After LIFE report Reborn Restoration of boreal nordic rivers

A LIFE project which restored watercourses heavily affected from the timber floating era.

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Project description

The main two objectives of the ReBorN LIFE project (Restoration of Boreal Nordic Rivers) were to improve the conservation status of habitat and species, as defined in the Habitats Directive and to enhance the modified water bodies and achieve good ecological status, in accordance with the Water Framework Directive.

Measures were performed in six river systems in the very north of Sweden, in the counties of Norrbotten and Västerbotten. In parts of the river systems habitats have been altered to facilitate timber floating, which have decreased aquatic habitats and changed the geomorphology, hydraulics and water velocity in the streams. Habitats such as spawning, nursery and feeding areas for fish were destroyed and water velocity increased which made it a less favorable environment for aquatic organisms. Loss of habitat and fewer host fish have also affected the endangered freshwater pearl mussel (Margaritifera margaritifera). The project started in 2016 and ended in 2022. Throughout the course of the project, 243 km of streams and 14 679 spawning beds have been restored.

To monitor the measures, several surveys has been done on, for example, freshwater pearl mussel, fish population, otter (*Lutra lutra*), geomorphology etc.



Photo: Jeremias Kinnunen-Levy

Included river systems and species

The project areas were the Kalixälven project area (Vassaraälven and Linaälven), the Råneälven project area (parts of the main stem in Råneälven, Solälven and Rutnajoki), the Byskeälven project area (Långträskälven), the Piteälven project area (Stockforsälven and Vitbäcken), the Åbyälven project area (parts of Åbyälven within the county of Norrbotten) and the Lögdeälven project area (covering the entire of the Lögdeälven water system).



All six project areas are included in the Natura 2000 network. Within these river systems, the efforts carried out as part of ReBorN contributed to restoration and improved status of the riverine habitat, with a particular focus on the two habitat types Fennoscandian natural rivers (3210) and Watercourses of plain to montane levels with the Ranunculion fluitans and Callitricho-Batrachion vegetation (3260), that have been identified by the EU as being particularly important to protect and conserve and are protected under the EU Habitats Directive. While a wide range of aquatic organisms are expected to benefit from the measures, the project focuses in particular on the protection and conservation status of the following species: freshwater pearl mussel (Margaritifera margaritifera) (1029), Atlantic salmon (Salmo salar) (1106) and otter (Lutra lutra) (1355).

While various species of fish and otters will

benefit directly from the restored habitats, the impact on freshwater pearl mussel populations will be indirect. This is because the survival of mussel larvae, and consequently the long-term survival of the freshwater pearl mussel populations, depends on the successful reproduction of brown trout and Atlantic salmon as the mussel larvae live as parasites on the gills of juvenile salmon and trout during the first year of their life cycle. Hence, efforts that have a positive impact on the reproduction of salmon and trout will also have a positive impact on freshwater pearl mussel recruitment.

Goals and methods for After-LIFE

Policies and collaborations on a national/regional scale

The work with restoring streams that has been damaged by timber floating activities will continue after the completion of ReBorN in 2022. This type of measures has been identified as a priority on both a national and a regional scale by the Swedish Agency for Marine and Water Management (SWAM) and the regional Water Authorities. The Water Authorities are regional agencies responsible for coordinating the efforts by other authorities and municipalities. In December 2016, the management plans for the two northernmost Water Districts were agreed upon (BSWA and CABN 2016, BBWA and CABV 2016). In these management plans, the damage done from the timber floating is still recognized as one of the main reasons why the Bothnian Bay Water District has not yet reached good or excellent status in all water bodies. The management plans point out the agencies responsible for making sure that the efforts to improve geomorphology are carried out to the extent necessary and also identify the water bodies where further actions are needed. Authorities and municipalities are responsible for achieving the environmental quality standards, i.e., implementing the management plans.

In order to promote a dialogue among different agencies and authorities on issues related to restoration of streams, a network of professionals working with restoration has been established for collaborating on the issue. The network includes representatives from the County Administrative Boards (CABs) and the SWAM.

A SharePoint (a shared workspace) is available for all in the restoration network. In 2020, SWAM introduced a project list, where CABs can add project proposals. Based on the project list SWAM grants funds for national projects. CAB Västerbotten has two persons working together with SWAM with the allocation of projects to the project list.

Members of the restoration network have developed a national manual for river restoration. It was done and released for the public 2021.



Photo: Josefin Pyka

Dissemination of information regarding methods and surveillance

Throughout the course of ReBorN, in order to increase the knowledge about the restoration work, forestry with consideration to water environment and the history and damage by timber floating era, landowners and the general public were invited to information meetings and excursions.



Four demonstration sites were built by personnel from the Swedish Forest Agency (SFA).

Information signs in demonstration site Högåker, project area Lögdeälven. Photo: County Administrative Board of Västerbotten

Co-workers from all partners of the project have arranged and participated in over 120 meetings, seminars and conferences and met almost 10 000 persons.



Pupils learn about benthic fauna. Excursion in project area Piteälven, September 2020. Photo: Josefine Strand

The majority of the physical meetings were abrupt cancelled due to the Covid-19 pandemic, since many of the public excursions were frequently visited by senior citizens. Instead, five excursions were arranged with younger participants (pupils and students), which was regarded safer through Swedish guidelines.



Students from Kiruna Fishing School are learning how to create spawning beds. Project area Åbyälven, October 2021. Photo: Jonas Pålsson

The website (<u>www.rebornlife.org</u>) will continue to be available for the public five years after the project as ended (until 2027).

In order to make information regarding the project available for a broader audience, a film was produced and posted on YouTube <u>https://youtu.be/njOnfO0837g</u>, with English subtitles <u>https://youtu.be/WaOhFC41W7s</u>

The SFA has an extensive experience in dissemination of information about forestry with consideration to water environment and this work will continue after the project has ended. The work with development of target scenarios regarding this will continue as will the work with guidance to landowners.

The partners will continue the effort to spread knowledge about best practices regarding river restoration in their everyday work. It will also be part of other projects focusing on the restoration of river habitat and connectivity, such as ReVives LIFE (Reviving freshwater pearl mussel populations and their habitats) TRIWA LIFE (The Torne River International Watershed LIFE) and Ecostreams for LIFE (Restoration watercourses, remediation of migration barriers, great measures to reestablish freshwater pearl mussel and more). Further details regarding the project in the section "Projects and partnerships". The County Boards of Norrbotten and Västerbotten continue to actively promote the methods developed within the ReBorN project. When receiving visitors from other agencies, from other parts of Sweden, or foreign governments, a trip to some of the demonstration sites is often part of the visitors' program.



Freshwater pearl mussel. Photo: Andreas Broman

Monitoring of habitat and species

The monitoring of the conservation status of species and habitats will be done by the CABs through their conservation plans for the Natura 2000 areas and the work done in line with the Water Framework Directive.

For the Natura 2000 areas, one conservation plan per Natura 2000 site has been developed. The conservation plans describe the management goals for each habitat type and species (CABN 2007, 2018, 2019a, 2019b, 2020a and CABV 2019). The conservation plans state that the restoration of habitats affected by timber floating is a prioritised measure and that at least 85% of the length of the affected water bodies must be restored.

The Water Framework Directive states that all waterbodies must have good ecological and good chemical status. A range of assessment criteria are used when assessing the status of a waterbody. The system is complicated due to the extent of the variability and the large number of parameters that must be taken into consideration when doing an assessment. The waterbody is assigned a status that ranges from good to bad. There are five levels: high, good, moderate, bad and poor. If the status is lower than good, an action plan must be put in place. The classification of the morphology of a waterbody is affected to facilitate timber floating it will set five of those parameters to moderate or worse. The classification of the morphology is then one of several other parameters that is used to classify ecological status. Moderate or worse classification of biological parameters often reflects the status of the morphology of the waterbody.

The restoration does not automatically lead to an improvement of the ecological status as the status is determined by a range of other factors. Other factors that determine the ecological status are, e.g., migratory barriers, land use, eutrophication and the presence of ditches. In some cases, the ecological status of a waterbody does not improve following the ecological restoration unless these other factors are also addressed. However, in the northernmost counties the modification of rivers and creeks to facilitate timber floating and the presence of migration barriers (primarily culverts and dams) have been identified as the leading causes behind low ecological status, while eutrophication and acidification are of less concern.

In total, 44 water bodies have been restored in the ReBorN project. In the water districts of the Bothnian Bay and the Bothnian Sea, the classification of the parameters of hydromorphology was done in May of 2019. Restoration work done after (2019-2021) has not been taken into account in the classification in cycle 3. When cycle 4 is done, we will compile the data and assess the outcome of the restoration work on the water bodies applying the classification of the Water Framework Directive.

16 water bodies had their hydromorphological parameters improved by the actions in the ReBorN project. However, even when the restoration has been a part of the assessment a reclassification is not guaranteed, six of those did not improve their ecological status since there were still other parameters that were worse than good.

The management plans for the freshwater pearl mussel state that recruitment must be confirmed in all rivers with freshwater pearl mussel populations, and that the recruitment of its host species (juvenile salmon or trout) must be ensured at sites with freshwater pearl mussel populations. They also state that when restoration measures are conducted, they must be done with special consideration of the preferences of freshwater pearl mussel and salmon. For the otter, there must be a natural hydrology and enough food (fish). Many of the management efforts that are beneficial for fish in general, such as the removal of

Many of the management efforts that are beneficial for fish in general, such as the removal of migration barriers and restoration of natural habitat from the impact of timber floating, are also beneficial for all aquatic species.

The CABs are responsible for carrying out environmental monitoring in their respective jurisdictions. This monitoring is part of regional monitoring programs as well as national monitoring programs. The monitoring of freshwater includes the monitoring of surface water (lakes, rivers, and estuaries) as well as groundwater, and comprises the monitoring of water chemistry, eutrophication, acidification, and environmental contaminants, metals, in lakes and rivers. Information regarding the objectives and the structure of the environmental monitoring carried out by the CABs of Norrbotten and Västerbotten are publicly available (e.g., in CABN 2020b and CABV 2016). The monitoring is done in selected streams and lakes (selected through random selection) that have been monitored for several years and are being monitored several times per year.

Monitoring of animal and plant populations in lakes and rivers, include sampling of fish populations and the benthos, surveys of macrophytes, algae and plankton. Recruitment of Atlantic salmon and brown trout is monitored in all the rivers that harbour salmon populations. This is done by carrying out electrofishing at the reproductive areas as part of a monitoring programme that has been ongoing since the 1980s. In two rivers, the Kalix and the Pite Rivers,

long data series from fish counters are available and they give an indication of the numbers of brown trout and Atlantic salmon that are migrating up the rivers to spawn. Fish counters were installed in the Råne River and the Lögde River 2014 and 2012, respectively, making it possible to monitor the number of adult trout

and salmon migrating up these rives to spawn and potential changes in their numbers.



A small salmon in river Råneälven Photo: Sara Elfvendahl

The CABs are also responsible for carrying out the monitoring and implementation of actions to protect species that have been targeted in national action programmes for endangered species (Åtgärdsprogram för hotade arter), which is carried out in collaboration with a range of other agencies and organizations. These national action programmes have been developed in order for Sweden to meet their national and international obligations regarding the protection of biodiversity. More than 150 species are targeted by national action programmes, including the freshwater pearl mussel and the otter (SWAM 2020 and SEPA 2006).

The freshwater pearl mussel monitoring programme is part of a national monitoring programme targeting unionids. The objective of the monitoring is to assess recruitment, the threats to different populations, the conservation status of different populations, the ecological and chemical status of its habitat, and need for action. The recruitment of the freshwater pearl mussel is used as an indicator for a natural ecosystem. The monitoring of the mussels also includes monitoring of its host populations, i.e., assessing the recruitment of brown trout and Atlantic salmon. As a complement, the CABs have regional monitoring programmes where 16 selected streams with populations of freshwater pearl mussels are monitored according to a predetermined schedule every eight years.

The objective of the otter monitoring programme is to assess changes in the range and the size of the otter population, the genetic variation within the populations, the conservation status of the species, the ecological and chemical status of its habitat, and need for action. The implementation of actions to protect otters that involve the rebuilding of bridges to install functioning underpasses are done in collaboration with the Swedish Transport Administration.

In the counties of Norrbotten and Västerbotten, new nature reserves are being established in order to protect valuable habitat in the region. The legal protection of these areas encompasses the land areas as well as the aquatic environment. The establishment of nature reserves is a continuous process.



An otter crossing a road. Photo: Kenneth Johansson

Projects and partnerships

The work with restoration of streams and improving the conservation status of the species and habitat targeted by ReBorN will continue in a range of projects and partnerships. Every year the SWAM grants project national funding for restoration measures. The CABs of Norrbotten and Västerbotten have been successful in getting projects approved and financed by SWAM.

In both Counties, the work with removing migratory barriers (road-water crossings and dams) continues. The CABs are doing the measures with national funding from SWAM. Major road owner such as the Swedish Transport Administration and the forestry companies are working continuously with the removal of migratory barriers. The work is done in collaboration with the CABs.

As a preparation of the restoration work, the CABs do habitat mapping of streams annually. So far almost 5 700 km of streams have been visited and mapped. This work is very important since the future restoration work is based on data from the habitat mapping.

The CAB of Norrbotten has received national funding from SWAM to establish a local management model for salmon and trout that that is both effective and firmly anchored among stakeholders. The goal was to increase the knowledge base about fish stocks and create sustainable fishing regulations based on sound scientific advice. The project finished in 2018 and has resulted in an adaptive, locally based, sustainable management of salmon and seatrout. The river Råneälven has been the pilot river for the project, and the management model is now available for use by other river management organisations.

The CAB of Norrbotten is involved in projects which is part of the Kolarctic CBC Programme. The objective of the Kolarctic CBC Programme is to continue and strengthen cross-border cooperation between the countries in the North Calotte.

The CAB of Norrbotten is the lead partner in two Kolarctic projects whose objectives are to restore and improve the habitat for fish and other aquatic organisms in a number of water bodies. Ecological Restoration of Arctic Rivers (ReArc) are focusing on the river Luleälven and its tributaries and Salmonid Fish and Freshwater Pearl Mussel– Riverine Ecosystem Services and Biodiversity in the Green Belt of Fennoscandia (SALMUS) are targeting streams with populations of freshwater pearl mussels. The knowledge acquired through ReBorN are used and dissipated throughout the projects.

Additionally, CAB of Norrbotten is lead partner in a new project (EXPERT) within the Kolarctic CBC Programme that started in December 2021.

The CAB of Norrbotten participate in a project called EMRA. It is a Swedish-Finnish cross border project financed by Interreg Nord programme. The project aims to perform restoration actions, knowledge exchange about restoration rivers and increase the knowledge about trout and grayling by doing genetic analysis. The CAB of Västerbotten has received funding from the LIFE programme for the project Ecostreams for LIFE. The project started in 2021 and it will run for 6 years in the counties of Västerbotten, Västernorrland and Jämtland. CAB of Västerbotten is the coordinating beneficiary and it is carried out in collaboration with a large number of stakeholders. The project focuses, in the County of Västerbotten in the river Öreälven catchment area, which is included in the Natura 2000 network.

The project revolves around three themes: The first theme being restoration of 140 kilometres of river stretches from the damages done during the timber floating era, creating specific sites with habitat for the endangered small liverwort and the remediation of 221 migration barriers (mainly riad culverts and dams). The river restoration builds upon the knowledge acquired during ReBorN. The second theme involves the freshwater pearl mussel and to investigate different methods to reestablish the species.

The third theme consists of the development of a management plan of fish populations in the project rivers, which will be carried out in collaboration with the holders of fishing rights. In line with ReBorN, demonstration areas with information of forestry consideration to aquatic environment will be created in all three counties and a communication effort with information about invasive alien species, mainly with focus on protection of the noble crayfish.

The CAB of Norrbotten has received funding from the LIFE Programme and started a new project called LIFE ReVives (Reviving freshwater pearl mussel populations and their habitats). The project focuses on improvements of the habitat of freshwater pearl mussel populations in order to increase the chances for their long-term survival. The project also includes efforts to improve the recruitment of its host-species Atlantic salmon and brown trout. The measures include efforts to restore the natural flow of water from wetlands. The drainage of wetlands (resulting from the construction of ditches and the lowering of the threshold at the outlet of the wetland) contributes to a larger release of sediments into the streams and larger fluctuations in water flow. Restoring the capacity of wetlands to retain water would reduce the release of sediments and reduce the fluctuations in water flow throughout the year. The efforts to improve recruitment of Atlantic salmon and brown trout involve efforts to increase their access to spawning areas near freshwater pearl mussel populations. This will be done through the restoration of spawning areas and the removal of migration barriers, and this part of the project would build upon the knowledge acquired through ReBorN.

The CAB of Västerbotten and SFA participate in the integrated LIFE project Grip on LIFE (Using functional water and wetland ecosystems and their services as a model for improving GReen infrastructure and Implementing PAF in Sweden) together with other counties. The project runs 2018 to 2023. One of the actions in the project is to disseminate knowledge on best practice in forestry nearby to streams- much like we do in ReBorN. In Grip on LIFE, 60 demonstration sites will be built to spread knowledge and awareness of best forest practices among the forestry stakeholders, aid them in implementing protocols in how to protect water habitats in close proximity to harvesting sites. The project's objective is also to have seminars, excursions and meetings with landowners.

The project has done a compilation which is an update of the code of practice for aquatic restoration presented by two governmental agencies in 2008 –" Ecological restoration of running waters". The present version has been broadened and now also covers urban environments, climate change, ecological flows and re-meandering. (Degerman and Näslund 2021)

A large water restoration project, TRIWA LIFE, will start in 2023. TRIWA LIFE is a Swedish-Finnish effort to improve the conditions of riverine ecosystems in the whole international catchment area of River Torne NATURA 2000 site, the main rivers are among the largest freeflowing rivers of Europe. The overall aim is to improve conservation status for species and habitats of the Habitats Directive and reach good ecological status according to the Water Frame Directive. 103 hectares of streams will be restored, 399 anthropogenic migration barriers will be removed so more than 3 366 km of tributary river and stream will open up for fish migration.

Additionally, 2 521 hectares of wetland, that was historically ditched for forestry use, will be restored so the water quality and the wetland habitats will be improved.

The SFA is a partner in the Interreg (Botnia-Atlantica) financed project KLIVA (Vattenbalans, ekosystemtjänster och metalltransport i ett klimat i förändring). The use of natural resources effects the aquatic environment, the availability of ecosystem services and the possibility of achieving environmental goals. A climate in change means new challenges for sustainable production and clean water. During the years 2019–2022, the KLIVA project is working with stimulating to climate-adapted measures in agriculture and forestry through to start from a holistic view of water flow and water supply in a catchment area. With a more natural water balance and less pollution from acidic sulphate soils, conditions are created for sustainable production, biodiversity, and healthier water. The project model areas Toby å i Finland and Hertsångerälven in Sweden.

The SFA is a partner in the Kolactic project IMPRESS. The project addresses the need to combine economic activities in timber industry and long-term values associated with forest ecosystems, such as preservation of biodiversity and carbon storage. Climate changes is an important part of the project. The SFA will produce a climate resilience plan with focus on forest management in the northern part of Sweden, which hopefully can apply on the whole North Calotte.

Summary of After-LIFE conservation actions, implementing institutions, possible funding sources and expected due dates are given in the table below.

Activity	Involved organisations	Funding source
Swedish restoration network regarding restoration of streams	The county Administrative Boards and the Swedish Agency for Marine and Water Management	Swedish Agency for Marine and Water Management
Dissemination of siteams Dissemination of information about best practices regarding river restoration Monitoring of salmon, freshwater pearl mussel and otter	The county Administrative Board of Norrbotten, the county Administrative Board of Västerbotten, Swedish Forestry Agency, the municipalities of Gällivare and Nordmaling, Swedish Agency for Marine and Water Management The county Administrative Board of Norrbotten, the county Administrative Board of	National funding from the Swedish Agency for Marine and Water Management. Projects ReVives LIFE, Ecostreams for LIFE, GRIP on LIFE and TRIWA LIFE, ReArc, SALMUS (Kolactic) and EMRA (Interreg). National funding from the Swedish Agency for Marine and Water Management and
	Västerbotten	the Swedish Environmental Protection Agency
Mapping and developing action plans according to the Water Frame Directive	The county Administrative Board of Norrbotten, the county Administrative Board of Västerbotten	National funding from the Swedish Agency for Marine and Water Management
Mapping and developing conservation plans according to the Habitats Directive	The county Administrative Board of Norrbotten, the county Administrative Board of Västerbotten	National funding from the Swedish Agency for Marine and Water Management and the Swedish Environmental Protection Agency
New nature reserves	The county Administrative Board of Norrbotten and the county Administrative Board of Västerbotten	the Swedish Environmental Protection Agency
Restore more streams	The county Administrative Boards, Swedish Forestry Agency, municipalities, Swedish Agency for Marine and Water Management, partners in Finland and Norway.	National funding from the Swedish Agency for Marine and Water Management and the Swedish Environmental Protection Agency. Projects ReVives LIFE, Ecostreams for LIFE and TRIWA LIFE, ReArc, SALMUS (Kolactic) and EMRA (Interreg).

Activity	Involved organisations	Funding source
Remove migratory	The county Administrative	National funding from the
barriers	Boards, Swedish Forestry	Swedish Agency for Marine
	Agency, municipalities, Swedish	and Water Management.
	Agency for Marine and Water	Projects ReVives LIFE,
	Management	Ecostreams for LIFE and
		TRIWA LIFE, ReArc,
		SALMUS (Kolactic) and
		EMRA (Interreg)
Educate excavator	The county Administrative Board	National funding from the
operators	of Norrbotten and partners in	Swedish Environmental
	Finland and Norway.	Protection Agency. Project
		EXPERT (Kolarctic).
Continue work with	Swedish Forestry Agency	IMPRESS(Kolarctic) and
climate change		KLIVA (Interreg)

References

- Bothnian Sea Water Authority (BSWA) and County Administrative Board of Västerbotten (CABV). 2021. *Förvaltningsplan 2016–2021 Bottenhavets vattendistrikt*
- Bothnian Bay Water Authority (BBWA) and County Administrative Board of Norrbotten (CABN). 2021. *Förvaltningsplan 2016–2021 Bottenvikens vattendistrikt*.
- County Administrative Board of Norrbotten (CABN). 2007. *Bevarandeplan Natura 2000, Råneälven SE082043*1.
- County Administrative Board of Norrbotten (CABN). 2018. *Piteälven SE0820434 Bevarandeplan Natura 2000*.
- County Administrative Board of Norrbotten (CABN). 2019a. *Byskeälven SE0820432 Bevarandeplan Natura 2000-område*.
- County Administrative Board of Norrbotten (CABN). 2019b. *Åbyälven SE0820433 Bevarandeplan Natura 2000-område*.
- County Administrative Board of Norrbotten (CABN). 2020a. Torne och Kalix älvsystem SE0820430 Bevarandeplan Natura 2000.
- County Administrative Board of Norrbotten (CABN). 2020b. Program för regional miljöövervakning i Norrbottens län 2021–2026.
- County Administrative Board of Västerbotten (CABV) 2014. Friskare skogsvatten. Website
- County Administrative Board of Västerbotten (CABV). 2016. *Miljöövervakning i Västerbottens län*.
- County Administrative Board of Västerbotten (CABV), 2019. *Bevarandeplan Lögdeälven SE0810433*.

- Degerman E. och Näslund I. *Fysisk restaurering av akvatiska miljöer Vattendrag och sjöar med kantzon och våtmarker*. <u>Fysisk restaurering av akvatiska miljöer</u> (skogsstyrelsen.se)
- Interreg Nord and the European Union. 2017. Borderless opportunities, Project portfolio version 2017-01-04.
- Swedish Agency for Marine and Water Management. 2020. Åtgärdsprogram för flodpärlmussla Margaritifera margaritifera (Linneus 1758), Rapport 2020:19.
- Swedish Environmental Protection Agency. 2006. Åtgärdsprogram för bevarande av *utter (Lutra lutra)*, Rapport 5614.