and we should not have to put any time or energy into thinking about covid anymore. After all, covid is sooo 2020!

2023 was the warmest year on record! Although we have been talking about climate change forever it seems it is flooding social media with one horror after the other, floods, fires, drought, causing immeasurable suffering and pain. Why isn't anybody doing something about this already? Is it just youngsters and middle-aged women who care? Not sexy, at all.

The war in Ukraine is still not over, it's been two years! The conflict is much more difficult to solve than it seems both Europe and the United States initially thought. Some countries seem genuinely surprised at the continued aggression from Russia. It seems a great fatigue has taken hold of us. And there are more wars, new wars, more conflicts, volcanic eruptions, plastic in the oceans and yet we all must go on with our everyday lives too. How will we manage?

The above is very much my own stream of consciousness, reflecting my own thoughts and feelings. Yet, I think in essence many can relate to simply being overwhelmed with crises and catastrophes. Our social media flow is flooded with one cry for help after another. The news is full of problems, and it is difficult to protect oneself from bad tidings. It is no wonder we see statistics of depression and anxiety creeping down in ages, affecting younger and younger children.

Resilience, or “the capacity of systems to restore after a disturbance”, is something you are bound to come across if you ever read anything about sustainability. There are different definitions of resilience, however. The above explanation is called engineering resilience whereas ecological resilience can be explained as “the magnitude of disturbance that a system can tolerate before it shifts into a different state with different controls on structure and function” as explained by Holling, C.S. (1996). The crucial difference between these two explanations is that Holling gives us an “after” and that after has different controls on structure and function than the “before”. What does that mean? In some cases we can estimate the impacts within certain limits of confidence, but even though our estimates and models might be quite good they are never 100% and they can never say what a change means on an individual level. That can feel both scary and decapacitating.

Professor Karen O'Brien in her book *You matter more than you think* (2021) lifts the paradox between how we know the current climate crisis has been created by human actions and how we think there is no possibility for our individual action to change the current course towards climate catastrophe. She suggests that there is a profound limitation to how we see solutions and take agency because we have adopted a classical Newtonian physical viewpoint of linearity, and singularity on how our societies, even humanity work. As a counterweight she introduces the concept of quantum social science where concepts from quantum physics are borrowed by social science stating connectedness through shared language, culture, and values. In this entangled system the action of one affects the state of others or in other words, you matter, and yes probably more than you think. I think this shifts at least my mindset into a more productive and calm state of mind where I can begin to see possibilities and claim agency of change. Along the same lines, a small RDI-crew in a remote, albeit happy country, can make a difference. The system in which we operate is made of connections, networks, sharing knowledge, and a very serious effort to make a change. It is often difficult to quantify or even identify the impact of our work, especially in the typical lifespan of single projects. This can cause frustration and a feeling of disappointment, but viewed from a quantum perspective contributing to the change we want to see is what matters. Because we are entangled, because we share values and because we share a will. This view feels empowering, and I hope some of the fear and gloom you might have been experiencing can be changed by this empowerment.

I will end by citing the Bene Gesserit litany against fear from Frank Herbert's Dune saga, and hope you will find the courage to join this entangled society in bringing forth the change we need.

"I must not fear. Fear is the mind-killer. Fear is the little-death that brings total obliteration. I will face my fear. I will permit it to pass over me and through me. And when it has gone past, I will turn the inner eye to see its path. Where the fear has gone there will be nothing. Only I will remain."

MARIANNE FRED
RESEARCH MANAGER



NORNA - NORDIC NATURAL FIBRES IN CIRCULAR ECONOMY

Natural fibres originating from agriculture, such as wool, flax, hemp, and nettle, have high potential in making a comeback as material for textile production and construction. Other, more innovative applications with natural fibres are, for example composites to replace plastic, and growing media for vegetables and mushrooms. However, the non-food aspect of agriculture is often overlooked by policymakers, media, and the agricultural sector itself. The project NorNa started in April 2023 with the aim to gather and spread information about natural fibres, their production, processing and selling, and to build networks of experts in different natural fibres sectors.

To begin with, a reference group for natural fibres was established. The purpose of the group is to discuss projects, education and natural fibres production and markets. The group is also available to give lectures and presentations about natural fibres. The members are:

Ulrika Dahlberg, Project Leader, Novia UAS
Marianne Fred, Faculty Head of RDI, Novia UAS
Lars Fridefors, Lecturer, Novia UAS
Kristiina Lång, Research Professor, Natural Resources Institute (LUKE).
Samica Sadik, Doctoral Researcher, University of Helsinki
Leena Pesu, Entrepreneur, Linen Stories
Rannvi Wallen, Entrepreneur, Stallwallen
Anu Pentti, Wool expert, Entrepreneur

*Field trip to Niipala Farm.
Outi Vahtila and Annika
Michelsson from HAMK
UAS, farmers Jonna
Panelius and Leena Pesu
taking a break. Picture:
Ulrika Dahlberg.*





Flax production at Niipala Farm in Hollola. Picture: Ulrika Dahlberg.

Highlights of the year

In April, a webinar about wool was organized. Ullkontoret from Gotland presented their scouring (washing) mill for wool, and pellets made from dirty wool, that can be used as fertilizer. **Alicia Trezise-Segervall** from the Faculty of Business at Novia UAS presented her plan for establishing a scouring mill in Finland. Trezise-Segervall also attended Novia's course module about production and processing of natural fibres at the Open UAS.

A field trip to Niipala organic farm in Hollola was organized in September. The participants were introduced to fiber flax growing on the farm, and to the concept of Niipala farm, where farmland and facilities are rented to other entrepreneurs to enable their business ideas.

The biggest event of the year was the seminar Natural Fibres: Product Development and International Business in December. The speakers were **Christoph Behrens**, who has a long experience from international wool trade, **Leena Pesu**, who is working to revive fibre flax production and processing in Finland, and **Sini Honkala**, one of the founders of Ruukin Kehräämö, producing and selling alpaca wool products. In conjunction with the seminar, a discussion about how to get local wool out on the market, was organized. Experiences from Finland, Sweden, Norway, and Germany were shared during the discussion. A general conclusion was that European countries need to work together to preserve the knowledge and the production of wool on the continent, and to stand out in terms of quality instead of bulk.

On demand of the project, three agriculture students **Isac Lindén, Filip Ström** and **Jonatan Sandberg** made a report about the potential of Finnish straw in both traditional and new products, e.g. drinking straws and disposable plates. The report also touches upon the loss of nutrients from the field, which need to be compensated, when the straw is being removed for other purposes. The report, together with the experiences from seminars, field trips and network meetings, provide a good basis for the two upcoming years of project activities.

The project is funded by The Swedish Cultural Foundation in Finland.

ULRIKA DAHLBERG
PROJECT LEADER



Sammanfattning på svenska

Projektet NorNa – Nordisk naturfiber i cirkulär ekonomi jobbar med att sprida information och skapa nätverk kring naturfibrer som har sitt ursprung i det nordiska jordbruket (t.ex. lin, hampa, nässla och ull). Under året 2023 skapade projektet en referensgrupp för naturfiber med representanter från Novia och externa experter. Ett webinarium om ull, en fältträff med besök till en spånadslinodling samt ett seminarium med temat produktutveckling och internationell handel med naturfiber ordnades. I samband med seminariet ordnades ett diskussionstillfälle om hur man får ut lokal ull ut på marknaderna. En allmän slutsats var att europeiska länder måste samarbeta och satsa på kvalitet framför bulk, för att skilja sig från ullproduktionen i Asien och Oceanien. På beställning av projektet gjorde agrologstuderande en rapport om halm, nya och traditionella användningsmöjligheter och näringsförlust i åkern när halmen bärgas. Projektet finansieras av Henrik Nysténs fond inom Svenska kulturfonden.

LILL-NÄGELS AGROFORESTRY PILOT PROJECT



Building on a solid foundation

The project at Lill-Nägels in Kirkkonummi, Finland began 2023 in a good position to utilize the additional resources made available by the Rural Development fund due to the efforts of the previous year in setting up important infrastructure and the initial planting of the first successional cash crop. The project continued with its variety of aims: restore a degraded agricultural site's soil fertility by supporting ecological processes; utilize successional agroforestry methods to more quickly close the ROI gap commonly associated with agroforestry systems; market products from said system directly to consumers; as well as disseminate information about the project to a wide audience.

The winter months were spent finalizing plans for the tree system, which underwent a major revision incorporating lessons learned from further research and in-field observations. We settled on a system which saw us plant more than 170 fruiting bushes, trees, and vines during the course of the growing season. In addition, the greater part of the site- the cultivation zones between the trees (alleys) and the edge of the field (the margin)- were also planted with diverse plant communities of herbaceous plants to fulfill our objectives of revitalizing the soil.



*September 2022: drought and preparation
Picture: Joshua Finch*



August 29, 2023: cover crops begin to diversify away from a near monoculture of grass and the tree lines see growth of perennial woody species. Picture: Joshua Finch



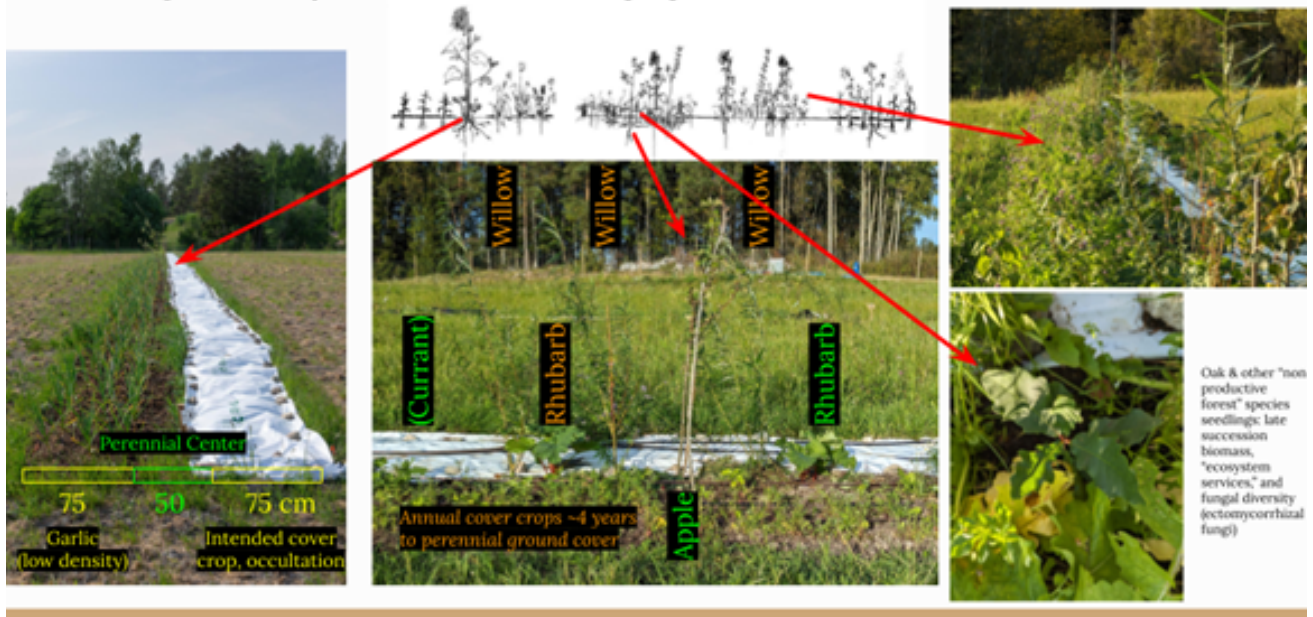
Supporting the growth of the cover crops through foliar applications of nutrients, biostimulants, and humic substances. Picture: Joshua Finch

Unfortunately the site experienced a drought which lasted for nearly two months during the start of the growing season, which put enormous pressure on every part of the whole system. The drought exacerbated the effects of the tillage used to prepare the ground for planting. It was not until August before the cover crops could begin to repair some of the damage. While the irrigation system we installed in the summer was able to allow the trees to recover the garlic suffered a crop failure.

Despite the setbacks, the perennials began to grow and establish themselves in both the tree lines and the margins. We also were able to make significant progress against the perennial grass weeds in the tree beds with the help of Florentine Che Ngong, our project assistant during the summer. This enabled us to get the site back on track and establish cover crops where the garlic had failed. By the end of the year, the system was a thriving example of diverse agroforestry. We ended the year by planting a new crop of garlic according to the crop plan as well as hundreds of flowering bulbs, which were donated by the project manager, to fill an important early-spring niche in the needs of the local insects and soil life for food through photosynthesis.

The Lill-Nägels Agroforestry Project

From concept art to reality or- "How it started, how it's going"



From plan to reality: the sketch in the middle begins to take form in the field by late summer. Picture: Joshua Finch.

Gathering information

Our project continued to collect important data about the state of the soil and plant health. We gathered soil samples from four different soil conditions and plant communities over the course of the spring, summer, and fall. We now have the beginning of a data set which includes conventional soil assessments, near infrared soil testing, as well as soil biological assessments through direct microscopy. We intend to continue collecting data from these sampling locations for the next three years during the Agroforestry in Nyland project, which sees the Lill-Nägels project act as a living lab for one of our work packages.

Not only did we test the soil and begin to get a handle on the fluctuations of nutrient availability throughout the year, but we also were able to add plant sap analysis. By collecting leaves of different ages from our crops and sending them to a laboratory specialized in this process, more than 20 different measurable parameters regarding plant nutrition are returned. This information comes from the liquid sap inside the leaves, which informs the farmer about the current nutrient availability inside the plant. This information can be used immediately by the farmer to formulate additional fertilization applications or be on the lookout for certain classes of pests.

Conclusion

The project drew to a close at the end of 2023 and celebrated the establishment of one of Europe's most northerly successional agroforestry systems by hosting a day-long final seminar. Our final seminar drew 57 participants from around Europe either remotely or to our campus in Raseborg. Joel Williams of Integrated Soils provided the audience with a background of current soil science and farmer practices that aid soil formation, Rikard Korkman- the owner of the Lill-Nägels farm- shared his experiences transitioning to regenerative agriculture, the project manager shared two lectures on the project itself, and we closed with an overview of agroforestry in Finland by Michael den Herder.

Heading into 2024, the project is expected to start making some progress on its goals now that the tree systems are established in primary tree lines and cover crops have begun to diversify the soil in the rest of the site. With an irrigation system ready to go, the garlic will have a chance and the trees will not suffer from drought.

Project Partners

- Rikard Korkman (Farmer)

JOSHUA FINCH
PROJECT LEADER



STIFTELSEN
FINLANDSSVENSKA
JORDFONDEN



Sammanfattning på svenska

Lill-Nägels Agroforestry pilotprojekt genomför ett successivt agroforestry projekt för att bioremediera degraderad jordbruksmark främst genom tillämpning och förvaltning av växtbiologisk mångfald. Projektet syftar till att producera kvalitetsprodukter från den första hela växtsäsongen och marknadsföra dem genom en samhällsstödd jordbruksmodell (CSA). Processen för design, implementering och förvaltning dokumenteras och delas med allmänheten.

Projektet finansierades ursprungligen av Stiftelsen Finlandssvenska Jordfonden och Yrkehögskolan Novia under år 2022. Projektet fick ytterligare finansiering från Nylands närings-, trafik- och miljöcentral, Jordfonden och Novia för år 2023.

Projektet leds av Joshua Finch som bidrar med omfattande praktisk erfarenhet av att tillämpa agroekologiska principer i projektet.

AGROLOG OCH SKOGSBRUKSINGENJÖR 2028 - ÖSTERBOTTEN

I projektet Agrolog och skogsbruksingenjör 2028 – Österbotten, arbetar Novia och Svenska lantbruksproducenternas centralförbund tillsammans för att främja intresset för lant- och skogsbrukssektorn, erbjuda flerformsstudier för agrologer och skogsbruksingenjörer i Österbotten och trygga tillgången på arbetskraft.

Hösten 2023 inledde institutionen för bioekonomi vid Novia utbildning till agrolog och skogsbruksingenjör vid campuset i Vasa. Lant- och skogsbrukssektorn är en viktig del av näringslivet i Österbotten och behovet av utbildade agrologer och skogsbruksingenjörer är större än antalet som utexamineras.

Utbildningen stöds av projektet Agrolog och skogsbruksingenjör 2028 – Österbotten. Projektet utvecklar ett koncept för flexibel flerformsutbildning som riktar sig till yrkesverksamma personer i arbetslivet och personer som på grund av livssituation inte kan studera vid campuset i Raseborg. Målet är att trygga lant- och skogsbrukssektorns behov av kompetent arbetskraft och främja intresset för sektorn som ett framtida yrkesområde.



Gruppdiskussioner bland studerande på närstudiedag i Vasa. Bild: Christel Holmlund-Norrén.



Studiebesök i fält med företagsrepresentant och entreprenör. Bild: Christel Holmlund-Norrén.

Intresset för agrolog- och skogsbruksingenjörsutbildningen översteg förväntningarna och ett stort antal blivande agrologer och skogsbruksingenjörer inledde studierna under senhösten 2023. Studierna förverkligas de två första åren som öppna yrkeshögskolestudier (120 sp), varefter studerande antas som examensstuderande och erlägger resterande studierna (120 sp) under åren 2026–28.

Studerande möts ca en dag per månad för närstudier främst i Vasa. Lärarledda distansstudier sker kvällstid med lärare från Novia och gästföreläsare. Självstudier sker oberoende tid och plats. Beroende på kurserna ingår också fält- och studiebesök i studierna. Den praktik som ingår i studierna kan studerande flexibelt utföra i regionen i samarbete med arbetslivet.

De studerande då – vad är målet med att studera till agrolog eller skogsbruksingenjör hos personer som redan är i arbetslivet? Citaten är från ”Låt din röst höras”, en förfrågan som studerande besvarade i november 2023

”Att skapa en bred kunskapsbas inom lantbruk, som jag kan använda för att utveckla gården hemma, och hjälpa andra att utveckla”

"Målet är att kunna arbeta med frågor angående Finlands skogsbruk, genom forskning, utvecklande av strategier och/eller implementering av nya ramverk. "

"Har höga förväntningar på studierna, har lång erfarenhet av branschen så tänker att min utbildningsnivå bör motsvara den."

CHRISTEL HOLMLUND-NORRÉN

PROJECT LEADER



Svenska
lantbruksproducenternas
centralförbund

Summary in English

The main objective of the project Agrolog och Skogsbruksingenjör 2028-Österbotten, is to contribute to the workforce in the agriculture and forestry sector, with the target being professionals in the agriculture and forestry sector who are interested in studying bioeconomy.

The project involves the development of a concept for a flex path for B.Sc in Agriculture and B.Sc in Forestry in Ostrobothnia, as well as the creation of networks and promotion of interest in the agriculture and forestry sector as a future professional field. The intention is continuous development to ensure the sector's need for competent workforce.

In October 2023, a group of students started their studies in Vaasa. Students meet about one day per month for face-to-face studies mainly in Vaasa. Teacher-led distance studies take place in the evening with teachers from Novia. Self-studies take place independently of time and place. Guest lecturers and partners will also be hired. Depending on the courses, field and study visits are also included in the studies. The practice that is included in the studies can be flexibly performed by students in the region in cooperation with working life.

Novia University of Applied Sciences/Faculty of Bioeconomy will implement the project during the years 2023–28 in collaboration with The Central Union of Swedish-speaking Agricultural Producers in Finland.

A WETLAND MAP FOR WESTERN UUSIMAA

The aim of the project Våtmarkskarta (Wetland Map) was to map existing wetlands in Western Uusimaa and to investigate where it would be appropriate to construct new wetlands. The project ran from 1 April to 31 December 2023 and was funded by Svenska litteratursällskapet. The project was led by **Stefan Heinänen** and in addition **Jonna Engström-Öst** and **Heidi Barman- Geust** worked in the project. The intern **Aija Aakula** made an interactive survey with a map, where landowners could mark their wetlands and fill in information about them. Interns **Joy Jeremiah** and **Daniel Emmanuel** continued to map existing wetlands in the coastal municipalities of Hanko, Raasepori, Inkoo and Siuntio. Information was gathered by studying various materials and information on wetland projects via organisations and projects constructing wetlands in the region.

Geographical information systems (GIS) and the ScalgoLive programme were used to investigate which sites would be suitable for new wetlands. The programmes can be used to identify suitable sites for wetland creation based on various criteria.



Wetland at Västankvarn in Inkoo. Picture: Kay Feliciano

We started from catchment areas between 20 h and 200 h and have also looked at where there is flatness, where there are depressions, at the soil and at risk areas for runoff.

The results were summarised in a report in the form of a Storymap and a map. The map is available on Novia's website. In November, the project organised a seminar "Practical solutions for agricultural water management" where the project and the map were presented. The seminar attracted as many as 80 visitors. The first day included presentations and interviews with farmers. On the second day, various action sites were visited within the framework of the Raseborg å project.

HEIDI BARMAN-GEUST
PROJECT LEADER



Sammanfattning på svenska

Projektet Våtmarkskarta pågick 1.4-31.12.2023 och finansierades av Svenska litteratursällskapet. Målsättningen med projektet var att göra en kartläggning över befintliga våtmarker i västra Nyland, samt att undersöka var det skulle vara lämpligt att anlägga nya våtmarker. Resultaten sammanställdes i en Storymap, och presenterades vid ett seminarium som projektet ordnade i november 2023.

BUILDING PERMANENT AND INTERNAL SPATIAL COMPETENCE WITHIN NOVIA

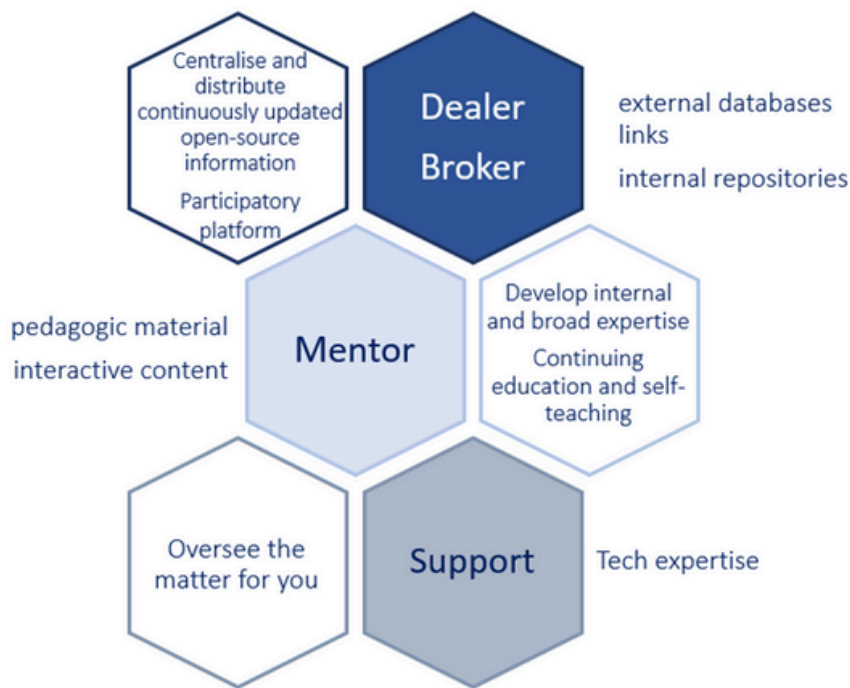
Geospatial data can tell you anything you want to know about any location you like; and that information is crucial to act efficiently, every day. We are building a spatial competence centre to provide Novia with a permanent and broad source of geospatial data, whether as general databases, as geo-informatic tutorials or as help centre. That essential advanced skill will allow Novia to make informed, integrated, and strategic decisions and to pursue projects that are more sustainable.

Highlights of the year

Novia has been cultivating geospatial expertise in its interdisciplinary projects for years and demonstrated its essential role in making sustainable decisions ever since. In 2023, Novia launched the development of a dedicated centre aiming at building spatial competence within the institution. The centre would not be project dependent, allowing for perennial expertise and a cross-disciplinary content, and would have a dual form. First, of a data repository and participatory platform where one would upload one's own data or find actual databases relevant to one's project, whether it is from a previous Novia's projects or from open-source databases.

Secondly, of an educational platform where one could get pedagogic material or tutorials. Finally, the centre would also offer customised help for current or future projects that would require the use of geospatial technologies (such as mapping, modelling, spatial analysis, imageries by satellite or drone or even to plan efficient fieldwork) as a one-time gig or as a long-term partner. As a result, we will enhance our internal skills, combining Novia's vision to respond to continuous learning and aiming to reach one of Novia's strategic goals of digital learning and service. And we will use those skills for informed, integrated, and strategic decision-making.





Aurelie Noel, the project leader, is now in the process of assessing the level of spatial knowledge within Novia and gathering background information with current geospatial Novians to proceed in the launch of the spatial competence centre (SCC) by fall 2024.

An article has already been published for the Novia community:

<https://novialia.novia.fi/novialia/bloggar/bioekonomi/why-novia-needs-to-build-its-competence-with-spatial-data>

The SCC project has been described on the RDI current project page:

<https://www.novia.fi/fui/specialkunnande/bioekonomi-och-hallbart-nyttjande-av-naturresurser/aktuella-projekt/scc-spatial-competence-centre>

AURELIE NOEL
PROJECT LEADER

Sammanfattning på svenska

Geodata kan berätta allt du vill veta om en plats och den informationen är avgörande för att agera effektivt i det dagliga livet. Vi bygger ett spatialt kompetenscenter för att förse Novia med en permanent och bred källa av geospatiala data, antingen som allmänna databaser, som geoinformatiska handledningar eller som hjälpcenter. Denna viktiga avancerade kompetens kommer att göra det möjligt för Novia att fatta välgrundade, integrerade och strategiska beslut för att driva projekt som är mer hållbara.

GEOICT4E-GEOSPATIAL TOOLS AND METHODS FOR SUSTAINABILITY AND EMPLOYABILITY

Since August 2020 a consortium consisting of Novia UAS, University of Turku and Turku UAS, participates in a project that aims at strengthening the geospatial skills for students in Tanzanian universities. The project received funding from HEI ICI, a programme financed by the Ministry of Foreign Affairs and administered by the Finnish National Agency for Education.

The 4 year project, named GeoICT4e, aims at improving entrepreneurial skills for university students in five Tanzanian universities, skills related to geospatial sciences (GIS) and to sustainability in a broad sense.

University of Turku has previously implemented two similar HEI ICI projects in Tanzania, then aiming at developing the infrastructure at the universities such as GIS labs, as well as training the university staff in geospatial matters. The current project takes a step closer to the society as it builds on a learning method that we call MCL, Multi-Competence Learning, and is implemented through so called challenge campaigns, where students solve multi-faceted problems in a real-world setting.

The project looks at the world through a sustainability lens, and consists of several themes, the most important being climate change and its implications, geospatial technologies and ICT, innovation and entrepreneurship and natural resources management. As Novia's input is channeled through the Faculty of Bioeconomy, our main focus is on natural resources management and sustainable coastal management issues, but we will also take part in development and testing of the MCL method and other activities during the project.

Just as in 2022, the coordinators from the Tanzanian universities visited Novia Raseborg in late spring 2023, together with colleagues from University of Turku and Turku University of Applied Science, as a part of a training and development workshop organized by the project.

During 2023, the second round of 5-8 week long MCL challenge campaigns were organized in the five Tanzanian universities, based on the experiences from the first round in 2022. Experts Novia took part as mentors in two of them. An analysis done by the partners during a workshop at the end of the year showed that clear improvements had been made in the way the challenges were conducted.

Effort was also put into the development of the “MCL playbook”, a detailed manual for organizing MCL campaigns. The playbook will be one of the main outputs from the project, and it will also work as a tool for the involved universities when they conduct internal and external training of MCL mentors in the future. A supporting website for this post-project activity was set up in late 2023. It will be hosted by University of Turku and contain useful materials for anyone wanting to conduct campaigns in the MCL spirit, and also work as a marketing hub for the project partners interested in selling training and consultancy services related to MCL.

The work with the short courses, “mini-MOOCs” and “nuggets”, continued during the year, if not to the planned extent.



ROMI RANCKEN
PROJECT LEADER

Coordinators visiting Novia Raseborg in May 2023. Picture: Romi Rancken.

Sammanfattning på svenska

Projektet GeolCT4e strävar efter att förbättra entreprenöriellt kunnande hos studerande inom branscherna för GIS och hållbar utveckling vid fem universitet i Tanzania.

Universitetssektorn i Tanzania växer i snabb takt och miljoner utexaminerade förväntas komma in i arbetslivet under de kommande åren. Tidigare generationer har kunnat förlita sig på en karriär som tjänsteman inom offentliga sektorn, men nu behöver studerande utveckla färdigheter som gör dem attraktiva på arbetsmarknaden.

Hållbar utveckling, klimatförändringen och dess konsekvenser genomsyrar projektet. Teman som lyftas fram är bland annat geospatial teknik och ICT, innovation och entreprenörskap samt förvaltning av naturresurser.

CLIMATE CHANGE AND PLANKTON ECO-PHYSIOLOGY

Team: Jonna Engström-Öst, Kay Feliciano, Joy Jeremiah, Andriana Koutsandrea, Jinzhu Su, Ella von Weissenberg

During 2023 we participated in a mesocosm experiment on microphytobenthos (MPB) ecology, led by **Leena Virta**. The aim of the work was to study warming and salinity effects on MPB growth and biodiversity. We also measured plankton biodiversity and greenhouse gas production. Preliminary results show that warming and salinity have some effects on the community. The work will finish during 2024.

During the year we also collected field data at Husö Biological Station and Tvärminne Zoological Station to study eutrophication and warming effects on fatty acid profiles and antioxidants in zooplankton *in situ* (more information in **Andriana Koutsandrea's** report).



Andriana Koutsandrea at Åland Islands. Picture: Jonna Engström-Öst



Stefan Heinänen, Joy Jeremiah and Daniel Emmanuel collecting water samples at Tåktom wetland. Picture: Jonna Engström-Öst

In 2023 we mostly focussed on processing data and preparing manuscripts for publication; we worked on **Ella von Weissenberg**'s field data on community (von Weissenberg et al. 2024) and zooplankton fatty acid profiles that will generate two publications in collaboration with prof. Reijo Käkeläs team at Lipidomics Unit at University of Helsinki. Further we processed the 2019 mesocosm data from Sète Marine Station, University of Montpellier together with **Soultana Zervoudaki** and **Maria Protopapa** (submitted ms). **Kay Feliciano** (Novia) helped in the project during summer, and **Joy Jeremiah** did her BSc thesis in Våtmarkskarta project.

Ella von Weissenberg and co-authors published a paper in 2024 in *Frontiers in Marine Science* on environmental effects on a main grazer *Limnocalanus* in the northern Baltic Sea. They showed that a main copepod in northern Baltic Sea that providing important food for herring, sprat and other planktivores can do dietary shifts, based on the fatty acid profiles. But warming and eutrophication pose threats to this important species. The paper is a collaboration between Novia and University of Helsinki.

Jinzhu Su conducted a winter experiment on the phytoplankton community at Tvärminne Zoological Station; she showed that glyphosate (=RoundUp) can benefit cyanobacteria in some instances when added to the aquatic environment (Su et al., submitted ms). Glyphosate contains phosphorus, a nutrient much needed by growing cyanobacteria.



Jonna Engström-Öst, Per Hedberg, Nicolas-Xavier Geilfus, Leena Virta, Kay Feliciano and Iris Orizar at Tvärminne Zoological Station.

Picture: Ilse Klockars

JONNA ENGSTRÖM-ÖST

SPECIAL RESEARCHER

Sammanfattning på svenska

Hur påverkas plankton av en förändrad miljö? Kan djurplankton anpassa sig till klimatförändringen? Vi forskar i hur klimatförändringen samt övergödningen i våra kustområden påverkar Östersjöplankton. Vi jobbar främst med djurplankton och undersöker deras eko-fysiologi, reproduktionsframgång, stressnivåer samt fettsyresammansättning. Projektet var år 2023 finansierat av Svenska kulturfonden, Onni Talaan säätiö och Waldemar von Frenckells stiftelse, samt Aquacosm Transnational Access.

ECO-PHYSIOLOGICAL RESPONSES OF MARINE BIOTA TO WARMING WATERS AND OCEAN ACIDIFICATION - FOCUS ON BENTHICPELAGIC COUPLING

Team: Andriana Koutsandrea, Jonna Engström-Öst

I moved to Finland in June 2023, so I could start my PhD. I am a PhD student at Åbo Akademi University, and my supervisors are **Jonna Engström-Öst** from Novia and **Anna Törnroos-Remes** from Åbo Akademi. I am granted by Svenska kulturfonden. Last summer I collected samples from Tvärminne Zoological Station (Storfjärden, Hermansö and Längden) and from one area of Husö Biological Station. I want to study the effects of climate and eutrophication on zooplankton under different stressors, such as temperature, oxygen or eutrophication. That's why I measure the temperature, chlorophyll a, turbidity, dissolved oxygen and salinity. After these measurements, I collected zooplankton community samples to analyse different biomarkers, to study how they respond under these stressors, using the fatty acids profile, and how the differences will impact the food-web. I analysed fatty acids in the laboratory of Prof. **Reijo Käkelä** at the Lipidomics Unit (University of Helsinki) and the biomarkers in the Laboratory of Animal Physiology of Prof. **Katja Anttila** (University of Turku).

Once per week, I attend seminars at my department at Åbo Akademi University, about environmental and marine biology. Also, I attended an R statistics course at Åbo Akademi University. I am glad to announce that we recently prepared my first paper, based on my MSc thesis (Zervoudaki et al., under review), and are waiting for approval.



The zooplankton net during the sampling in a eutrophicated area. Picture: Andriana Koutsandrea

During this period, I am doing the statistical data analyses for the next paper, based on my PhD research. Also, I am communicating with different collaborators for my next projects.

In August I presented the poster Eco-physiological responses of marine biota to warming waters – a focus on benthic-pelagic coupling, at the Baltic Sea Science Congress in Helsinki.

ANDRIANA KOUTSANDREA

PHD STUDENT



**Svenska
kulturfonden**

Collaborators:

Prof. Katja Anttila, Tytti-Maria
Uurasmaa, University of Turku.

Prof. Reijo Käkelä, Minna Holopainen,
University of Helsinki

Dr. Soultana Zervoudaki, Dr. Maria
Protopapa, Hellenic Centre for Marine
Research

*Andriana is sampling at Tvärminne Zoological
Station. Picture: Jonna Engström-Öst*

Sammanfattning på Svenska

I mitt doktorandarbete mäter jag fleromättade fettsyror samt respirationspotential hos pelagiska organismer i kustnära förhållanden påverkade av olika stressfaktorer. Bl.a respiration är en viktig faktor som bidrar till havsförurning. Jag skall också bedöma effekten av ökad alkalinitet i havet under globala uppvärmning på den bentisk-pelagiska näringsväven vid kusten.

BUMBLEBEES IN FINNISH AGRICULTURAL LANDSCAPES

Team: Patrik Byholm, Torgny Backman

In this project, we attempt to get an understanding of what factors determines the population sizes of bumblebees in agricultural landscapes. Given their important role as pollinators of not only wildflowers but also crops such understanding is of interest not only scientifically but also for management purposes.

The project, which was initiated in 2023, aims at understanding which factors governs the sizes of bumblebee populations locally, in particularly what is the role of early spring food abundance when the bumblebee queens are in the process of establishing their nests. For this we mapped bumblebees in the field four times during the summer simultaneously quantifying food abundance and landscape composition. The material is at best being analyzed, and we hope to submit the first scientific paper on the topic for publication during 2024.



*Sometimes flowers get a lot of attraction from pollinators – here four male forest cuckoo bumblebees (*Bombus sylvestris*) simultaneously visit a tansy (*Tanacetum vulgare*). Picture: Patrik Byholm*



Pollen and nectar from willows (Salix spp.) are important food for bumblebees.

Picture: Patrik Byholm

PATRIK BYHOLM

PROJECT LEADER

Collaborators

Annica Lind (City of Närpes, Rural Management)

Lotta Kaila, Juho Paukkunen (University of Helsinki)



**Svenska
kulturfonden**

Sammanfattning på Svenska

Pollinerande insekter, speciellt då humlor, har stor betydelse för blommande gröders skördemängd och frösättning. Mot denna bakgrund genomfördes sommaren 2023 ett fältprojekt i Sydösterbotten var humlerikedomen i olika jordbrukslandskap i studerades. Projektets mål är att få en bättre uppfattning om vilka faktorer som reglerar humlebestånden lokalt för att i förlängningen förstå hur detta bidrar till skörden.

MODELLERING AV STORSKARVAR FÖDOSÖKNINGSOMRÅDEN MED HJÄLP AV GPS-UPPFÖLJNING

Team: Patrik Byholm, Andreas Lindén

In this project, managed by Natural Resources Institute Finland and in which Novia is partner, the goal is to create modeled predictions of the predation pressure caused by great cormorants along the Finnish coast.

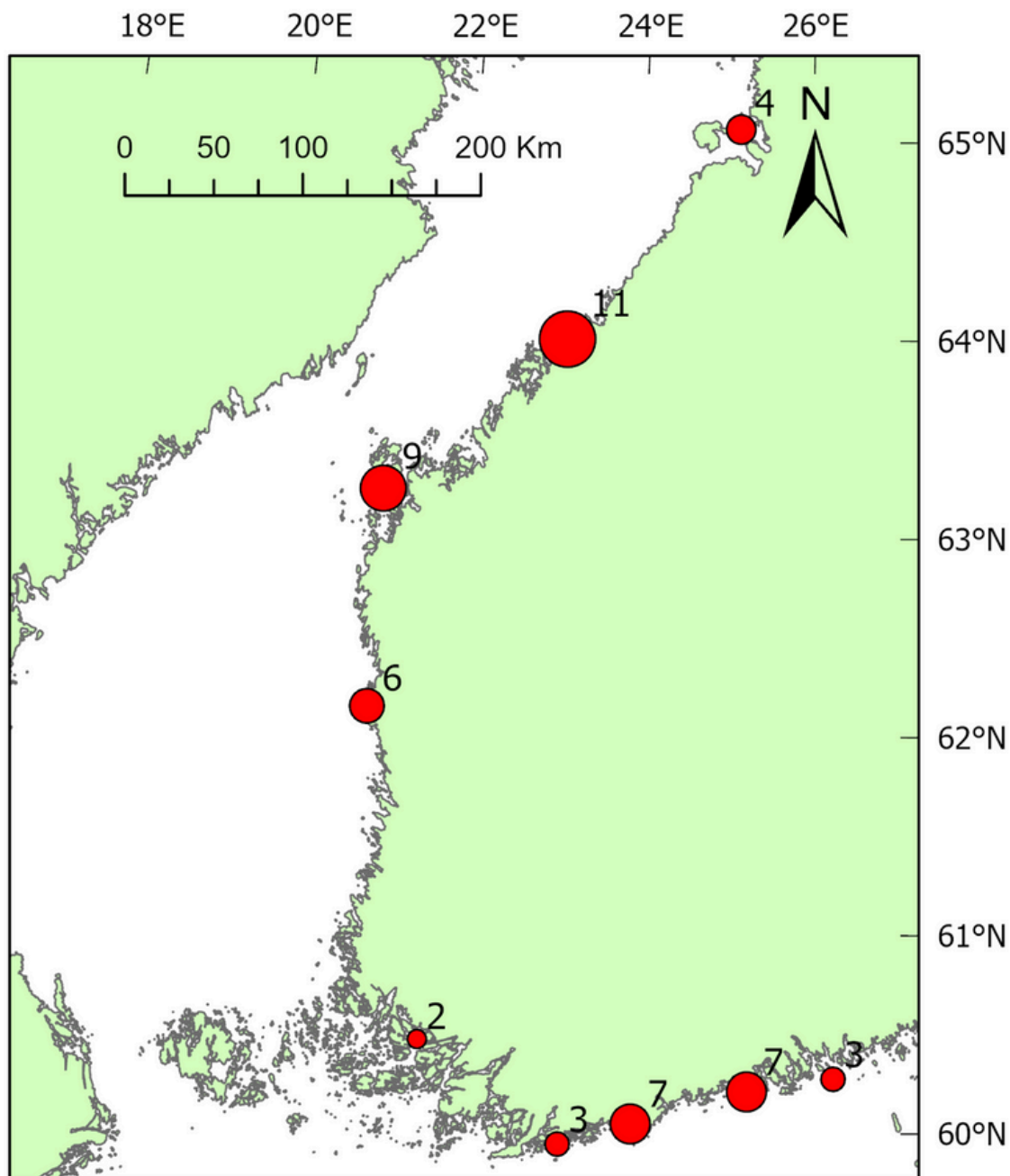
The analysis is part based on data from produced in a previous Novia-project, part on new data produced in this project collected in May–June 2023 in the Gulf of Bothnia and the Archipelago Sea. The modeling of predation pressure is based on the data on predation distances obtained from GPS tracking, as well as modeling of fishing habitats preferred by tracked birds. Modeled predation pressures are used to create heat maps and an open geospatial data product.

The preliminary analysis of the material shows that cormorants on average fish about 7.2 km from the previous night's roost, and although > 15 km fishing flights are already rare, some flights are 20–30 km long, or in extreme cases even 30–50 km. At the time of writing, the habitat modeling is still in progress. The explanatory variables designed to be used in it are depth, distance from the shore, exposure to waves, bottom material of the seabed, and the probability of occurrence of *Fucus vesiculosus* and lagoons.

Collaborators

Camilla Ekblad, Toni Laaksonen (University of Turku)

Markus Piha, Tuomas Seimola (Luke)



The locations where great cormorants were caught and equipped with GPS-trackers in the present project.

PATRIK BYHOLM
PROJECT LEADER

Sammanfattning på Svenska

I detta projekt var Novia agerar partner till Luke eftersträvas att skapa kartmaterial var framkommer det predationstryck storskarvar åsamkar fiskbestånd längs den finländska kusten. För att möjliggöra detta analyseras GPS-uppföljningsmaterial från totalt 52 skarvar. Materialet är fortfarande under analys, men redan nu vet vi att en typisk av skarvar genomförd fiskefärd sträcker sig dryga sju kilometer från den senaste övernattningsplatsen.

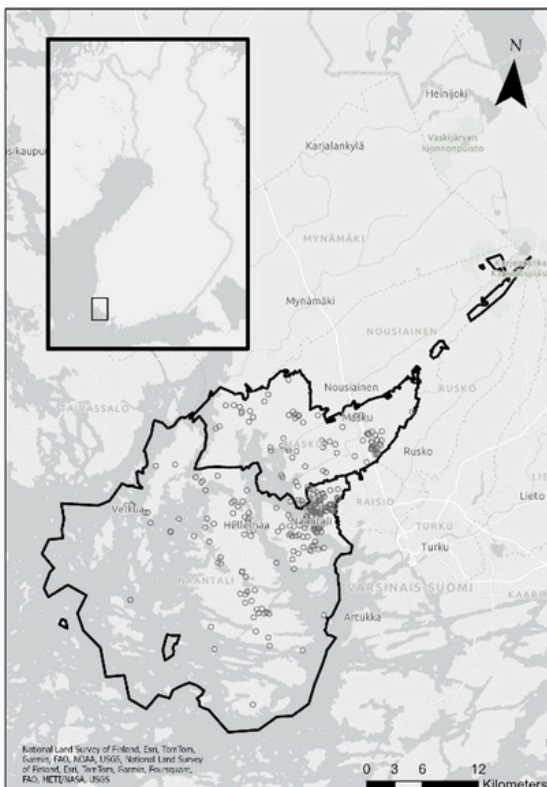
LES 2.0. ROAD TO THE ENVIRONMENTAL DEMOCRACY THROUGH INVESTIGATION OF RELATIONSHIPS WITH THE ENVIRONMENT

LES is a simple acronym meaning Linking Environment and Society, which itself describes the main idea of the project. LES 2.0 is a continuation of the previous project that successfully ended with PhD defense in 2022. A new project LES 2.0 is executed as the project at Åbo Akademi University in collaboration with Novia. In 2024 we expect to have results to be presented in scientific articles and at international conferences.

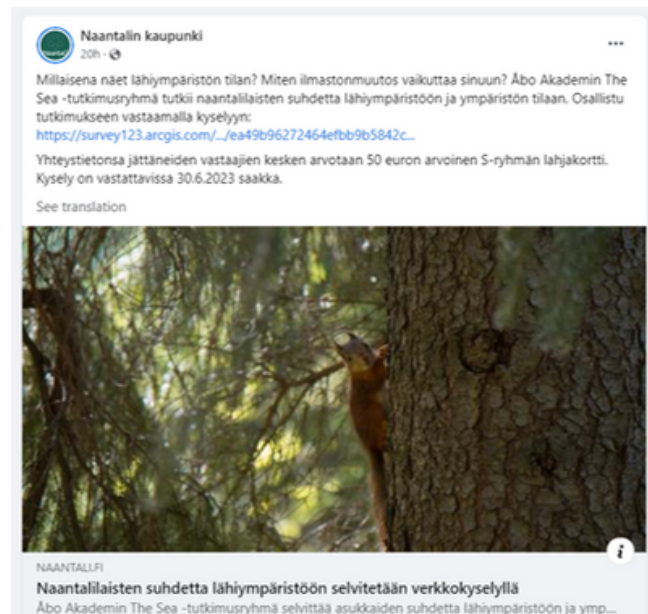
LES 2.0 is an interdisciplinary project aiming to investigate the role of the natural environment in the well-being of people and examine the factors that can affect the relationship between people and nature. Specifically, we are interested in understanding if different types of nature (e.g., coastal waters and forests) influence life quality differently, and what impact political factors such as political orientation or active participation in political life may have on this relationship. For this purpose, we employed an interdisciplinary approach and utilized different sets of data, including objective data collected with professional equipment and subjective data collected through surveys of local inhabitants in the research area.

In the spring of 2023, the project commenced with the selection of the study area and the planning of the project. Due to the availability of high-quality water quality monitoring data and objective environmental data regarding the forest environment, the project group selected two Finnish municipalities, Naantali and Masku, as the study area. Consequently, subjective data collection was carried out in these communities. Throughout the summer of 2023, we distributed an online questionnaire, inviting individuals to share their views on the state of the natural environment, evaluate their well-being, describe their connection to nature, and rate their perceptions of climate change. Additionally, we gathered data on respondents' socio-economic status. Furthermore, we queried participants about their political orientation, participation in elections, and their level of engagement in political discussions at various scales (national and local).

In total, we received over 350 responses and spent the fall of 2023 preparing them for analysis. The preliminary analysis conducted demonstrated the potential for publishing future project results in the form of scientific articles. Consequently, towards the end of the year, we began preparing two articles. The first focuses on the role of different types of nature in people's well-being and how various factors influence it. The second article examines how political orientation, in conjunction with perceptions of climate change impact on different scales (national, municipal, and personal), affects the subjective evaluation of the natural environment. Furthermore, both articles are planned to be submitted and scheduled for presentation at international conferences in 2024. Finally, we continue to work on the analysis and discuss potential new scientific outcomes from LES 2.0.



The distribution of places in Naantali and Masku evaluated by respondents.



The information about the survey published by the official Facebook channel of Naantali municipality.

RUSLAN GUNKO
RESEARCHER

Sammanfattning på Svenska

LES 2.0 är en fortsättning på det tidigare projektet som framgångsrikt avslutades med disputation 2022. Ett nytt projekt LES 2.0 genomförs vid Åbo Akademi i samarbete med Yrkeshögskolan Novia. Projektet kopplar ihop detaljerade mätningar av vattenkvalitet och miljökvalitet i Nådendal och Masku med enkätundersökningar bland orsbefolkningen för att förstå betydelsen och uppfattningen av miljöns tillstånd för välbefinnande på ett lokalt plan och undersöker hur politisk inriktning påverkar den subjektiva värderingen av naturmiljön.

RED-THROATED DIVERS AND OFFSHORE WINDFARMS

We are studying the potential impact of offshore windfarms on Red-throated Divers wintering in the North Sea due to potential habitat loss In the DIVERLOG project. We capture the bird on the sea and tag them with GPS-GSM transmitters. We can consequently follow and analyze their movements and foraging behavior in fine resolution, both in space and time. You can have a look at the data and bird movements on the project web page <https://www.divertracking.com/en/tracking-map/>

The project is carried out in collaboration with colleagues from Bioconsult SH (Germany), Justus Liebig University of Giessen (Germany), Ornitela (Lithuania), Julius Morkunas (Lithuania) and Novia University of Applied Sciences.



Collaborators

Bioconsult SH, Germany

Justus Liebig University of Giessen, Germany

Ornitela, Lithuania

Julius Morkunas, Lithuania

The project is funded by the German Federal Maritime and Hydrographic Agency (BSH).



BUNDESAMT FÜR
SEESCHIFFFAHRT
UND
HYDROGRAPHIE

STEFAN HEINÄNEN
PROJECT LEADER

Sammanfattning på svenska

I projektet DIVERLOG studerar vi hur havsvindparker påverkar smålommas rörelsemönster och födosök. Lommarna märks med GPS-GSM sändare i Nordsjön och vi kan sedan följa med och analysera fåglarnas rörelsemönster. Det är möjligt för envar att följa de märkta fåglarna via websidan <https://www.divertracking.com/en/tracking-map/>

Projektet utförs i samarbete med kolleger från Tyskland och Litauen och finansieras av BSH.



PERSONNEL

Backman Torgny, Project Researcher
Barman-Geust Heidi, Project Leader
Bourdin Pauline, Project Assistant
Bucciolini Gian Luigi, Project Researcher
Byholm Patrik, Senior Lecturer
Dahlberg Ulrika, Project Leader
Emmanuel Daniel, Trainee
Engström-Öst Jonna, Special Researcher
Feliciano Katrina, Project Assistant
Finch Joshua, Project Leader
Fred Marianne, Faculty head of RDI
Gunko Ruslan, Researcher
Gustafsson Pia, Research Assistant
Heinänen Stefan, Senior Lecturer

Holmlund-Norrén Christel, Project Leader
Jeremiah Joy, Trainee
Karell Gun, Senior Lecturer
Karimi Farid, Special Researcher
Koutsandrea Andriana, PhD student
Liinamaa Johanna, Head of Research
Långvik Otto, Research Coordinator
Ngong Florentine, Trainee
Noel Aurelie, Project Leader
Rancken Romi, Project Leader
Riesinger Paul, Senior Lecturer
Sandberg-Kilpi Eva, Dean
Su Jinzhu, PhD student
von Weissenberg Ella, PhD student

PUBLICATIONS, PRESENTATIONS AND MEDIA APPERANCES

A1 Peer-reviewed scientific articles

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Poutanen, Jenni, Fuller, Angela K., Puseenius, Jyrki, Royle, J. Andrew, Wikström, Mikael & **Brommer, Jon E**. (2023). Density-habitat relationships of white-tailed deer (*Odocoileus virginianus*) in Finland. *Ecology and evolution*, 13 (1).

Rueda-Uribe, Cristina, **Byholm, Patrik**, Lötberg, Ulrik, Isaksson, Natalie, Beal, Martin, Raj Pant, Sara & Åkesson, Susanne. (2023). Timing rather than movement decisions explains age-related differences in wind support for a migratory bird. *Animal behaviour*, 196, p. 23-42.

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E1 Popular articles, newspaper articles

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Presentations

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Engström-Öst, Jonna. (2023). The use of biomarkers in zooplankton research. Marine Ecology Research Division Seminar Series, Helmholtz Centre for Ocean Research, GEOMAR, Kiel, Germany, 4.5.2023. Oral presentation.

Engström-Öst, Jonna. (2023). The use of biomarkers in zooplankton research – a focus on climate change. Abo Tech Talks. 5.10.2023. Oral presentation.

Koutsandrea, Andriana. (2023). Eco-physiological responses of marine biota to warming waters – a focus on benthic-pelagic coupling. Baltic Sea Science Congress, Helsinki 21-25.8.2023. Poster presentation.

Su, Jinzhu. (2023). Effects of residual glyphosate on phytoplankton growth in water environment. Novia Research seminar, 13.4.2023. Oral presentation.

Media appearances

Byholm, Patrik. (2023). Forskaren Patrik ska räkna regionens humlor i sommar– då önskar han sig soligt och vindstilla väder, och bra hörsel. Syd-Österbotten, 26.3.2023.

Byholm, Patrik. (2023). Outside/Inbox: How do young animals know how to migrate? New Hampshire Public Radio, 9.6.2023.

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<https://novialia.novia.fi/novialia/bloggar/bioekonomi>

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The Novia Bioeconomy Research Team

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