Forest Life project - Restoration of boreal forests and forest-covered mires LIFE03NAT/FIN/00034

N°7

IN A NUTSHELL

Identity of the organisation

Organisation: Metsähallitus

Website: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=2485

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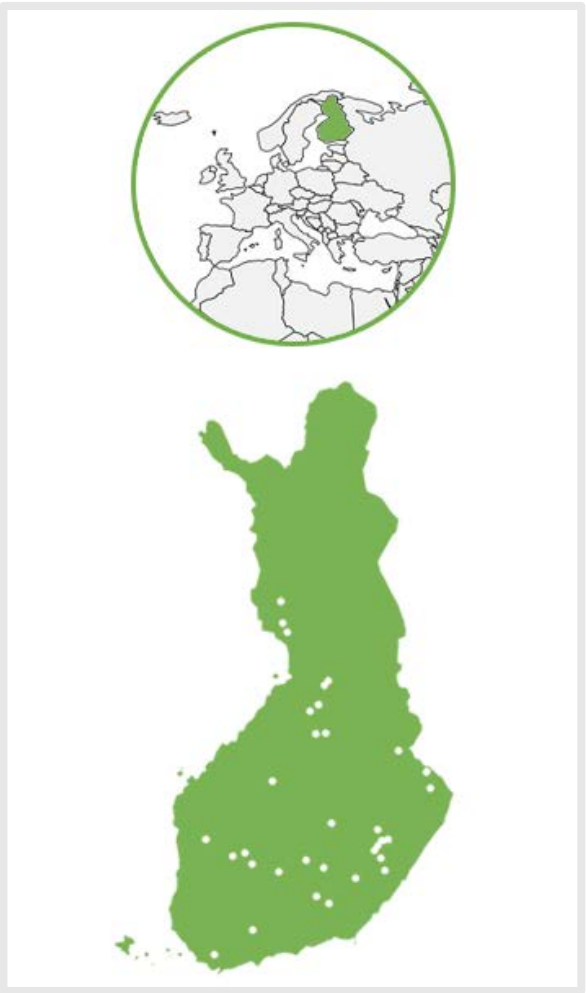
Site identity

Location: 33 "Natura 2000" sites in Finland (see the map).

Specificities: A lot of boreal forests, mires and esker forests in Finland have been modified by commercial operations and human activities. Their surface is progressively shrinking, biodiversity is decreasing and their structure and functions are altered.

Challenges: Boreal forests, eskers forests and bog woodlands are important refuges for a wide range of species and especially birds, who use these forests for breeding or during migration. Some targeted habitats are priority habitats under the European Habitats Directive, such as Western Taïga (9010) and Bog Woodland (91D0).

Many species of polypores, insects and mosses depend on dead wood and are today threatened due to the lack of decaying wood.



Areas: Woodland area, wet area

Action type: Restoration or rehabilitation

Action framework: Management of nature areas, Natura 2000

History and context

Only about a quarter of the forests inside protected areas in southern Finland are in their natural state or a close-to-natural state (Similä and Junninen, 2012). Most of these forests have been commercially managed at some time in the past, before they were designated for protection[1]. The main threats to natural heathland forests and their characteristic species are insufficient quantities of decaying wood, unfavourable changes in the age-structure and tree species assemblages of forests, the scarcity of natural forest fires, eutrophication and the fragmentation of forest habitats.

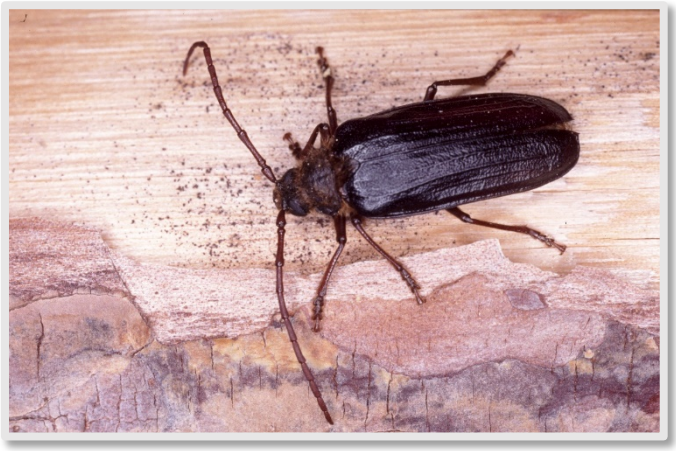
Forest ecosystems have been managed for decades to promote biodiversity in Finland's protected areas, but the extensive restoration of heathland forest habitats was initiated only in 2003 through related EU LIFE projects and the METSO Forest Biodiversity Programme for Southern Finland.

Occasional wildfires are typical of boreal coniferous forests and therefore a lot of the species have in the course of time also adapted to making use of trees killed by fires. Since wildfires can today be effectively suppressed, species depending on them are becoming threatened, due to the lack of decaying wood (such as tens of beetle species (e.g. *Boros schneideri, Pytho kolwensis, Tragosoma depsarium*, etc.), tens of polypore species and many hole-nesting birds (e.g. *Parus sp, Glaucidium passerinum, Aegolius funereus*, etc.)[2].

Forests growing on eskers are sunny and dry. Wildfires used to be frequent in Finnish esker forests. Since wildfires are today effectively suppressed and since a lot of the esker forests have been turned into commercial forests, sunny habitats have decreased. This has had a detrimental effect on plants, such as the Breckland Thyme (*Thymus serpyllum*), that require such habitats. In turn, insects have also suffered, including *Apion atomarium* (a seed weevil) and *Merrifieldia leucodactylia* (a moth) that use the Breckland Thyme as their host plant.

Mires used for commercial forestry often contain drainage ditches. Natural forest-covered mires have become scarce, especially in southern and western Finland. Forest-covered mires, especially spruce dominated mires, however provide a habitat for a number of bird, insect and cryptogam species.

Moreover, forests are fragmented by networks of logging roads. When forests are turned into conservation areas, unused roads that are no longer needed for logging can be removed and thus unnecessary motor traffic in conservation areas can be reduced.



Tragosoma depsarium, an example of threatened saproxylic beetle species. © P.MARTIKAINEN

[1] In Finland, Natura 2000 areas were selected around 1995-1997. Most of them are strictly protected (commercial forestry not allowed). That means all negative changes in state of habitats have happened before 1997. In general, forestry became intensive after the Second World War. In addition to Natura 2000 areas, there is a vast amount of other strictly protected areas (no commercial forestry allowed). In Finland, nature conservation is a continuously ongoing process: new areas of forests and peatlands are strictly protected each year.

[2] The list of all threatened species and the causes of threats in Finland can be found at : http://www.ym.fi/fi-FI/Ajankohtaista/Julkaisut/Erillisjulkaisut/Suomen_lajien_uhanalaisuus__Punainen_kir(4709) and updated Red List of Finnish Bird species at https://helda.helsinki.fi/bitstream/handle/10138/159435/Suomen_lintujen_uhanalaisuus_2015.pdf?sequence=1

Presentation of the project

Issues and objectives

Because of the pressures above-listed, the aim of the Forest Life project was to restore forests and mires, in order to maintain and improve the diversity of species and quality of habitats in the Natura 2000 areas. The project involved ecological restoration of forests and mires, management of White-backed Woodpecker forests and esker forests, and removal of unused logging roads.

It aimed at improving the conservation status of 33 Natura 2000 sites. The main objectives were:

- to allow forests to become more "natural": to increase amount of dead wood, make tree stand structure more diverse and emulate natural forest fires by controlled burning
- to reduce the degree of fragmentation inside areas by dismantling unnecessary roads in protected areas
- to increase the amounts of sunlight in sunlit habitats of eskers
- to restore natural-like hydrology of spruce mires and other forest-covered mires

The restoration measures have speed up the recovery of the structures of natural boreal forests and of the hydrology of natural forest-covered mires in these areas.

Because of its large scale, this project provides an invaluable best practice experience of forest restoration. This project was the largest forest restoration project in Finland when it began in 2003.

Excavator filling in the drainage ditch in forest-covered mire in North Karelia 2017 © Metsähallitus/M.SIMILA

Creation, restoration methods

The restoration work was based on surveys of the structure of the tree stands and other habitat features in each area. Restoration plans were drawn up for 30 Natura 2000 sites.

Practical measures were carried out on 33 Natura 2000 sites. Different restoration techniques were employed such as:

- Controlled burnings to increase burned and dead wood as well as to initiate improvement of tree stand structure in general
- Blocking of drainage ditches with peat to restore bog woodland, so that water returns to its natural course and drained areas become mires again.
- Felling, girdling and blowing up trees to provide decaying wood
- Removing spruce trees and small rowans from deciduous forests to increase the amount of light to enable Dendrocopos leucotos to breed and feed. White-backed woodpecker is depending on deciduous forests and decaying wood (insect larvae

living in dead trees is a food source for woodpeckers).

Liquefied petroleum gas is used to set the fire. © M.SIMILA

Controlled burning process:

- Preparation of the burning: A particular attention is paid to the area to be burnt, in case there are some valuable species (for example, trunks hosting threatened species may need to be protected from burning). The area to be burnt is delimited carefully, the creation of firebreak corridor is sometimes needed. The burning session is planned carefully (fire extinguish equipment check, water availability near the area, preparation of the burnable material (to adjust the intensity of fire), etc.).
- Organization of the burning: suitable conditions for burnings usually occur between mid-May and August in Finland (not too dry, not too rainy). The direction of the wind must be favourable and predictable, with speed less than 5m/s. The choice of the method and the intensity of the fire depends on the objectives of the burning and on the specificities of the site (shape, size, topography, amounts and nature of burnable biomass, etc.).
- Extinguishing the fire: The best time to extinguish fires is usually at night, when conditions tend to be calmer. Sufficient equipment must be left available at burnt sites to enable any later outbreaks of fire to be extinguished. After any remaining hotbeds have been extinguished, burnt areas must still be patrolled.
- Costs per burning vary depending mainly on size of the area to be burnt. Recent years costs have been about 3000 €/burning area less than 5 ha and about 5000 €/burning area larger than 5 ha. Recent years area of burning site has been 7 hectares on average. Metsähallitus has been able to reduce costs per burning e.g. by improving co-operation with local associations concerning guarding the recently burnt areas.
- In certain cases, high tree density of area to be burnt need to be thinned to 750-1000 trunks per hectare (to improve drying of the area and to ensure fire control). In those cases net income may cover majority of the costs of controlled burning.

More information on the controlled burning process and on the methods to increase the amount of decaying wood can be read in the guidelines 'Ecological restoration and management in boreal forest – best practices from Finland (Similä and Junninen, 2012).

After the burning the edges of the burnt areas are watered carefully. © M.SIMILA

Morning after the burning © M.NIIRONEN

Human and material resources

Large-scale ecological restoration of forests and mires was a relatively new method of conserving biodiversity at the time the Forest Life project was launched, though such methods had been introduced through various small-scale restoration experiments since the late 1980s.

More than 300 forest workers and a number of other forestry employees actively participated in the development of restoration methods. They have been trained for practical restoration work as well as supervisors of natural heritage services. The training, largely carried out as field training, focused on the objectives of restoration and on how these objectives are achieved.

Fire extinguishing equipment were needed for controlled burnings, e.g. water pumps and hoses.

Monitoring and evaluation methods

The impacts of forest habitat restoration measures are monitored to assess how well the restoration objectives have been realised. For this purpose an extensive network of monitoring sites has been set up around the country (17 Natura 2000 sites of monitoring network were restored during the project). Monitored variables include living and dead trees, beetle species composition (1 and 5 years after the measures) and polypore species composition (5, 10, 15 etc. after the measures) at sites where deadwood has been created, and living trees and tree seedlings where small canopy gaps have been opened (5 years after the measures - monitoring is not continued at the moment).

Species feeding or growing on decaying wood, such as beetles and polypores, play a significant role in the decaying process of dead trees. The development of beetle species composition was monitored with window traps in areas where the amount of decaying wood was increased. As soon as a year after the restoration, the number of different beetle species that depend on decaying wood was considerably higher in these areas than in the surrounding forests.

<u>Monitoring of the restored mires:</u>

Finland has set up a national monitoring network for restored mires (mainly during the Boreal Peatland LIFE project in 2010 - 2014). Both the impacts of peatland restoration on hydrology and on biodiversity are monitored.

General monitoring of the restored mires is carried out to visually ensure that the measures have been technically successful and that the peatland is progressively reverting to a more natural state.

Hydrological monitoring includes measuring water levels, analysing water quality (pH, nutrients concentrations, etc.) and monitoring the impacts on watercourses downstream (quantities of runoff discharged from restored peatland).

Biodiversity monitoring aims to identify any changes occurring in plant and moss species communities and their relative abundance after restoration. In selected sites and selected years e.g. lepidoptera, dragonfly, bird and Diptera species have been monitored.

Thymus serpyllum : an important species for several

Water table level rises quickly after restoration measures, recovery of plant species assemblages, tree stand structure and scenery takes years or tens of years.

Special cases of monitoring of beetles and polypores:

The Kakonsalo Natura 2000 site in eastern Finland still has plenty of old living and dead aspens and thus also supports species of beetles and polypores that depend on the aspen. An experiment was made there to determine whether decaying aspen brought to the conservation area would attract these species. The species soon colonised the aspen logs transported to the area, proving that they can be helped by transferring decaying wood to their habitat.

Beetle species seeking their way to burnt forests were monitored on nine Natura 2000 sites throughout Finland during the years 2005 and 2006. On the basis of monitoring, the occurrence of threatened beetle species that favour or depend on fires is governed by the location of the burning site. The further east in the country the burning site is, the faster threatened species appear there and there is also a greater variety of them.

Monitoring of the White-backed Woodpecker:

The winter movements and breeding status of the White-backed Woodpecker were monitored on the Natura 2000 sites of Linnansaari, Kuijärvi-Sonnanen and Puulavesi after management measures had been carried out in the forests providing a habitat for the species. The monitoring proved that the management measures of White-backed Woodpecker forests had been directed at appropriate Natura 2000 sites. The measures had improved the

White-backed woodpecker © M.VARESVUO

feeding and breeding conditions of the White-backed Woodpecker, since one new breeding occurrence was found on the Linnansaari Natura 2000 site and, judging from the spoor, White-backed Woodpeckers have also discovered the managed forests on the Puulavesi Natura 2000 site.

White-backed woodpecker populations are monitored yearly all over the southern Finland. The size of population has increased remarkably thank to active species conservation (active management of habitats suitable for the species and protection of habitats). Happy coincidence have been wanderings of the specimens (some years even huge eruptions) from east and south east.

Photo monitoring of the restored forests and mires also permits to evaluate the efficiency of the restoration measures. For this project no photo monitoring was done after the end of the project, but photo rounds were used to monitor the changes during the project.

Description

The project started in December 2002 and ended in December 2007.

Partners

The project was coordinated by Metsähallitus, Natural Heritage Services, Southern Finland.

- Technical partners: WWF Finland, the UPM Kymmene Corporation, the Karelian Brigade of the Finnish Defence Forces, and also Metsähallitus Forestry, Metsähallitus Laatumaa, Metsähallitus, Natural Heritage Services, Lapland, Natural Heritage Services, Ostrobothnia.

- Scientific partners : the University of Joensuu

- Financial partners : WWF Finland, the UPM Kymmene Corporation, the Karelian Brigade of the Finnish Defence Forces, the University of Joensuu, and also Metsähallitus Forestry, Metsähallitus Laatumaa, Metsähallitus, Natural Heritage Services, Lapland, Natural Heritage Services, Ostrobothnia.

Costs and financing

As a LIFE project, the project was financed according to usual LIFE projects financing rules. The total budget of the project was 3,680,467.00 €. Each partners co-financed the project and the EU contribution was 1,840,234.00 €.

Overall assessment

In mature forests, a sustainable supply of decaying wood was initiated by felling, girdling and blowing up trees on 2700 hectares. 350 hectares of forests were treated with controlled burning. Canopy gaps were created on 2880 hectares, which will improve varied age structure of the tree stock as new seedlings gradually appear in clearings.

200 hectares of White-backed Woodpecker forests on the Natura 2000 sites of Linnansaari, Puulavesi and Kuijärvi-Sonnanen were managed by removing spruces and small rowans from deciduous forests in order to increase the amount of light in them. Decaying wood was increased by both girdling and felling birches.

The esker forests on the Maakylä-Räyskälä Natura 2000 site were becoming over-grown. Therefore 300 hectares of sunny habitats were recovered by small-scale

controlled burning, by making small clearings and by increasing decaying wood.

Drainage ditches of forest-covered mires on an area totalling around 400 ha on 10 Natura 2000 sites were dammed and filled in.

On the Maakylä-Räyskälä Natura 2000 site, 1 km of unused logging roads were removed, and on the Rokua Natura 2000 site, 2 km of such roads were removed. Roads in the Rokua area were blocked from traffic by felling trees across them in conjunction with the forest restoration process. In the Maakylä-Räyskälä area, the surface of the roads was ripped with an excavator and the soil was then levelled out to follow the contours of the terrain. The growth of tree seedlings on the road tracks is thus speeded up as seeds will germinate better in tilled soil.

The project has been awarded the title of "Best of the best" from a short list of 26 "best" LIFE nature projects in 2007-2008.

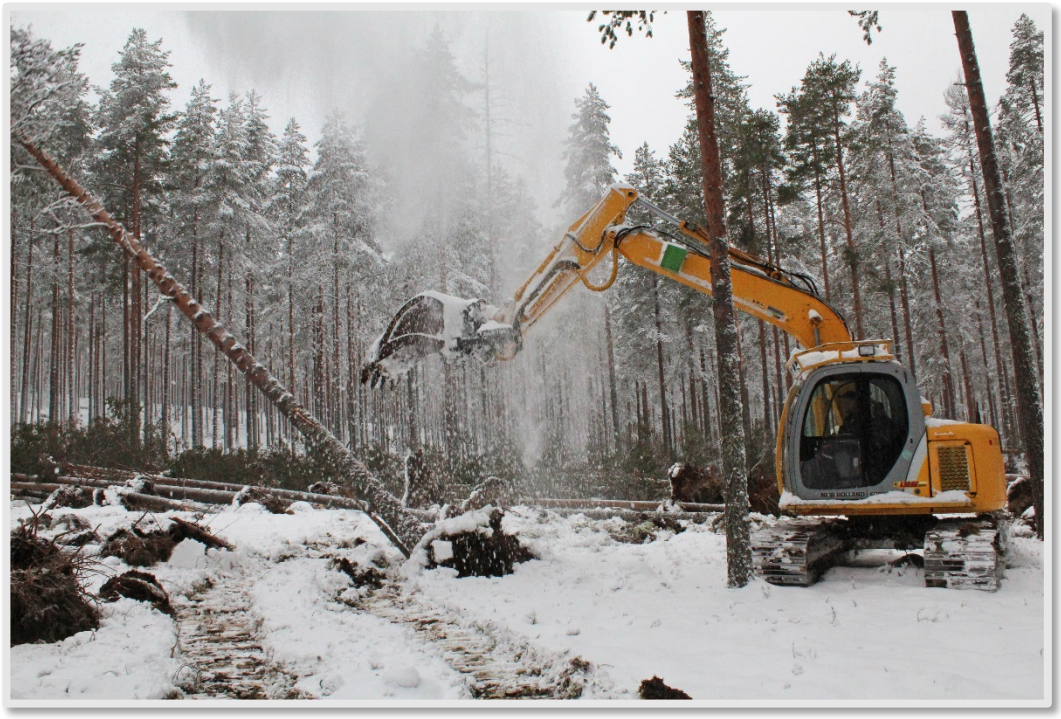
Amount of dead wood was increased 5-35 m3/ha. Common polypore species colonise produced dead wood first and start succession of dead wood. For beetle species, burnt areas are the most attractive: fire-dependent or burnt-area oriented species inhabit area quickly after burning (e.g. *Boros schneideri*) and production of dead wood continues gradually long after burning. This creates habitats for various saproxylic species.

Finnish spruce-dominated mire before and after restoration. © M.SIMILA

STRONG POINTS	WEAK POINTS
— Large and effective monitoring network allow to see the impacts of restoration projects for boreal forests in the whole country. — Large and effective monitoring network of restored peatland sites, based mainly during the Boreal Peatland LIFE project in 2010-2014, shows the ecological effects of mire restoration. — A lot of work has been done to improve social acceptance and status of ecological restoration, the role of dead wood and controlled fire for forest ecosystem (web pages, brochures, press, radio and television, public information events, organization of a restoration-themed nature trail, information board in many areas, etc.) — Many other restoration (LIFE) projects have been implemented after this one. — Experience gained from this project and other similar projects shows that controlled burning is the best and the most recommended method to restore boreal forests. — Effective communication has been done around the project: web pages, brochures, and a DVD (Back to nature) were produced and the project was featured on more than 150 occasions. — A restoration-themed trail was built on the Hevonniemi Natura 2000 site. — Restoration methods are better known by the general public	— Controlled burning requires optimal weather conditions and a lot of skilful labour. Only a few areas can be burnt per year. — Controlled burning requires special attention to valuable species that could be on site — Co-project of several organisations: fluctuations in general economic situation may affect the own financing of organisations. Prioritisation of the project measures is important within organisations. — Changes in the habitat characteristics of restored sites is a slow process, and monitoring conducted during the project may not continue long enough to detect any changes. Continuity of monitoring actions should be ensured also when the project has ended.

IMPROVEMENTS - ADVISES

- Climate change leads to more storms and windy days which in turn leads to more dead wood. That is why Finland has almost completely given away girdling and felling trees by timber jacks.
- If increase of dead wood is required and burning is not possible action, excavator is the best tool to produce dead wood (root connection remaining and decaying process resembles more natural than if tree is felled by chain saw).
- Controlled burning is an ideal way to restore boreal forests. Competent burning managers and skilled labour should be ensured through education and field training.
- Monitoring is important to see and show the ecological effects of the restoration measures. Monitoring should last long enough to see the long-term effects of restoration in addition to short-term effects.



Finnish spruce-dominated mire before and after restoration. © M.SIMILA

Perspectives

Continuation

Restoration of forests and peatlands, ecological management of white-backed woodpecker habitats as well as recovering of sunny habitats on eskers have been continued through several other remarkable LIFE-projects (such as the Boreal Peatland LIFE project in 2010 -2014, the Species rich LIFE project in 2011-2016, Light & Fire LIFE in 2014-2020, Hydrology LIFE in 2017-2023 etc.) in Finland. Monitoring of dead wood succession and polypore species composition is still ongoing.

Transposability

Controlled burning is the best method for forest restoration at least in boreal zone. It is relatively widely accepted in Finnish society, but e.g. in Central Europe probably more criticized. Active informing is necessary if the method is applied.

Restoration of mires has to be planned and completed as hydrological entities. Vegetation and other characteristics of mires are dependent on water supply coming from catchment area.

In Finnish conservation areas even large amounts of dead wood are widely tolerated. Awareness of the importance of diverse dead wood composition also outside the conservation areas requires continuous communication with the general public. Networking with other LIFE projects showed that this topic can be more sensitive in other countries even in conservation areas and that communication with public is really important everywhere.

This pine-dominated forest intended to be restored by timber jacks but nature was quicker. The jet stream felled trees on area of 25 hectares in 2004. Dead wood supply in sunlit habitat is ensured for a couple of decades. Structure of new tree generation (photo taken 8 years after the storm) is completely natural. © M.SIMILA

Publications

Similä Maarit, 2007: Forest Life 2002 – 2007, Final report. 24p.

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Similä Maarit and Junninen Kaisa 2012 : Ecological restoration and management in boreal forests - best practices from Finland. Metsähallitus Natural Heritage Service. Available at: < https://julkaisut.metsa.fi/assets/pdf/lp/Muut/ecological-restoration.pdf >

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Video:

https://www.youtube.com/watch?v=X2XMzjsdNa4&feature=c4-overview&list=UUD6wtnaysTMpT-zcA7laJYg

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With the financial support of: AGENCE FRANÇAISE POUR LA BIODIVERSITÉ ÉTABLISSEMENT PUBLIC DE L'ÉTAT

and the technical support of the French Ecological Engineering Resource Centre: Centre de ressources GÉNIE ÉCOLOGIQUE