Species-rich LIFE

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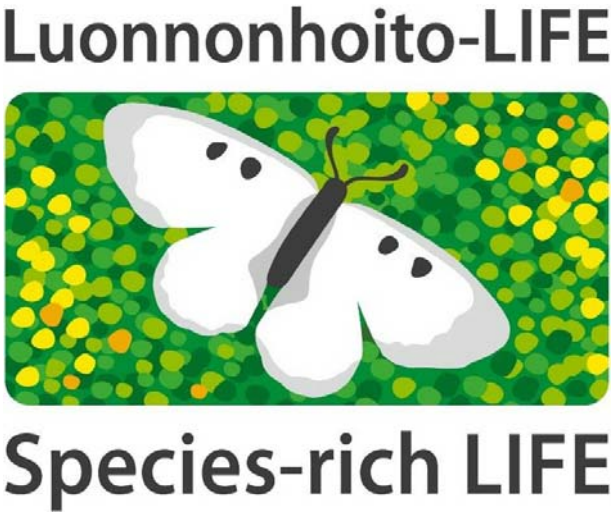

After-LIFE Conservation Plan

November 2017

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2. Overview of the project and an assessment of the situation at the end of the project

2.1. Project history and situation analysis

The objective of the Species-rich LIFE project was to carry out habitat restoration and other nature conservation actions that contribute to the implementation of Habitats and Birds Directives in Finland. The actions targeted 64 N2000 sites in 2011-2017, focusing on the most species-rich Directive habitats in protected areas across the boreal zone in Finland. Habitat restoration actions were carried out in herb-rich forests and other broad-leaved forest habitats, as well as in semi-natural grasslands. Habitat restoration and direct conservation measures targeted also specific Directive species which inhabit these environments and are endangered in Finland. Most notable species are White-backed Woodpecker (*Dendrocopos leucotus*), Clouded Apollo (*Parnassius mnemosyne*) and the beetle *Cucujus cinnaberinus*. Also, many other Birds and Habitat Directive species benefitted directly or indirectly from the habitat restoration measures.

One of the main threats to natural habitats in Finland are the drastic changes in forests induced by modern forestry management practices and changes in land use. According to the national assessment of threatened habitat types, especially the fertile herb-rich forest habitats are threatened, the situation being most critical for forests with different broad-leaved trees. The herb-rich forests are also the main habitat for over 20 % of the nationally threatened species, although their proportion of the forest area in Finland is only 1 %. Another main factor leading to species extinctions in Finland is the intensification of agriculture, which has led to the loss of traditional agricultural biotopes shaped by earlier farming practices. According to the national assessment, the proportion of threatened habitat types is by far greatest among traditional rural biotopes, 93%. About 28% of the threatened species typically live in traditional farmland habitats, and this proportion is rising. Without management the traditional semi-natural grasslands become overgrown, thus active management and habitat restoration to maintain and increase their coverage are required to improve their conservation status.

The specific objectives of the project were to improve the representativeness and conservation status of the target habitats and sites by restoring structural features important for maintenance of the biological diversity, and to increase the extent of the target habitats by restoring severely degraded areas. The restoration measures also included removal of invasive alien species. The project targeted 64 Natura 2000 sites in Finland and the habitat restoration measures covered 1126 ha. Project sites were selected based on presence of the target habitats with urgent need for restoration.

Habitats Directive Annex I habitats restored in the project included forest habitats *9010 Western taiga (14,7 ha restored), *9020 Fennoscandian hemiboreal natural old broad-leaved deciduous forests (12 ha), *9030 Natural forests of primary succession stages of land upheaval coast (16,7 ha), 9050 Fennoscandian herb-rich forests (359,6 ha) and 9180 Tilio-Acerion forests of slopes, screes and ravines (1,6 ha). Restored semi-natural habitats were *1630 Boreal Baltic coastal meadows (103,8 ha restored), 4030 European dry heaths (58,7 ha), *6210 Semi-natural dry grasslands on calcareous substrates (1,1 ha), *6230 Species-rich Nardus grasslands (1 ha), *6270 Fennoscandian lowland species-rich dry to mesic grasslands (57,1 ha) , *6280 Nordic alvar and precambrian calcareous flatrocks (6,0 ha), 6430 Hydrophilous tall herb fringe communities (13,2 ha), 6450 Northern boreal alluvial meadows (13 ha), 6510 Lowland hay meadows (10,2 ha), *6530 Fennoscandian wooded meadows (0,7 ha), 9070 Fennoscandian wooded pastures (124,7 ha) and 8210 Calcareous rocky slopes with chasmophytic vegetation (18,1 ha). Small areas of habitats 7230 Alkaline fens (1 ha) and *91D0 Bog woodland (2 ha) were also included.

The project was implemented by coordinating beneficiary Metsähallitus Parks and Wildlife Finland (PWF) together with the associated beneficiaries Finnish Environment Institute (FEI), World Wide Fund for Nature Finland (WWF) and Metsähallitus Forestry Ltd (MHF).

The Species-rich LIFE project focused on reducing the following threats:

- **Degradation of forest habitats due to forestry management**: Commercial forest management has radically changed the structural elements which are crucial for forest biodiversity, thus decreasing species richness in forested habitats in Finland. For example, in managed forests coniferous trees are strongly favoured.
- **Degradation of semi-natural habitats due to abandonment of pastoral systems and the lack of managers**: Intensification of agriculture has resulted in abandonment of non-intensive agricultural management techniques (e.g. pasturing, hay-making, traditional grazing) and traditional semi-natural habitats have been taken to other land uses. Without management the characteristic vegetation change over time and there is a gradual conversion of open or semi-open grasslands to forested habitats.
- **Habitat fragmentation**: Even in protected areas the most valuable habitats often cover small areas and are patchily distributed, and the resulting small size and isolation of habitat specialist species' populations makes them prone to local extinction.
- **Invasive alien species**: Aggressively spreading alien species (e.g. Himalayan balsam Impatiens glandulifera, Garden lupine Lupinus polyphyllus) threaten the valuable natural habitats, flora and fauna of the project sites. Their unchecked dispersal would result in gradual replacement of the native species.
- **Lack of knowledge on natural values of the Natura 2000 sites**: Several project sites lack complete up-to-date data on the species found on the site. Many of the threatened species found on the Natura 2000 sites are elusive (e.g. saproxylic beetles) and their presence can only be confirmed by detailed inventories using appropriate methods.
- **Climate change**: Climate change is likely to be the most profound threat to global biodiversity, leading to new impacts and exacerbating existing pressures.
- **Increased human disturbance**: Growing pressure from human activities may cause disturbance and decrease the conservation value of Natura 2000 sites (e.g. disturbance to sensitive species during the breeding season or disturbance to the soil)
- **Lack of environmental awareness and appreciation of the target habitats and the Natura 2000 network**: Natural habitats are not valued as much as their high conservation value and significance as elements of rural landscapes would warrant, and habitat restoration is sometimes negatively perceived by local people due to lack of knowledge about the objectives. The Natura 2000 network and the value of Natura 2000 sites are still unclear to many citizens.

2.2. Species-rich LIFE 2011-2016

Species-rich LIFE included the following project actions:

	ACTION	
Preparatory actions	A1	Restoration Action Plans
	A2	Management Plans
	A3	Monitoring and Communication plans
	A5	Preparatory training
Concrete conservation actions	C1	Restoration of herb-rich forests
	C2	White-backed woodpecker habitat restoration
	C3	Restoration of semi-natural grasslands
	C5	Restoration camps for volunteers
Dissemination actions	D1	Media cooperation
	D2	Restoration trails
	D3	Project communication
	D4	Information tables
	D5	Senior ranger events
	D6	Layman's report
Project management actions	E1	Project coordination
	E2	Advising and project group
	E3	Networking
	E4	Auditing
	E5	After-LIFE conservation plan
	E6	General monitoring of restoration success

The main method for achieving the project's objectives was to improve the representativeness of the target habitats at 64 N2000 sites by restoring structural features important for maintenance of the biological diversity. Restoration of severely degraded areas also aimed at increasing the extent of the target habitats in the N2000 sites. Remaining herb-rich forests are fragmented and even in protected areas often suffer from gradual invasion of Spruce from the surrounding managed forests. Removal of Spruce (Picea abies) to open space for light demanding species and for broad-leaved tree species was the most important restoration method in forest habitats. In traditional rural biotopes the restoration methods were e.g. removal of trees, bushes and undergrowth, mowing, removal of reed (*Phragmites australis*) from coastal meadows, and construction of fences to enable continuous management by grazing animals. Herb-rich forests and HD Annex species habitats were restored in 594 ha on 35 Natura 2000 sites, White-backed Woodpecker habitat in 82 ha on 8 sites and semi-natural grasslands in 451 ha on 31 sites.

Restoration actions were mainly carried out by Parks and Wildlife Finland (PWF, coordinating beneficiary). Associated beneficiary WWF Finland organized restoration camps for volunteers, and Metsähallitus Forestry Ltd (MHF) was responsible for majority of timber harvesting on the restoration sites. FEI was responsible for reintroduction and monitoring of endangered butterfly Clouded Apollo (*Parnassius mnemosyne*).

The project succeeded at restoring 594 ha of Fennoscandian herb-rich forests (9050) and other broad-leaved forest habitats inhabited by Directive species, 81 ha of White-backed Woodpecker habitat, and 450 ha of various types of semi-natural grassland habitats. The project made a significant contribution to increasing the quality and extend of the habitats and to improving the viability of the threatened species' populations in the restored sites.

Over the previous 10 years before the project started, circa 1 500 hectares of herb-rich forests and 2 500 hectares of semi-natural grasslands had already been restored in State-owned protected areas by PWF. The Species-rich LIFE greatly benefitted from this previous technical experience (e.g. best practices of restoration in https://julkaisut.metsa.fi/assets/pdf/lp/Muut/ecological-restoration.pdf), but was also able to develop further the best restoration practices for these sensitive habitats. The sites restored by the project were originally proposed for LIFE funding due to their exceptional conservation value, urgent need for restoration and the relatively high cost of restoration actions. LIFE funding was crucial for carrying out the most expensive restoration measures, and permitted implementation of specific conservation actions, for example the Clouded Apollo reintroduction, that could not have been covered by national funding sources.

The outlook for the restored habitats is positive. We were able to overcome the many inevitable difficulties and challenges during the technical implementation of restoration activities, and more hectares could be restored than was originally planned. Long-term management could be secured for the sites that require continuous management, i.e. grazing in semi-natural grasslands.

Restoration planning was done with great expertise, and the project collected essential data about the species and habitats present at the sites. This information will be utilized for monitoring the recovery of the restored sites, which will continue as part of the routine work of the PWF. Monitoring actions during the project verified that the restoration measures were technically successful. Although the project duration was too short for collecting sufficient long-term monitoring data for making strong conclusions, it is safe to say that in numerous sites the restoration measures have already triggered the desired habitat recovery. The reintroduced Clouded Apollo populations will be monitored by Finnish Environment Institute, funding permitting, until the new subpopulations are securely viable. The three management plans prepared in the project will also be important tools for coordinating different land use interests, and they will help to secure long-term conservation targets of the 14 N2000 sites covered by the plans.

An essential part of the project was to inform and involve people. Nature conservation in protected areas is still often presumed to be passive preservation rather than active intervention, and the importance of habitat restoration for long-term survival of species and habitats was an important message to transmit to general public. Media coverage of the project was an important tool for raising public awareness and dissemination of project results, but also the many volunteering opportunities that were offered through the project reached wide audience. These efforts to influence and inform the wider audience will continue in the future as part of the work MPWF carries out in protected areas.

Networking with relevant actors and projects was successful throughout the project's life cycle. The project results were disseminated in Finland internally inside the PWF and project partners, and to various collaborating partners, e.g. SME's working in nature conservation, forestry and agriculture, the Grassland Group of the Finnish Board on Ecological Restoration (http://www.metsa.fi/web/en/fbergrasslandgroup) and the Finnish Forest Center. Internationally the project results have been presented in numerous scientific congresses, visits to relevant projects and protected areas (e.g. in Norway, Denmark, Latvia, USA and Canada) and in IUCN publication and IUCN World Congress. The project experiences were also utilized in formulation of a National Action Plan for management of semi-natural grasslands and in preparation of the ongoing LIFE project Light & Fire LIFE.

2.3. Current situation - SWOT analysis

Summary of SWOT-analysis:

	POSITIVE	NEGATIVE
INTERNAL	**STRENGTHS:** • Restoration measures were successful in all project sites and restoration planning produced invaluable inventory data and detailed site-specific plans for guiding future conservation efforts. • All project sites have sufficient protection status to secure the sustainability of project results. • Coordinating beneficiary PWF will be responsible for adaptive management of the sites after the project, and collaboration with project partners FEI and WWF will also continue. • Continuing monitoring of restored sites will prompt corrective actions if they are needed. • Necessary partnerships for continuous management of semi-natural grasslands were built already during the project.	**WEAKNESSES:** • Project management was not as smooth as ideally could have been. • Project's concrete conservation actions made an important contribution towards improving the conservation status of the target habitats and species, but the work needs to be continued and extended to wider areas. • Restoration planning process demanded lot of resources. • Unfavorable weather conditions were unexpectedly common during the 5-year project and caused many delays.
EXTERNAL	**OPPORTUNITIES:** • Funding through Agri-Environment Scheme will help to sustain restoration results in semi-natural grassland sites. • New methodologies and best practices developed in the project are now widely applied - PWF will continue the project's efforts and involve new partnerships. • Dissemination actions were very successful and will help to maintain and replicate the project results.	**THREATS:** • Scaling up the restoration efforts is essential for maintaining the project results. • Invasive alien species will require attention still in the future. • Funding for future conservation efforts and for maintaining the project's results is largely dependent on national political decision-making, which is difficult to predict in the long-term.

2.3.1. Strengths

Project actions were sufficient for restoring the sites to a state where positive development of habitat characteristics will continue through natural processes. In semi-natural grassland sites favorable future development is secured by continuous management by grazing in most of the sites, and the rest of the sites will be managed by Metsähallitus Parks & Wildlife Finland (PWF) based on specific needs identified during restoration and in the future through continuous monitoring. PWF has the necessary expertise and authority for securing the sustainability of the restoration results into the future. Moreover, restoration efforts will continue by PWF in the Natura 2000 sites in the coming years and will further increase the extent of the target habitats, thus increasing the connectivity of the habitat patches. During the LIFE+ project valuable inventory data was collected about the species and habitats present at the project sites and this information will help to direct the future conservation efforts. Project personnel working in restoration planning and implementation gained extremely valuable practical experience and expertise, and the best practices developed in the project will be applied in the future work of PWF.

PWF has developed guidelines for monitoring the results of semi-natural grassland and White-backed Woodpecker habitat restoration during the past ten years in co-operation with relevant research organizations. During the project a detailed methodology for monitoring herb-rich forests was developed. All restored sites will be monitored in the future, and if deemed necessary, supplementary restoration measures, e.g. additional removal of trees, will be carried out. The associated beneficiary Finnish Environment Institute also has long experience in monitoring and reintroductions of threatened butterfly species in managed habitats.

The sustainability of the project actions and investments will be secured from direct land-use changes since all project actions were carried out within protected areas. PWF manages most of the project sites and controls their use with national funding, which will secure continuous monitoring and management of the sites in the future.

2.3.2. Weaknesses

No major weaknesses in the project team or implementation of project actions were met during the project and in general the project actions were carried out very smoothly and cost-efficiently. Lack of full-time project management personnel caused some administrative challenges, but it was partly compensated by the highly skilled and experienced professionals working in the field. Mainly the difficulties encountered during the project implementation were due to outside factors.

Project's focus on certain species-rich and threatened habitats caused the project actions to be geographically widely dispersed. The project covered 64 Natura 2000 sites throughout southern Finland, and in addition to the high number of individuals sites there were in many cases multiple small subsites within each N2000 area. Because of the PWF's wide network of regional offices this did not cause major problems to project implementation, but project results are scattered around a large area. Partly this is due to the fact that the target habitat types are indeed very rare in Finland. However, in the future it will be essential to complement the network of restored sites to secure the connectivity of the habitat patches. Species-rich LIFE was an important step towards a favorable conservation status of the target habitats, but the work will need to be continued and extended to wider areas.

Detailed, site-specific restoration planning is a demanding task, and in this project it proved to be somewhat more laborious than anticipated. During the planning process it became evident that some of the sites could not be restored due to natural conditions or other impediments, and looking for supplementary sites delayed

the restoration work. If the selection of restoration sites could have been done more carefully prior to the project, it would have saved time and resources during the project implementation. Especially laborious and resource-consuming was the planning of privately-owned protected areas, because the procedure for approving restoration plans is often quite time consuming. On the other hand, the plans are necessary for carrying out the restoration work, and will also direct the future conservation efforts of the restored sites. This dilemma of imperative but resource-consuming planning process is a great challenge that requires sophisticated solutions. At least partly it will be solved by the new GIS based planning tools PWF brought into use during the last two years of the project. New SAKTI system allows for automated compilation of the basic information required for restoration plans, once the up-to-date background data from field inventories has been supplied to the database. This somewhat reduces the time needed for manual compilation of the baseline data.

Another reason for delays in project implementation were the weather conditions that during the project years were not very favorable. Tree removal by heavy harvester machines in sensitive restoration sites should ideally be carried out while the soil surface is frozen and there is protective snow cover. Most winters during the project had atypically high temperatures and tree removal with heavy machines was difficult. In most cases this problem could be overcome by revising the logging plan, but it caused extra work and expenses. Another weather-induced problem occurred with reintroduction of Clouded Apollo butterflies. Atypically rainy and cold summers made the breeding of the established new subpopulations very difficult, and the reintroductions needed to be repeated after a few years. Although weather conditions were anticipated to cause a potential risk to project implementation, the high number of consecutive unfavorable years during the project's duration caused more distress than was foreseen. These problems did not, however, prevent us from achieving the project's restoration goals.

2.3.3. Opportunities

One of the most important resources for future conservation of the project sites will be the funding available through Agri-Environment Scheme to farmers, who collaborate to manage some of the restored semi-natural grassland sites. These partnerships were built during the project and they are vital for successful long-term management of these sites.

New restoration methodologies and best practices tested in the project have been taken into use by PWF, for example in the ongoing Light & Fire LIFE+ project. Habitat restoration of dry heaths by prescribed burning and restoration of highly sensitive habitats on calcareous substrates had not been done at large scale before Species-rich LIFE project in Finland. Early experiences in Species-rich LIFE were so encouraging that additional sites were restored towards the end of the project. This know-how gained during the project will be utilized in the future and will be essential for securing favorable conservation status for some of the rarest and most threatened habitat types in Finland. PWF will continue the work and will distribute the knowledge and best practices continuously through various partnerships.

The project successfully disseminated the importance of species-rich habitats in Finnish protected areas, and large number of citizens participated in the project actions as volunteers and in other roles. Project web pages will be an important resource for information on restoration of herb-rich forests and semi-natural grasslands in the future. These efforts will contribute to future maintenance and replication of the project work.

2.3.4. Threats

This LIFE project restored some of the most species-rich and valuable habitat patches inside the Finnish Natura 2000 network. The conservation status of all the target habitats in the boreal zone in Finland is either unfavourable-bad or unfavourable-inadequate. Restoration results were very encouraging, but ensuring a favorable conservation status for these habitats will require continued restoration efforts in wider areas. Without more extensive restoration the long-term benefits of the project may not be sustained, if the target habitats remain too degraded and fragmented. Scaling up the restoration efforts will be vital for the sustainability of the results. To optimize this work, PWF will use modern analytical tools (e.g. spatial conservation prioritization software Zonation, http://www.metsa.fi/web/en/zonation) to select the priority areas for future restoration efforts. PWF is also actively working to further improve the cost-efficiency of restoration methodology used in the Natura 2000 network.

Removal of invasive alien species was carried out in numerous project sites. Also in this case LIFE funding was essential for carrying out the work, since there are no national sources of specific funding available. Project duration was not sufficiently long for completely eradicating all the individuals, and the work will need to be continued even after the project at some of the project sites. This can be done as part of the PWF's routine work in the State-owned protected areas, but in the privately-owned areas also the land owners need to be active. LIFE funding could be used only inside the N2000 sites and in some cases the invasive species are still present outside the N2000 site boundaries, and may reinvade the sites. Close monitoring of these sites will be carried out by PWF.

National political decision making in Finland will be critical for maintaining the project's results. Future continuation of the work implemented in the Species-rich LIFE project will mainly rely on governmental funding available to PWF. Political atmosphere in Finland is currently quite favorable to nature conservation, but there is a continuous pressure to decrease the expenditure of governmental organizations. It is evident that PWF will need to adjust to somewhat lower budgetary frame in the future. Although habitat restoration will definitively continue, the available resources may become more limited. Also, the Agri-Environment Schemes in place for financing the continuous management of semi-natural grassland sites by grazing, which is essential for maintaining the restoration results, may also be subject to changes in the future. Major changes in these funding mechanisms would be detrimental for the restoration results achieved by the project. Fortunately, for the time being no such threats are imminent. Additionally, the project made great progress by involving volunteers, which is a significant resource that will be available also in the future.

3. After-LIFE objectives and methodology

3.1. Restoration objectives and methodology

Annexed table lists all the project sites and summarizes the restoration actions during the project in each site. It also lists the future measures necessary for maintaining project objectives in the long term. PWF will be responsible for monitoring and adaptive management of the restored sites after the LIFE project, seeking support from WWF if volunteer camps need to be organized. Also the implementation of the management plans, and preparation of updated restoration plans in the future as necessary, will be the responsibility of PWF. FEI will continue the work with Clouded Apollo, depending on availability of national funding.

In most cases the restored herb-rich forest sites (Action C1) and White-backed Woodpecker habitats (Action C2) do not require further restoration actions to be carried out within at least 10 years. General monitoring was carried out in all sites after restoration, when the changes in tree stand structure and lightning conditions were already readily observable. Based on the results the project actions were sufficient to trigger desirable changes in the habitat structure. Within few years we expect the restored areas to become both structurally (habitats and species) and functionally (e.g. soil properties, nutrient circulation, lighting conditions) closer to favorable state. Thus, we expect these sites to develop in a positive direction by natural processes without further interventions, but monitoring will be continued in the future to ascertain that this is indeed the case. However, the 10 restoration sites where invasive alien species were eradicated during the project make an exception, because in some cases it is likely necessary to continue eradication measures even after the project. Annual monitoring of these sites will be necessary for several years after the LIFE project.

Semi-natural grasslands are ecologically inherently different than forest habitats in the sense that they require recurring management, e.g. grazing or mowing, to maintain their characteristics. To achieve long-term sustainability for these sites, partnerships with local farmers were developed during the project. By the end of the project, 21 of the 31 restored semi-natural grassland sites were at least partly managed by grazing on the basis of 5-year agreements with farmers. In these cases the farmers take operative responsibility for managing the restored sites based on the agreement and a site-specific management plan, whereas PWF has a directive role securing that the ecological objectives of management are reached. The objective is to establish long-term collaborations that will continue far into the future after the initial 5-year period.

Ten semi-natural grassland sites remained without grazers by the end of the project, and these sites will be managed by PWF. In some of these sites grazing is not a suitable management method, whereas for the other sites it was not yet possible to conclude partnership agreements with farmers. PWF will either organize the management by mowing or actively seek management partners (farmers, volunteer organizations) for these sites.

In conclusion, the main activities required after LIFE include monitoring of restored habitats to secure that additional restoration measures will be carried out if necessary. Monitoring is especially important in case of invasive alien species. Recurring management of semi-natural grasslands will require active coordination and collaboration with the farmers, or organizing the management e.g. by annual mowing. Also, the site-specific management plans will need to be updated periodically, and inventories of habitats and species will be necessary in the long-term to maintain the GIS database of PWF up to date. Three management plans prepared in the project will be important tools for coordinating different land use interests, and they will be used as guidelines for long-term conservation efforts in the N2000 sites covered by the plans. All of these activities will be carried out by PWF with governmental funding.

The restored areas were selected to Species-rich LIFE partly based on the urgency of need for restoration. In most cases the restored areas were relatively small, and in many of the project's Natura 2000 sites there remain other valuable habitat areas that should be restored in near future. In addition to this, there are numerous of other N2000 sites in Finland where these species-rich N2000 habitat types and Directive species urgently require habitat restoration. Especially in the case of semi-natural grassland biotopes habitat degradation is advancing at an alarming rate. PWF has estimated that in 2016 in Finnish protected areas about half (51%, 11 000 ha) of semi-natural grassland habitats had recurring management. Without management, and probably in many cases in need of restoration, were 8 000 ha (37%), whereas for 2 500 ha (12%) there was no data available on the condition of the site. It is thus likely that half of the semi-natural grassland biotopes in Finnish protected areas, many of them part of the N2000 network, are facing an

imminent risk of disappearing due to lack of management. These areas should be restored in the future as part of new LIFE projects or with other funding.

3.2. Monitoring objectives and methodology

As can be seen in the annexed table, general monitoring of restoration success was conducted at all 60 habitat restoration sites to get an overall picture of the development of the site after restoration. Restoration success was assessed by evaluating the direct technical changes on habitat structure, such as canopy layer coverage and tree species composition of the site. In addition to general monitoring, a more detailed monitoring data set including e.g. vegetation sampling, species inventories and environmental variables was collected from selected herb-rich forest (6 subsites) and semi-natural grassland (13 subsites) sites. Moreover, White-backed Woodpeckers were monitored in all 8 restored sites in 2016 using camera-trapping technique.

The data collected in general monitoring are intended for making conclusions about the general state of the restored sites. The objective was to check whether the restoration measures had clear positive or negative effects on the species and habitats, and to find out if there is need for corrective actions. Clear negative impacts were not detected during the monitoring in any of the monitored sites, in general the monitoring results indicated that restoration measures were successful and even in the most sensitive sites the results were very encouraging.

The objective of detailed monitoring is also to serve adaptive management of the sites, and to collect long-term data on the restored sites. Since similar monitoring methods are used by PWF also in restoration sites apart from the LIFE project, these data can be combined with larger national monitoring data sets. In semi-natural grassland sites monitoring data will be essential for directing the recurring management activities to ascertain that the habitat recovery is progressing in a favorable direction. Detailed monitoring data from the LIFE project sites will be useful in the long term for improving the restoration work conducted by PWF, and will also indicate if there is need for complementary restoration actions in the project sites.

After-LIFE site monitoring will continue according to the Monitoring Plan and the Monitoring Report produced during the project. In the 60 sites where general monitoring was carried out, the restored sites will be checked during a short visit approximately 5 and 10 years after restoration. If invasive alien species were present at the sites, monitoring visits will be annual until it is certain that the eradicated species have indeed disappeared completely. Detailed monitoring in 6 herb-rich forest sites will be carried out at 5-year intervals and includes sampling of trees, vascular plants, bryophytes and soil characteristics. Detailed monitoring of 13 semi-natural grasslands includes vascular plants and in 5 sites also day-active butterflies. First sampling after restoration is carried out 1-2 years after restoration, and after that detailed monitoring will be repeated at approximately 5-year intervals.

PWF is responsible for monitoring of White-backed Woodpecker population in Finland, and the project sites will be included in the national monitoring programme at ca 5-year intervals. The objective is to check whether the species is present and breeding in the restored territories, and to provide data for the national monitoring programme. Progress of habitat recovery will also be checked during the visits. Species inventories of Directive species such as *Cucujus cinnaberinus* will also be carried out in the relevant project sites as part of PWF's routine work. The reintroduced Clouded Apollo populations will be monitored annually by Finnish Environment Institute, funding permitting, until the new subpopulations are securely viable.

3.3. Project communication and dissemination objectives

Communication and dissemination to general public were important objectives of the project and these efforts will be continued by the project beneficiaries in the future. Project web pages (http://www.metsa.fi/web/en/speciesrichlife) will be maintained by PWF after the project and will continue to provide information about habitat restoration and project sites. Layman's report was produced in Finnish and in English, and can be used not only as a reference to the LIFE+ project but also for promoting the wider work done by all the project partners. If necessary, more copies of the paper version will be printed in the future. Volunteer involvement will also continue to be important, especially in the semi-natural grassland sites where recurring management is necessary in the future. Information boards in restored sites will tell about the project's work to visitors, but also the restored sites themselves with their magnificent landscapes will be promoting the value of habitat restoration. Species-rich LIFE collaborated with many volunteers, organizations and projects, and these partnerships will be maintained in the future. PWF will be responsible for these continuing efforts, e.g. the maintenance of the information boards.

4. Financial outlook

Below is a rough estimate of costs incurred during the 5-year LIFE project for implementing the restoration and monitoring actions that may/will be continued after the LIFE project. These calculations are based on the total cost of each project action in 2011-2016, divided by the results gained per action. It should be noted that the results of the calculations are crude simplifications that obscure the broad variation in costs per individual project sites. However, these calculations will help to gain an overall estimate of the magnitude of budgetary needs of After-LIFE conservation efforts.

Project action		Cost (€) during the project	Units
C1	Restoration of herb-rich forests	750	Total cost of restoration/ha
C2	White-backed woodpecker habitat restoration	970	Total cost of restoration/ha
C3	Restoration of semi-natural grasslands	3000	Total cost of restoration/ha
	Recurring management of semi-natural grasslands by PWF (if site has no grazing)	500	Estimated cost of recurring management by PWF/ha
C4	Clouded Apollo reintroduction	3000	Total cost of one reintroduction/site
C5	Restoration camps	175	Total cost of one volunteer working day
E6	Monitoring of restoration success	1500	Total cost of all monitoring efforts in one project site
E7	Clouded Apollo monitoring	4500	Annual cost of monitoring Clouded Apollo in one project site

4.1. Restoration

It is difficult to foresee how many restored forest sites (Actions C1 and C2) will actually require complementary restoration measures after LIFE, but by the end of the project there was little indication they would be necessary. Assuming that 10% of the sites would need some corrective restoration measures within

the next 5 years, the cost would be roughly 10 000 € annually. However, this is clearly an overestimate, since complementary restoration measures would likely be much less rigorous than the ones carried out during the project. More realistic estimate would likely be 5 000€ annually.

In case of semi-natural grasslands (Action C3), majority of recurring management of the restored sites is currently at least partly financed through Agri-Environment Schemes, and in most cases the farmers receiving this funding will take responsibility for additional restoration measures in case they are required after LIFE. The costs incurring to PWF from future management of these 21 sites will be quite low, probably varying between 0,5-2 working days annually/site and resulting from the need to coordinate cooperation with the farmers. The annual cost would thus be approximately 4 000-10 000 €. Moreover, after LIFE approximately 90 ha of semi-natural grasslands remain to be managed solely by PWF, and the approximate total cost will be approximately 40 000€, if annual recurring management is carried out.

If Clouded Apollo (*Parnassius mnemosyne*) would be reintroduced again to new sites after LIFE, the cost per new reintroduction/site would be at least 3000 €, including the applications for required permits. However, such measure is not planned for the time being, definitively not before the fate of the two subpopulations reintroduced in 2016 will be ascertained.

4.2. Monitoring

Monitoring of restoration results will be carried out (to varying degree of detail) by PWF in all 60 restored sites. The average cost of monitoring efforts during the project were 1 500€/site during the 5-year project period. Monitoring will continue in the 60 sites after the project according to the Monitoring Plan and Monitoring Report produced during the project. Monitoring costs per site after LIFE will likely be lower than during the project, because the initial monitoring phase required establishment of monitoring plots and other field work that does not require repetition after the project. Moreover, during the project before-restoration monitoring was carried out in some sites that finally could not be restored, thus these sites will no longer contribute to future monitoring costs. A conservative estimate for the total annual cost of monitoring of restoration results is estimated to be 1 200 €/site for 5-year period, which would total ca 14 500€ annually.

Clouded Apollo monitoring costs were in total ca 4 500€ per site annually during the project. FEI will continue annual monitoring in three sites if national funding will be available:

- Site 7, FI0100074 Porvoonjoen suisto (habitat restoration site)
- Site 16, FI0200102 Rekijokilaakso (reintroductions in 2012 and 2016)
- Site 63, FI0100066 Sipoonkorpi (reintroduction in 2016)

Clouded Apollo monitoring costs will be approximately 13 500€ annually for the 3 sites. If there is no national funding available, FEI may coordinate voluntary efforts with butterfly aficionados to determine whether the two reintroduced subpopulations are surviving.

4.3. After-LIFE financial scenario

Based on estimates detailed above, the total annual cost of After-LIFE conservation efforts by PWF will be approximately 63 500-74 500 € (Action C1 and C2 5-10 000€, Action C3 44-50 000€ and Action E6 14 500€). Moreover, FEI will require ca 13 500€ annually for continuing the Clouded Apollo monitoring (Action E7).

Sufficient financial resources will be available from the governmental funding to PWF, and the After-LIFE work will be incorporated to the routine work of PWF staff. However, there is no permanent national funding for Clouded Apollo monitoring, and FEI will be applying for various grants and other financial sources to be able to continue the monitoring efforts. As to other project actions, PWF will have the necessary governmental funding for maintaining the information tables, restoration trails and implementing the management plans as part of its routine work.

In addition to After-LIFE efforts within the project sites, new restoration efforts similar to Species-rich LIFE should be targeting other areas within the Natura 2000 network in Finland. Especially semi-natural grasslands require more extensive restoration efforts in the future. PWF is carrying out this work with budgetary funding, but acquiring additional resources through future LIFE projects and other funding mechanisms will be crucial. Thus, it will be important for PWF to also allocate sufficient resources to preparation of future funding applications to extend the successful work carried out by Species-rich LIFE.