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White backed woodpecker landscapes and new nature reserves

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Skogsstyrelsen
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1. Preface

This report presents results of the project "White-backed woodpecker landscapes and new nature reserves. It was conducted in 1996-1999 with the support of EU's LIFE fund. The objective of the project was to preserve, restore and create new habitats within 10 landscapes in south and central Sweden that are suitable for the White-backed Woodpecker and other accompanying species associated with the same environments in the Western taiga. This report has been prepared after project termination. It has basically not been revised to consider what has happened after the year 2000.

The White-backed Woodpecker is one of the most threatened species in Sweden. At present there are probably no more than about 20 pairs in Sweden. The future for these is very uncertain and the work should not be regarded as an acute measure to save them. Instead, habitat management must be conducted with a long-term perspective where the goal is that the forests of the future will contain qualities that provide conditions for survival of all these species.

Western taiga is among the most important habitats for the White-backed Woodpecker. Since this woodpecker is an umbrella species, these habitats are also the home of several other species. They have in common an association with high proportions of deciduous trees, large amounts of dead wood, together with disturbances caused by fires or flooding, all of which require specific considerations to be taken in forestry. Consequently, it is an important task for the forestry sector to identify and protect these environments as part of the work to achieve the environmental goals of forest policy.

The project has given rise to a diversity of other projects with the intention to combine, on the landscape level, a number of different instruments for cooperation between land-owners, authorities, and different organisations in order to achieve an optimal solution where nature preservation and forest production can be combined.

We wish to thank the European Union and its Environmental Fund LIFE for the support that has been an absolute necessity for accomplishment of the project. We also wish to thank our partners in the project, all the staff and all the locally participating land-owners and other interested persons who, sometimes even without compensation, have participated in the accomplishment of the project.

It is the hope of the National Board of Forestry that the project experiences and this report will contribute to the development of co-operation between authorities, land-owners and other interested parties for sustainable forestry as seen in a landscape perspective. This is in particular the case as it concerns the EU network of protected areas, Natura 2000.

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Head of Environmental Division

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Project Leader

2. Sammanfattning

Vitryggig hackspett *White-backed woodpecker (Dendrocopos leucotos)* räknas som akut hotad i Sverige och i övriga EU. Arten finns med i Fågeldirektivet Annex 1 och åtgärder för att skydda arten har hög prioritet. Under de senaste decennierna har populationsstorleken minskat avsevärt, och för närvarande återstår endast 30-50 par i Sverige. Den främsta orsaken till tillbakagången är biotopförändringar till följd av skogsbruk. Arten kräver skogar med stor tillgång på död ved och stor lövandel. Äldre bestånd som inte påverkats i någon större utsträckning av skogsbruk hyser ofta rätt kvaliteter, men även en del yngre lövskogar kan vara värdefulla. Naturliga störningar som brand och översvämning medför stora mängder död ved och gynnar därmed den vitryggiga hackspetten.

Syftet med det här projektet var att bevara, restaurera och nyskapa värdefulla miljöer för den vitryggiga hackspetten. Arealen och utbredningen av de miljöer (habitat) som huvudsakligen ingått i projektet minskar generellt och flera av dem finns därför med i Habitatdirektivet Annex 1. Ett exempel på en sådan viktig miljö är ”Västlig taiga”. Tio olika landskapsavsnitt i södra och mellersta Sverige valdes ut (Fig. 1).

Arbetet baseras på ett antal olika inventeringar (fågelinventeringar, nyckelbiotop och sumpskogsinventering mm.). Analyser gjordes av varje landskap för att finna en effektiv strategi där flera olika instrument kombineras för bevarande och restaurering. Områden med mycket höga värden och som täcker större arealer har säkerställts som naturreservat. Mindre områden (generellt mindre än 5 ha) med höga naturvärden eller med ett strategiskt läge i landskapet har säkerställts som biotopskydd. Områden med lite lägre värden, men med ett potentiellt högt (t.ex. yngre lövskogar) värde har bevarats genom ett naturvårdsavtal mellan markägaren och staten. Flera olika metoder för att öka naturvärdena har genomförts med NOKÅS bidrag (ett stöd som ges för Natur Och Kulturmiljö Åtgärder i Skogen). Exempel på detta är naturvårdsbränning, gallring av barrträd för att öka solexponeringen och lövandelen, ringbarkning för att öka mängden död ved, skapande av högstubbar och sprängning av träd. En annan viktig del av projektet har varit information, diskussion och exkursioner med markägarna. Frivilliga avsättningar i form av hänsynsytor utan ekonomisk ersättning har ytterligare förstärkt naturvärdena i respektive landskap. Totalt har ca 2 000 ha, eller 10% av landarealen, avsatts som hänsynsområden.

Projektet var ett samarbete mellan Naturvårdsverket (SNV) och Skogsstyrelsen (SKS). Det regionala arbetet i landskapen har genomförts av Länsstyrelser och Skogsvårdsstyrelser. Flera andra organisationer har också deltagit (Naturskyddsföreningen, Sveriges lantbruksuniversitet m.fl.). Projekttiden har varit 1 april 1996 till 31 mars 1999. Budgeten har omfattat 3 146 600 Euro, varav LIFE fonden har bidragit med 50%, SNV med 25% och SKS med 25%.

Resultatet av projektet (Tabell 1) har medfört ökade möjligheter för den vitryggiga hackspetten att överleva i skogslandskapet. Relativt stora områden med höga eller potentiellt höga naturvärden återstår dock att säkerställa. Det är också viktigt att naturvärden som död ved och lövträd bevaras genom generell hänsyn vid alla skogsbruksåtgärder. På kort sikt är dessa åtgärder troligen ändå inte tillräckliga för att

bevara arten. För att lösa den akuta situationen kan återintroduktion av individer möjligen vara en lösning.

Förutom direkta naturvårdsåtgärder i skogen har projektet skapat en bra bas för fortsatt samarbete mellan olika myndigheter och organisationer. Arbetet fortsätter bland annat i styrgruppen för vitryggig hackspett. Flera andra projekt med liknande metoder har redan påbörjats.
Projektet ingår också i upprättandet av det Europeiska nätverket Natura 2000. Totalt har 13 nya SPA ("Special Protection Areas") områden med sammanlagda arealen 2 604 ha bildats. Nästan halva arealen är också föreslagen som 12 nya pSCI ("proposed Site of Community Importance") områden.

En stor andel, 86%, av landarealen av pSCI områdena utgörs av miljöer som ingår i habitat direktivet. Det viktigaste "habitatet" inom pSCI områdena är västlig taiga som utgör hälften av pSCI arealen. Andra viktiga "habitat" är alluviala ängar, lind-lönnskogar i sluttningar och raviner, samt ek-alm-ask blandskog längs vattendrag.

Inom de områden som är föreslagna som Natura 2000 objekt förekommer 21 fågelarter som finns med i Fågeldirektivet. Järpe *(Bonasia bonasia)* och spillkråka *(Dryocopus martius)* förekommer i samtliga SPA områden. Andra arter som förekommer i flera SPA områden är tjäder *(Tetrao urogallus)* , sparvuggla *(Glaucidium passerinum)* , vitryggig hackspett *(Dendrocopos leucotos)*, pärluggla *(Aegolius funereus)* och tretåig hackspett *Picoides tridacylus*. Bland de arter som finns med i Habitatdirektivet Annex 2 finns bara fem arter i pSCI områdena, tre mossor och två insekter. Förutom dessa förekommer ett antal arter som räknas som hotade inom EU (t.ex. flera arter av lavar och mossor), men dessa ingår ej i habitatdirektivet.

Projektet har varit en av flera viktiga projekt i Sverige med syfte att bevara den vitryggiga hackspetten. Det har också varit ett viktigt steg för att genomföra Habitatdirektivet i Sverige med avseende på barrskogsmiljöer. De nya pSCI områdena är av stor betydelse för Natura 2000 nätverket, inte bara på grund av områdenas höga naturvärden utan också på grund av den geografiska fördelningen.

3. Summary

The White-backed woodpecker *(Dendrocopos leucotos)* is an endangered species in Sweden as well as in the rest of the European Union. The species is listed in the Birds Directive´s Annex 1 and measures for protecting the species are therefore of high priority. During recent decades the population size has decreased considerably in Sweden and at the moment only 30-50 pairs remain. The main reason for the decline is lack of suitable habitats due to forestry. The species prefers forests with high abundance of dead wood and high proportion of deciduous trees. This is often found in older stands less affected by forestry, but also some young deciduous forest could be valuable. Natural disturbances such as fires and flooding often favour the species by creating large amounts of dead wood.

The main purpose of this project was to conserve and restore important habitats for the White-backed woodpecker. Some of the habitats included in the project are also declining in their distribution and several of them are listed in the Habitats Directive´s Annex 1. Western taiga, which has been the main habitat for protection, is one example. The strategy was to combine several different conservation measures. Ten different landscapes in south and central Sweden were selected (Fig. 1).

The work was based on several surveys (White-backed woodpecker, other ornithology surveys, woodland key habitats, swamp forest etc.) and analyses of each landscape to find the most effective strategy for conservation and restoration. The largest and most valuable sites have been conserved as nature reserves. Smaller sites (often smaller than 5 ha) with high nature values or a strategic position in the landscape have been conserved as Biotope reserves. Areas with high potential value, such as younger deciduous forest, have been conserved by using Conservation agreements between the landowners and the County Forestry Board. Several types of restoration methods (Adaptive forestry) to increase the nature values have also been used. These include conservation burning, removing coniferous trees to increase sun exposure and the proportion of deciduous trees, killing trees by girdling, creating high stumps or using explosives. Information given to, and excursions with, the landowners have also been important parts of the project. Voluntary conservation or Environmentally Managed Forestry (EMF) without economic compensation further improved the conservation strategies in the landscapes. The total area of such EMF is about 2 000 ha, or 10% of the total land area.

The project was a co-operation between the Swedish Environmental Protection Agency (SEPA) and the National Board of Forestry (NBF). The County Administrations and the County Forestry Boards have carried out the local work within the landscapes. Several other institutions or organisations have also participated (The Swedish Society for Nature Conservation, The Swedish University of Agricultural Sciences, etc.) The project period has been 1 April 1995 – 31 March 1999. The total budget was 3 146 600 EURO. Of these, the LIFE fund covered 50%, NBF 25% and SEPA 25%.

The result of this project (Table 1) has increased the possibilities for the White-backed woodpecker to survive in these landscapes. However, large areas with high or potentially high nature values remain to be conserved and restored. It is also important

to adapt "normal" forestry to increase the nature values in general, i.e. by saving dead wood and deciduous trees. At the moment, the White-backed woodpecker is so rare that it is probably also necessary to use other methods, such as reintroduction, to be able to conserve the species.

Besides the conservation and restoration of forest, this project has created a good base for continued co-operation between different authorities and organisations. A new group of people has already been formed to continue the work with the White-backed woodpecker. Several other projects, using the same methods as this project, have already started.

The project has many connections with the establishment of the Natura 2000 network. Altogether 13 new SPAs ("Special Protection Areas") covering 2 604 ha have been the result of the project. Almost half of that area is also proposed as 12 new pSCIs ("proposed Site of Community Importance").

A large proportion, 86%, of the pSCI land area is covered by habitats listed in the Directive. The most important habitat in the pSCIs are western taiga, almost half of the pSCI area is covered by this habitat. Other important habitats are alluvial meadows, Tilio-Acerion ravine forest and mixed deciduous forest along rivers.

In the areas suggested as Natura 2000 sites there are 21 of the birds listed in the Birds Directive present. Hazel grouse *(Bonasia bonasia)* and Black woodpecker *(Dryocopus martius)* are present in all the SPAs. Other birds present in many of the SPAs are Capercallie *(Tetrao urogallus)* , Eurasian pygmy owl *(Glaucidium passerinum) ,* White-backed woodpecker *(Dendrocopos leucotos),* Tengmalm's owl *(Aegolius funereus)* and Three-toed woodpecker *(Picoides tridactylus)*. There are only five species listed in the Habitats Directive Annex II present in the pSCIs, three bryophytes and two insects. There are also a number of species that are threatened in the European Union (e.g. several species of lichens and fungi) but these are not listed in the Annexes.

The project has been one of several important projects in Sweden trying to protect the White-backed woodpecker. It has also been an important step for implementing the Habitats Directive in Sweden as regards forest habitats. The new pSCIs are of great importance to the Natura 2000 network, not only for the conservation values but also due to their geographical distribution.

Table 1a. The total area and the total number of sites targeted for different actions in the project

Type of Conservation Measure	Number of sites	Total area
Nature reserve	12	976
Biotope reserve	39	172
Conservation agreement	123	761
Adapted forestry	48	227

Table 1b. Area (ha) of different actions in each landscape

Landscape	Type of conservation measure				
	Nature reserve	Biotope reserve	Conservation agreement	Adapted forestry	Total area
Långbro	135	85.5	35.1	0	255.6
Dalälven	263	15.5	96.4	6.6	380.8
Hallaren	30	8.4	101.7	44.9	185.0
Hemshyttan	0	3.8	24.0	0	27.8
Örten	10	4.1	92.7	34.9	141.7
Alken	40	18.5	108.0	38.3	204.8
Fjornshöjden	224	7.1	26.2	16.7	274.0
Stora Le	122	10.5	161.1	37.9	331.5
Råvarpen	83	12.9	114.3	31.0	241.2
Sommen	69	5.8	1.5	16.5	92.8
Total	976	172.1	761	226.8	2135.9

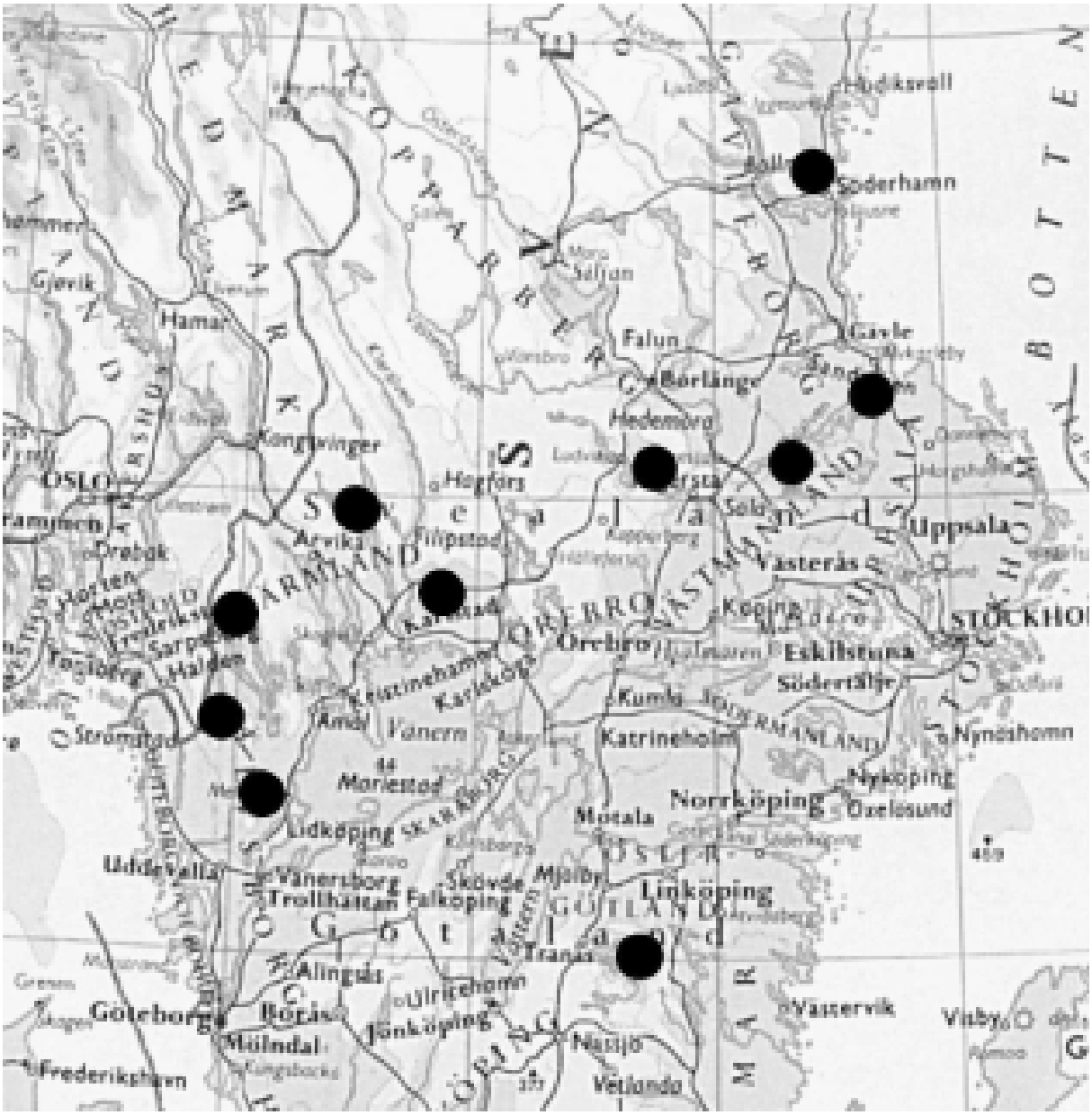

Fig. 1. Map of south Sweden. The locations of the ten LIFE landscapes are marked with black dots. The different landscapes are, from west to east: Stora Le, Fjornshöjden, Råvarpen, Alken, Örten, Sommen, Hemshyttan, Hallaren, Långbro, Dalälven.

4. Introduction

This is a final report of the project "White-backed woodpecker landscapes and new nature reserves" (Project number LIFE/95/S/A21/S/517/MLTRG). The original final report to the European Commission has been slightly revised for readability and subsequent events. The project, which has been a co-operation between the Swedish Environmental Protection Agency (SEPA) and the National Board of Forestry (NBF), started on 1 April 1995 and continued until 31 March 1999. The total budget has been 3 146 600 EURO. The LIFE fund has supported the project with 50% of the cost; SEPA and NBF have each contributed with 25% of the costs.

The County Administrations and SEPA were responsible for planning of the Nature Reserves. The National Board of Forestry and the County Forestry Boards were responsible for other conservation measures and information to the landowners. Initially, a reference group of experts was consulted for strategies and planning. Later, most of the fieldwork was carried out by the County Administrations and the County Forestry Boards.

This chapter describes the initiation of the project. It includes description of the situation for the White-backed woodpecker, the habitat western taiga and the other habitats involved in the project. The text about western taiga is more thorough in its description of the habitat status today, how much of the habitat that is already preserved and what the general threats against the habitats are. Unless other points of time are mentioned in the text, the data in the taiga text are based upon an analysis of the situation compiled during the spring of 1998.

Background

Reasons to establish the project

The objective of the project was to conserve and restore important habitats for the White-backed woodpecker *(Dendrocopus leucotos)*. The habitat use, distribution and population size of the species is well known, as well as the reasons for the decline. By conserving some of the most important habitats, and changing the forestry methods where the species occurs, the chances to conserve the species will increase.

Habitat types and species

Several habitats listed in the habitat directive have been included in this project. These are, for example, western taiga, residual alluvial forests, bog woodland and tilia-acerion ravine forest, mixed oak-elm-ash forest of great rivers, eutric screes and siliceous screes. All these habitats are preferred as feeding and breeding sites for the endangered White-backed woodpecker *(Dendrocopus leucotos)*. The species is included in the birds directive and is red-listed in Sweden.

Sites involved

Ten landscapes located in south and central Sweden have been involved (Table 2, Fig. 1). The total land area of these is 20 902 ha. Of these, 7 landscapes are known as breeding sites for the species, while 3 landscapes are potential breeding or foraging sites due to the high nature value and strategic position. The choice of landscapes is

based on several years of surveys made by the Swedish Society for Nature Conservation.

Main conservation threats

The main reason for the decline of the species is lack of preferred habitats due to forestry. The main threat in the future is also forestry, selective logging for fuel and removal of dead wood from the forest. In the future it will be most important to conserve the most valuable habitats within the main distribution area of the species in combination with habitat restoration. Habitat restoration may be combined with adapted forestry. The most critical factors are the proportion of deciduous trees and dead wood.

Initial work and planning

The project was prepared during 1995, in co-operation with the Swedish University of Agricultural Sciences, the Swedish Society for Nature Conservation and different authorities. Each landscape was mapped according to the nature values. Based on this and other surveys, a landscape plan was made for each area.

Overall and specific objectives

The overall aim of the project was to carry out a series of actions within these 10 areas, covering altogether 20 902 ha in central and southern Sweden, to conserve priority habitats and species of major Community importance. These actions will include:

- Purchase of approx. 625 ha of land for nature reserves
- Rental of approx. 675 ha of land through Civil rights agreements, lasting up to 50 years and approx. 100 ha for biotope reserves.
- Financial incentives for adaptation of forest management to nature conservation needs in approx. 475 ha.
- Various initiatives to raise public awareness and advisory services directed specifically at forest owners.

By the end of the project these areas would be designated as SPAs (“Special Protection Areas”) or candidate SACs, i.e. pSCIs (“proposed Site of Community Importance”).

The Swedish Environmental Protection Agency is responsible for the purchase of approx. 625 ha of land for nature reserves within the ten areas, which accounts for nearly half the budget of the project. The National Board of Forestry is responsible for negotiating biotope reserves, Conservation agreements and adapted forestry, as well as running consultation programmes with the landowners (forest extension service).

5. General project context

The White-backed woodpecker

Classification in the Bird Directive and other lists

In Sweden the species is red-listed and regarded as endangered (threat category 1, Ahlén & Tjernberg 1996). Also in Finland the population status is regarded as critical (threat category 1). However, it is not listed by IUCN (Red-list of threatened animals. IUCN 1996, Gland, Switzerland.)

It is included in the Bird Directive, Annex 1, and protected by the Bern convention, Appendix 2.

Distribution and population status in Europe

The White-backed woodpecker was probably widespread in Sweden and in some places common during the 19th century (Aulén 1988). During the period 1970-1982 it was found breeding at 80 locations. The main distribution areas for the species were Värmland County, the river Dalälven and near the lake Sommen. Since 1980 the number of breeding pairs has decreased considerably. During recent years (1998-2000) only about 30 individuals have been observed. Of these, only about 3 pairs has been found breeding, all of them in Southwest Sweden (Dalsland and Värmland).

In northern Europe the species also occurs in Norway, Finland and in the Baltic States. In Norway, there is still a big population of more than 1 500 individuals (Håland & Ugelvik 1990). Of the Baltic States, the biggest population occurs in Latvia. However, in Finland the population size has decreased rapidly and only about 30-40 individuals remain (Virkkala 1993).

The species is distributed in many European countries but the main population occurs in less developed parts in Eastern Europe. There are some small, isolated populations in the Pyrenees, the Alps and the Apennines. However in eastern Poland, Belorussia, Ukraine, Romania and Yugoslavia it is quite common.

Habitat and food preferences

The species is confined to forests with a large proportion of deciduous trees and dead wood (Stenberg & Hogstad 1992, Hogstad & Stenberg 1994). Most important tree species for foraging are aspen *Populus tremula*, birch *Betula* sp., sallow *Salix* sp., grey alder *Alnus incana*, common alder *Alnus glutinosa* and oak *Quercus robur*. Originally, its main habitat was probably forests frequently disturbed by fires or flooding, which favoured deciduous trees and created large amount of dead wood. Nowadays, these disturbances are prevented and the species mainly occurs in other types of deciduous-rich habitats such as overgrown pastures and meadows. The species is specialised on eating insects, especially wood-living insects. The most common food choice is larvae of Cerambycidae beetles (Aulén 1988). The preferred habitat for the White-backed woodpecker is also used by many other red-listed species favoured by high abundance of dead wood and high proportion of deciduous trees (Martikainen et al. 1998, Nittérus 1998)

Home-range and movements

The White-backed woodpecker has been studied using radio-transmitters in Sweden and Norway (Aulén 1988). The result shows that the species uses large areas. During summer the territories may be larger than 100 ha, and during winter their home range may be larger than 700 ha. Like all other European woodpeckers, except the wryneck, *Jynx torquila*, it is a stationary bird species. However, it is occasionally observed together with migrating birds at important migrating routes in spring and autumn, which indicates that some individuals migrate. During the non-breeding season it is also known to move long distances within Sweden. It is likely that in some years some individuals reach Sweden from the Baltic States or Norway. However, this has never been proven.

Reasons for the decline

The optimal habitat for the White-backed woodpecker has decreased and today only small patches of high quality habitats remain. The most important reason for this habitat change is intensive forestry with timber production as the main goal. In order to achieve this goal disturbances such as fires and flooding have been prevented. In thinning and clear-cutting operations dead trees have been removed. Areas with high proportion of deciduous forest have been logged and planted with spruce. The reasons for the decline are:

- Prevention of natural disturbances such as fires and flooding.
- Clear-cutting of deciduous woodland or stands with a large number of deciduous trees
- Thinning of deciduous trees
- Felling for firewood
- Wrong type of management in nature reserves, urban areas, etc.
- General “cleaning” in the forest (mainly removal of dead wood)
- Other exploitations

At the moment the population size of the White-backed woodpecker is very small and even if the habitat is restored the number of individuals may continue to decrease (Carlson & Stenberg 1995). Predation, competition, diseases and a number of stochastic events may have a great influence on a small population. Therefore the conservation of the species requires a long-term perspective. The habitat restoration must continue. However, the result in terms of population increase might take several decades.

Habitats

Western taiga

Description: The habitat “western taiga” as listed in the Habitats Directive is more like a biome than an ordinary habitat. The western taiga contains numerous different sub-types of boreal forests. The sub-types range from dry to moist forest. Most of the taiga sub-types consist of coniferous forests, either pine forests, spruce forest or mixed pine-spruce forests. Deciduous trees are common in some sub-types and rare in others. The most prevalent deciduous genera are *Betula, Alnus, Salix* and *Populus*.

Parts of the taiga have conservation values due to long periods without any disturbances, for example wet spruce forests, others have high values connected with natural disturbances like forest fires and flooding. Forest productivity varies widely within and between Counties.

The habitat "western taiga" is different when compared with other habitats in the Habitats Directive due to the claim of a certain quality. The forest has to be forest that has not been altered by forestry measures. Forest stands where there has been very extensive forestry with a slight human impact may also fit the claim of quality if species connected with natural forest still remain at the site in a significant amount.

Compared with managed forests there are many dead and dying trees, a crucial factor for many threatened woodland and forest species. Dead wood is essential for numerous insects, fungi, bryophytes and lichens. Many bird species require old trees with hollows during the nesting season. A scarcity of coarse woody debris - snags, stumps, logs and large branches - is one of the most serious threats to biodiversity in Swedish forests.

There are many endangered and vulnerable species to be found in the western taiga habitat. Several birds listed in the Birds Directive Annex 1 are, for example, dependent on the habitat. The habitat is also important for other rare or endangered species than the ones listed in the Directives, for example several fungi and lichens.

The western taiga's status today: Today there is about 29 Mha forest in Sweden, which is 65% of the land area. Depending on the forest productivity the forest stands are classified either as productive or non-productive. Non-productive forest has productivity of less than one forest cubic metre per hectare and year.

The total forest area has decreased due to human activities such as farming, building cities, infrastructure, etc., and by drainage of wetlands, plantations and other forestry methods the forest structure has changed and the timber production has increased. Without human intervention most of the forests in Sweden should have been western taiga except a small amount of broad-leaved forests in south Sweden and alpine birch forest in northern Sweden. Today, western taiga covers less than 5% of the original distribution.

The situation for the western taiga habitat in Sweden is severe. The situation for western taiga in Norway, Finland, Estonia, Latvia, Lithuania and parts of Karelia is similar. The situation in other parts of western Russia is better but the threat to the western taiga there is also increasing.

Preserved non-productive forests: The non-productive forest often consists of small forest stands on wetlands and bedrock outcrops. Altogether the non-productive forest covers approximately 6.2 Mha. According to the Forestry Act, forestry is not allowed in non-productive forests larger than 0.1 ha. There is almost always a certain amount of non-productive forest stands in every existing or future nature reserve. Non-productive forests are considered to have no economic value in forestry due to the regulations in the Forestry Act, but there are economic values connected with hunting.

The impact of non-productive forest on the funds needed for nature conservation is low.

Preserved productive forests: Approximately 22.5 Mha of the forest is regarded as productive forests. For the time being, 3.6% of the productive forest in Sweden is protected in nature reserves and national parks. The major part of the protected area (80%) is situated in the alpine region.

The Alpine region: The productive forest covers 1.5 Mha in the alpine region, of which approximately 43% are protected. The main reason for the high level of protection is that this region contains a lot of virgin forest of high conservation value. Large efforts have been made to protect the best parts. An important factor is that it has not been too expensive to protect the western taiga in the region. The state owns a lot of land and many of the conservation measures have been without cost. There are only a few sites left to protect according to the conservation plans in this region.

The Boreal and Hemiboreal region: In the Boreal region, productive forest covers 21 Mha. The conservation situation is the opposite compared with the Alpine region. The forests are expensive/ha and private individuals or large forestry companies own most of the land. Only 0.8% of the productive forest is protected. Forest that can be classified as western taiga covers less than 4% of its original distribution. More than 0.8 Mha of western taiga need to be protected in this region, if the objective is to protect all remaining western taiga.

Threats in general: If the sites of western taiga are not protected, their character will be dramatically altered by forestry practices. Old-growth forest with a mixture of tree species will be harvested and replaced by homogeneous coniferous stands. Forestry activity would also limit the supply of old trees, as well as dead and dying wood. All species that require the presence of deciduous trees for their survival will experience difficulty in locating suitable habitats. The hydrology and hydrochemistry at some of the sites would also be affected, as a consequence of draining intended to prevent a rise in the water table after clear-cutting on wet forestlands.

The forest is the most important natural resource in the Swedish economy. Forestry and accompanying industries are the largest industry sector in Sweden. Forestry measures are done all over the country, even in forest stands that are far from roads, difficult to cut and contain low productive forest. The western taiga habitat once covered almost the whole area that is forest today. Less than 4% remains of the original distribution in the Boreal region. Without protection or agreements, most of the remaining western taiga will be cut within twenty years.

According to Swedish legislation, a landowner has to give advance notice of planned cuttings to the local County Forestry Board, unless the cutting area is smaller than 0.5 hectare. Thinning and cleaning need not be reported in advance and may take place without the knowledge of the authorities. The announcement is made on a special form and the landowner has to wait for six weeks after submitting the form before he is allowed to cut the forest. During these six weeks the authorities have to decide if any conservation measures are necessary.

To summarise, a latent threat exists to all forest sites with high conservation values although it may not turn out to be acute until the landowner formally announces an intention of clear-cutting. In such a situation a period of six weeks is available for nature conservation authorities to react and raise the necessary funds. In the applications of LIFE support to the protection of forest sites, the SEPA has given priority for the selection of sites where landowners have accepted to wait with forestry measures for some years while the County Administration & SEPA raise funds and establish the nature reserve. However, they may have announced that they are prepared to wait only for a maximum of another one or two years.

The situation for western taiga will probably be a little bit better when more landowners have joined different certification systems for forestry, for which sustainable use is important. However, certification is primarily for adjustments of practices in commercial forestry, and cannot replace total protection of sites with very high nature conservation values, which are susceptible to adverse impacts of commercial forestry. Certification and protection by nature reserves are two complementary but not totally replaceable strategies.

Conservation measures when there is an acute threat: If a prospective falling site has high nature values and should be protected, the authorities contact the landowner. Depending on the site's conservation value, funds available for the time being or in the near future, and the landowner's interest in conservation measures, the situation can develop in many different ways.

If the site's nature values can compete for national funds with other sites in need of protection in a near future, the authorities ask the landowner if he can agree to establish a nature reserve and wait some years for compensation while SEPA tries to raise funds. At several sites all over the country landowners are aware of conservation interests and are also willing to avoid forestry measures for some years while the authorities try to get the funds necessary for establishing a nature reserve. This is the case for many of the landowners at the sites in this LIFE project.

If the landowner agrees, the site will become a pSCI and qualify to be included in a suitable LIFE-application. The situation may not seem so acute, but it is the most acute situation that is possible to apply funds for. All other situations will end up in cuttings or immediate measures, for which the procedure of making a pSCI and a LIFE-application takes far too long.

If the landowner's financial situation does not allow him to wait with forestry activities there is an immediate severe threat to the site. He must be compensated at once, or he will have to cut the forests. In a situation like this, another site that is not so acute, may be replaced by the acute one in the budget. There will be one more year of waiting for another landowner. If the landowner cannot agree to the conservation plans at all, there will soon be a severe conflict, where the authorities have to make an interim nature reserve to stop the cuttings.

The national funds are always limited and if the announced site's conservation values cannot compete with other acute sites the authorities can only inform the landowner about the values and ask the landowner to take care of them because the government cannot pay compensation in the near future. In cases like this the forest will normally

be cut more or less at once. Exceptionally, some sites have actually been preserved by the landowner for several years and SEPA has been able to pay compensation to the landowner many years after the announcement on intended felling, when the landowner has made a new application.

All conservation measures are not made as a result of cutting announcements. The authorities also establish nature reserves according to their own schedule. Most sites with high nature values will sooner or later be mature for cutting, or other forestry measures which do not have to be announced will be done.

Constitutional rights: According to Constitutional rights every landowner has the right to be totally compensated for all economic losses caused by activities of the government, for example, nature conservation measures with restrictions on forestry.

Funds needed for conservation of western taiga: To preserve the rich biodiversity of these forests, the sites must be protected as nature reserves with adequate restrictions on forestry. Conservation of the western taiga is therefore expensive.

During 1998 SEPA's budget was enough to protect 0.01 Mha of the natural forest per year. If national funds for conservation measures continue to be the same in the future, SEPA will have to use the annually available amount for more than 80 years to protect the remaining western taiga. After that, another 0.8 Mha of western taiga in the boreal region will be protected. By then, altogether less than 5% of the originally distribution of the habitat will be protected. The budget situation became a little bit better during the autumn of 1998, but the situation is still very difficult. Time is limited and most of the remaining western taiga will probably be cut down within twenty years.

During the project period the national funds have increased from approximately 190 MSEK/year in 1995 to approximately 370 MSEK/year during 1999. Even if there is a large increase in national funds, the LIFE contribution still means a large added value for Swedish nature conservation.

Other habitats

The western taiga habitat has been a main target for the project, but several other habitats have been included in the project. This depends either on the other habitat's own conservation values or the habitat's presence at sites where there is western taiga of high conservation value. Here, a short overview of the situation in Sweden for these habitats will be given.

Other forest habitats: As regards the status today, the threats and the legislation, the situations for the other forest habitats that are included in the project are similar to the situation for western taiga. Forests are the most difficult habitats to preserve in Sweden due to the large costs.

Mires: Several of the mire habitats can have some protection by general legislation, for example, drainage of mires and peat cutting can be avoided. Peat cutting needs a special permit. Drainage is forbidden in parts of Sweden and a special permit is needed in other parts. Drainage in order to avoid a raising of the ground water table after logging is not prevented by general legislation. New roads crossing the mire can also be difficult to avoid. Productive mires with a tree cover may be logged and will

then be handled like logging of western taiga by the authorities. So, there are still threats to mires in Sweden.

Grasslands: The few grasslands at the sites will have to be grazed to keep their conservation values, and making a nature reserve will guarantee grazing in a long-term perspective. Some grasslands need to be restored. The lack of grazing or hay cutting on grasslands is a severe problem in parts of the country. A lot of farms have stopped having cattle or sheep and in some counties it is difficult to find farmers that would like to have their livestock grazing on natural grasslands.

Lakes and rivers: There is a general legislation to protect lakes and rivers from drainage and dams, a special permit is needed to do measures that affect a lake's hydrology. Nature conservation may not win all cases but there is a fair chance of avoiding disturbance to the hydrology for the most important sites. Lakes can also easily be included in nature reserves due to a low price for land purchase or compensation.

The LIFE Project

The target of this project has been to use different conservation measures in a landscape to achieve good preservation conditions for flora and fauna connected to the western taiga habitat and other natural forests as well as forests affected by forestry. The different measures used in the project were based on surveys of the White-backed woodpecker (carried out before the project period) and landscape planning.

One important measure was to protect sites with western taiga as nature reserves. Western taiga is a priority habitat under the Habitat Directive and found only in Finland and Sweden within the European Community. With reference to the rapid decline of this habitat and the latent threat to remaining sites not having satisfactory legal protection, the inclusion of a representative sample of sites in the Natura 2000 network is urgent.

Other important measures in the project were to restore forest habitats to increase the nature values. This was done by active measures such as removing coniferous trees, killing trees etc, or by passive measures such as avoiding forestry activities in succession habitats like young stands of deciduous forest. These activities were supported by Conservation agreements or by compensations to the landowners for Adapted forestry methods.

Smaller areas (in general smaller than 5 ha) with high nature values or with a strategic position in the landscape, have been conserved as Biotope reserves.

The project is an important step of implementing the Habitats Directive in Sweden as regards the western taiga habitat. The sites are of large importance to the Natura 2000 network, not only due to their high conservation values, but also due to their geographic distribution. All nature reserves except three are situated in parts of the Boreal region where conservation measures have been quite few until now and less than 1% of the forest area is protected as nature reserves.

The support from LIFE is an extremely valuable input for the rapid protection of a selection of western taiga sites. Available Swedish funds are not sufficient for all the forest sites in need of protection. SEPA is always trying to find co-financiers to new nature reserves. However, it is hard to find co-financiers in Sweden. Only a few foundations and local communities take their own initiatives in nature conservation. Every contribution from other funds is important help for protection of western taiga.

By protecting sites as nature reserve, all the threats linked to land-use can be avoided through restrictions in national legislation. But still, air-borne pollution is a latent threat to many habitats in Sweden, especially lakes and rivers but also some forest habitats. The sources of pollution range from local to international. This threat has to be dealt with by other environmental measures.

6. Overall project operation

Organisation

The National Board of Forestry (NBF) and the Swedish Environmental Protection Agency (SEPA) are both responsible for this project. According to the contract, the SEPA should be the co-ordinator for the nature reserve's part of the project. As regards nature reserves, SEPA is responsible for the purchase of land and compensation to landowners. The County Administrations should be responsible for the establishment of the nature reserves, including making management plans. They are also responsible for the fulfilment of the management plan. The County Administrations are also responsible for the arrangements of consultants for valuations and negotiations. SEPA is responsible for taking the initiative to add sites to Natura 2000. SEPA and the Counties have co-operated in suggesting to the government new sites to add to Natura 2000. The project organisation has been working as planned in the contract during the whole project.

Several organisations and authorities have also been involved in the planning and the accomplishment of the project. Initially, a lot of experts from the following organisations were consulted: The Swedish WWF, Södra skogsägarna (The Forest Owners Association), Upplandsstiftelsen (A local organisation for conservation of nature and cultural important environments in Uppland), The Swedish Society for Nature Conservation, The Swedish University of Agricultural Sciences, STORA forest company, The Swedish Threatened Species Unit and the Swedish Ornithologist Society. Besides these organisations, several amateur bird watchers contributed with their knowledge.

Surveys of the White-backed woodpecker and of sites with high nature values have been organised by The Swedish Society for Nature Conservation, the County Forestry Boards and the County Administrations. The County Forestry Boards have been responsible for the landscape planning.

The County Forestry Boards carried out the local work at each landscape with Biotope reserves, Conservation agreements, Adapted forestry agreements and information to the landowners. The County Administration planned and carried out the Nature reserves.

Regular meetings with all people involved in the project were organised. At these meetings all kinds of problems with planning, measures, etc. in each "landscape" (see Chapter 7) were discussed.

Related projects and co-operation with other organisations

The Swedish Society for Nature Conservation

The Swedish Society for Nature Conservation has been working with the White-backed woodpecker for more than 20 years. They initiate surveys every year, inform forest companies, landowners and the public about the species and are at the moment

preparing reintroduction of individuals. Their experts have been involved in many parts of this LIFE project.

STORA skog

STORA is one of the biggest Forest Companies in Sweden. A large part of its properties are located in Värmland and Dalarna, where the White-backed woodpecker used to occur. In order to support the conservation of the woodpecker the company started a White-backed woodpecker project. The company decided to conserve and restore 100 sites, each of 100 ha. These were all managed in order to increase the nature value for the woodpecker. Some of these sites are located within or close to the LIFE landscapes. The co-operation with STORA Forest Company has been very good throughout the project, and their expert was included in the reference group.

Swedish University of Agricultural Sciences

The main research on the species in Sweden has been produced at the University of Agricultural Sciences in Uppsala. The species habitat use, foraging behaviour, food selection, home-range, etc., has been studied by using radio-transmitters, surveys and by direct observations. All researchers with experience of the species and other woodpecker species have been consulted during the project, and some were also included in the reference group.

Budget

The project encountered problems because the relation between the value of the Swedish crown and that of the Ecu which varied considerably during the project period. Therefore, it has been difficult to know the exact amount of resources available. With the exception of nature reserves, Biotope reserves and Conservation agreements, the cost for the project is within the revised budget. The total cost for the National Board of Forestry and the County Forestry Board is 13 697 539 SEK. The proportions of different costs are: Nature reserve 53%, Biotope reserve and Conservation agreements 28%, Adapted forestry 3%, Information 1% and other costs 15% (Fig. 2).

Nature reserves

According to the application the nature reserve part of the project should cost 15 000 000 SEK which was half of the total project budget. The LIFE fund was supposed to co-finance 50% of the cost and SEPA the national contribution. The nature reserve part of the project budget was supposed to only include costs for land purchase and compensation.

When the contract was written more measures that were supposed to be done by the Forestry Board were added, which affected the proportions between cost for nature reserves versus other measures in the budget. The nature reserve part of the budget became 1 545 000 EURO. That is 49.1% of the total budget and LIFE support. The maximum of LIFE support is accordingly 50% of that amount, i.e. 727 000 EURO. The proportion did not change when the budget was revised.

The output of the funds spent in each “landscape” (see Chapter 7) on nature reserves differs a lot from what was planned in the budget. This depends, of course, upon the

changes that have been made concerning the objectives during the project and the fact that more expensive habitats were chosen to be targeted when the contract was written.

The rate EURO/SEK has changed a lot to the beneficiary's disadvantage since the application was written. This has affected the available amount of funds for the project. Support from LIFE has decreased from 15 000 000 SEK, to approximately 13 200 000 SEK which is more than 10% less than applied for. The project has obviously suffered from exchange losses.

When the project was finished, 15 593 500 SEK had been spent on the nature reserve part of the project. That is 593 500 SEK more than applied for and even more than available after the exchange losses. The overspending has entirely been financed by SEPA.

The objective for land purchase/compensation was only fulfilled to approximately 77%. The main reason for the overspending even if only 77% of the area was achieved is the fact that the cost for the nature reserve part of the project has been much higher than estimated in the contract. This depends on the different intentions in the application and the contract. The first intention was to make nature reserves of shore forests and forests on old pastureland that cannot be classified as any habitat in the Habitats Directive. These forests consist very largely of deciduous trees and are cheaper per hectare then western taiga regardless of the feature of deciduous trees in the taiga. When the contract was written, the intention of the project had changed a bit because western taiga as a priority habitat became more important for the project and especially for the nature reserves. The total budget did not change accordingly. The difference in prices per hectare for the different forest types has made the nature reserve part of the project much more expensive than expected. The increased price on pulp and timber during the project has also affected the total cost, but is of minor importance compared with the differing price per hectare depending on the forest type. This is the explanation of why more than all the funds available have been used for approximately 77% only of the total area.

Biotope reserves and Conservation agreements

The total cost for Biotope reserve, Conservation agreements is 8 342 400 SEK. This is the second most expensive part and covers more than 60% of the expenses of the National Board of Forestry. It is about 656 000 SEK more than planned for in the budget.

Adapted forestry

The cost for Adapted forestry is 747 627 SEK, which is about 414 000 less than planned for in the budget. Adapted forestry has often been more difficult than expected to carry out, and the total area of adapted forestry is also less than planned.

Other expenses

Other costs include information to landowners, "landscape" planning and production of maps, seminars, publications, travelling , salaries and overheads. The total cost is 4 458 194 SEK, which is about 484 000 SEK less than calculated in the budget. Of this sum, salaries and overheads cover about 91%.

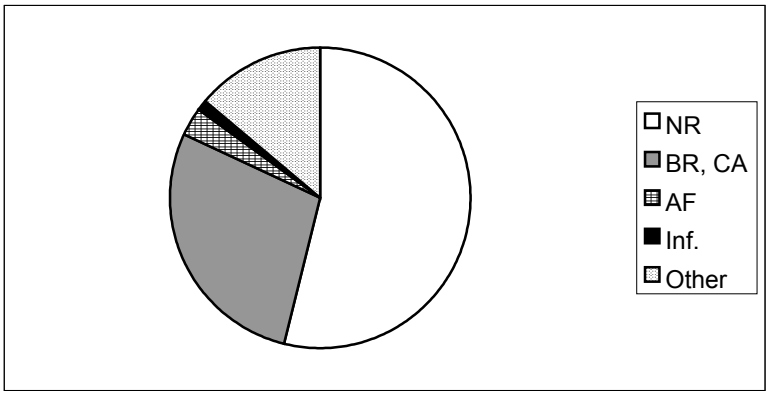

Fig. 2. Proportion of different costs in the project. NR = Nature reserve, BR, CA = Biotope reserve and Conservation agreements, AF = Adapted forestry, Inf. = Information (seminars, brochures and other publications, information to landowners), Other = other costs (salaries, travels, landscape planning, maps, overheads).

7. Objectives and results

This chapter describes the objectives of the project as formulated in the contract, and compares them with our results.

The landscapes

The project has taken place within ten “landscape” areas. The total area of each of the landscapes varies between 1 214-4 089 hectares (Table 2). All the landscapes are situated in the boreal region. Eight of them are parts of a broken chain that stretches along the neighbourhood of “Limes Norrlandicus”, the border between the two sub-regions (hemi-boreal and boreal) in the boreal region. The other two are more remote, both are situated in eastern Sweden, one is further north and the other is further south from “Limes Norrlandicus” (Fig. 1).

The landscapes were chosen for several reasons, the most important being the presence of White-backed woodpecker, or the future possibilities of colonisation. Some of the landscapes are situated in areas of the very highest conservation values, well known for a very diverse flora and fauna with many nationally red-listed species and several of them have FFH (Flora and Fauna habitats in the Habitats and Bird directive) relevance. The landscapes Dalälven, Bokullen and Sommen are good examples of landscapes of such dignity. Others do not have the very highest conservation values but have high values combined with the possibility of being good parts of a network of protected sites suitable for the White-backed woodpecker, for example Hallaren.

Most of the landscapes are situated in areas where forest is the most important ecosystem. Different types of coniferous forests are the most common. Compared with many other landscapes in the boreal part of Sweden, the project landscapes have a large proportion of deciduous trees in many of the coniferous forest stands, and the area of deciduous forest is relatively large. The reasons for this vary among the landscapes. In some cases this is due to natural disturbances by forest fires or flooding, but it can also be a result of a not-to-intensive forestry, or a combination.

Table 2. The location (County and Co-ordinates), number of landowners and terrestrial area of the ten LIFE landscapes

Site No.	Name	County	Co-ordinates	Number of estates	Size (ha)
1	Långbro	Gävleborg	61°30'N, 16°50'O	20	1956
2	Dalälven	Gävleborg-Uppland	60°25'N, 17°15'O	48	4089
3	Hallaren	Västmanland	60°05'N, 16°45'O	51	2148
4	Hemshyttan	Dalarna	60°05'N, 15°40'O	15	1214
5	Örten	Värmland	59°40'N, 13°40'O	7	2349
6	Alken	Värmland	59°45'N, 12°45'O	14	1644
7	Fjornshöjden	Värmland	59°35'N, 12°00'O	12	1861
8	Stora Le	Dalsland	59°05'N, 11°50'O	41	1556
9	Råvarpen	Dalsland	58°50'N, 12°25'O	58	1485
10	Sommen	Östergötland	58°00'N, 15°20'O	23	2600
Total					20902

The Natura 2000 connection

When the project started none of the areas that were part of the project had any Natura 2000 connection. There were no existing SPAs ("Special Protection Areas") or pSCIs ("proposed Site of Community Importance"). According to the contract, all the nature reserves co-financed by LIFE should be both SPAs and proposed SCIs. All other parts co-financed by the LIFE project should be SPA. This Natura 2000 connection should be ready within six months after the project was finished.

Today, most of the sites already fulfil the conditions in the contract, but new governmental decisions will be made during the autumn. Following that, all areas co-financed by LIFE will be 100% SPAs and the nature reserves will be pSCIs as well. Altogether 13 SPAs and 12 pSCIs have been established as a result of the project. The SPAs cover altogether 2 604 ha and the pSCIs 1 267 ha (Table 3). All facts in this report are based upon the situation after such a decision. The project's links with the implementation of the Birds and Habitats Directives is described below (for further details see the part of the report dealing with the sites). The results of the project have been a good contribution of legal protection to several of the sites in the Natura 2000 network.

Table 3. Habitats present in the pSCIs. The pSCIs are all protected as Nature Reserves to 100%. The columns show the total area of pSCI and nature reserve, the protected land area and the land area purchased during the project. The number of landscapes where the habitat is present for the three categories is also shown

Habitats	NUTS*	Total area protected		Protected land area		Purchased land area	
		ha	No.	ha	No.	ha	No.
Oligotrophic waters	3130	19	1	0	0	0	0
Wet Molinia meadows	6410	7	1	7	1	5	1
Eutrophic tall herb meadows	6430	4	1	4	1	0	0
Boreal alluvial meadows	6450	66	1	48	1	0	0
Transition mires	7140	32	3	32	3	11	2
Eutric screes	8120	2	1	2	1	0	0
Western taiga	*9010	602	8	602	8	339	7
Broad-leaved forests rich in epiphytes	*9020	2	1	2	1	2	1
Herb-rich spruce forests	9050	12	2	12	2	7	1
Wooded pastures	9070	4	1	4	1	4	1
Deciduous swamp woods	*9080	25	1	25	1	2	1
Tilio-Acerion ravine forests	*9180	39	1	39	1	39	1
Acidophilus oak woods	9190	11	1	11	1	11	1
Bog woodland	*91D0	18	3	18	3	7	3
Mixed deciduous forest along rivers	91F0	38	1	38	1	0	0
No FFH habitat		386	5	132	5	53	3
Total		1267	9	976	9	480	7
Mean per landscape		127		98		48	
Mean per nature reserve		106		81		40	

Protected habitats present in the pSCIs: The pSCIs proposed as a result of the project cover 1 267 ha. About 70% of the area can be classified as habitats according to the Habitats Directive Annex 1. Altogether forest habitats cover 751 ha, mires 32 ha, lowland grasslands 59 ha, water habitats 19 ha, and geotopes cover 2 ha. Altogether 15 habitats are affected by the project. The most distributed habitats in the project are western taiga (602 ha), alluvial meadows (48 ha), Tilio-Acerion ravine forest (39 ha) and mixed deciduous forest along rivers (38 ha). Western taiga is present in pSCIs in eight of the landscapes. All the other habitats are only present in pSCIs in 1-3 landscapes.

If excluding the water area, which has not raised any costs for the project, it can be seen that 844 hectares or 86% of the land area is covered with habitats listed in the Habitats Directive Annex 1. The remaining 14% mainly contain forest affected by forestry. These areas will be managed in a way that they later will qualify as western taiga.

There are five priority habitats present in the pSCIs: western taiga, broad-leaved forests rich in epiphytes, deciduous swamp woods, tilia-acerion ravine forest and bog woodland. These cover 686 ha, which is a little bit more than the total area of 625 hectares that should be proposed as pSCI due to the contract.

Purchased habitats in the pSCIs: The data for the purchased land area are slightly different. Approximately 89% of the purchased land area, 480 ha, is covered with habitats listed in the Habitats Directive Annex 1. The remaining part that is not classified as habitats mainly contains forest affected by forestry. These areas will be managed in a way that will later qualify them as western taiga.

The priority habitats; western taiga, bog woodland, broad-leaved forests rich in epiphytes, deciduous swamp woods, tilia-acerion ravine forest and bog woodland cover 389 ha or 81% of the affected area.

Altogether, forest habitats cover 459 ha, mire types 11 ha and lowland grasslands 5 ha. The best-distributed habitats in the project are western taiga 339 ha, tilia-acerion ravine forest 39 ha, transition mires 11 ha, and Acidophilus oak woods 11 ha.

Species: There are only a five species listed in the Habitats Directive Annex II present in the pSCIs in the project, three bryophytes and two insects (Table 4). Altogether five species are included, three bryophytes and two insects. Each of the species is only present in one reserve. Altogether there are two reserves containing such species, Bredforsen and Villingeskogen. The latter was affected by land purchase.

Table 4. Species present in the pSCIs. The pSCIs are protected as nature reserves to 100%. The columns show the total area of the pSCI, the protected land area and the purchased land area during the project. The number of landscapes where the species is present for the three categories is also shown. The population size is described as in the database for Natura 2000. The letters A-D correspond to the total population size within the biogeographical region within the country. A = More than 15% of the population is present, B = 2-15% of the population is present, C = 0-2% of the population is present, D = The species is occasionally present. NUTS are codes used in the database for Natura 2000 etc.

Species in the pSCIs		NUTS	Total area protected		Protected land area		Purchased land area	
			Pop. size	No of land-scapes	Pop. Size	No of land-scapes	Pop. size	No of land-scapes
Dicranum viride	*Plant*	*1381*	*C*	*1*	*C*	*1*		
Buxbaumia viridis	*Plant*	*1386*	*C*	*1*	*C*	*1*		
Herzogiella turfacea	*Plant*	*1984*	*C*	*1*	*C*	*1*	*C*	*1*
Dytiscus latissimus	*Inv.*	*1081*	*C*	*1*	*C*	*1*		
Xyletinus tremulicola	*Inv.*	*1928*	*C*	*1*	*C*	*1*		

Birds: The SPAs cover altogether 2 604 ha and there are 21 species present in the area (Table 5). Hazel grouse *(Bonasa bonasia)* and Black woodpecker *(Dryocopus martius)* are present in all the SPAs. Other birds present in many of the landscape SPAs are Capercallie *(Tetrao urogallus)* , Eurasian pygmy owl *(Glaucidium*

passerinum) , White-backed woodpecker *(Dendrocopus leucotos),* Tengmalm's owl *(Aegolius funereus)* and Three-toed woodpecker (*Picoides tridactylius)*. The population size affected by the project is smaller than 2% for all the species except the White-backed woodpecker, 2-15% of the population is present in SPAs in these landscapes. Eighteen of the species are present in the nature reserves protected by the project. Eleven of them are present at the land affected by land purchase as well.

Table 5. Bird species present in the SPAs. The columns show the total area of the pSCI, the land area protected by nature reserve and the land area within the nature reserve purchased during the project. The number of landscapes where the species is present is also shown. The population size is described as in the database for Natura 2000. The letters A-D correspond to the total population size within the biogeographical region within the country. A = More than 15% of the population is present, B = 2-15% of the population is present, C = 0-2% of the population is present, D = The species is occasionally present. NUTS are codes used in the database for Natura 2000 etc.

Bird species in the SPAs	NUTS	Total area		Land area protected as NR		Land area purchased in the NS	
		Pop Size	No.	Pop Size	No.	Pop size	No.
Black-throated diver (Gavia arctica)	*A002*	*C*	*3*	*C*	*1*	-	-
Whooper swan (Cygnus cygnus)	*A038*	*C*	*1*	*C*	*1*	-	-
Honey buzzard (Pernis apivorus)	*A072*	*C*	*4*	*D*	*3*	*C*	*1*
White-tailed sea-eagle (Haliaeetus albicilla)	*A075*	*C*	*1*	*C*	*1*	-	-
Osprey (Pandion haliaetus)	*A094*	*C*	*2*	*C*	*2*	-	-
Hazel grouse (Bonasa bonasia)	*A104*	*C*	*10*	*C*	*8*	*C*	*6*
Capercallie (Tetrao urogallus)	*A108*	*C*	*8*	*C*	*7*	*C*	*4*
Common tern (Sterna hirundo)	*A193*	*C*	*2*	*C*	*1*	-	-
Arctic tern (Sterna paradisaea)	*A194*	*C*	*1*	-	-	-	-
Eagle owl (Bubo bubo)	*A215*	*C*	*2*	*C*	*2*	-	-
Eurasian pygmy owl (Glaucidium passerinum)	*A217*	*C*	*9*	*C*	*7*	*C*	*5*
Ural owl (Strix uralensis)	*A220*	*D*	*1*	-	-	-	-
Tengmalm's owl (Aegolius funereus)	*A223*	*C*	*6*	*C*	*5*	*C*	*2*
European nightjar (Caprimulgus europaeus)	*A224*	*C*	*1*	*C*	*1*	-	-
Grey-headed green woodpecker (Picus canus)	*A234*	*C*	*5*	*C*	*5*	*C*	*3*
Black woodpecker (Dryocopus martius)	*A236*	*C*	*10*	*C*	*9*	*C*	*6*
White-backed woodpecker (Dendrocopus leucotos)	*A239*	*B*	*7*	*B*	*7*	*C*	*3*
Three-toed woodpecker (Picoides tridactylus)	*A241*	*C*	*6*	*C*	*6*	*C*	*4*
Red-breasted flycatcher (Ficedula parva)	*A320*	*C*	*2*	*C*	*2*	*C*	*1*
Red-backed shrike (Lanius collurio)	*A338*	*D*	*1*	-	-	-	-
Black grouse (Tetrao tetrix tetrix)	*A409*	*C*	*6*	*C*	*4*	*C*	*2*

Nature reserves

Establishing nature reserves & management plans

One of the most important objectives with the project was to protect 625 hectares as nature reserves. The sites concerned should be protected as nature reserves with sufficient restrictions and management plans so that their conservation status would be maintained.

When the project was finalised altogether 12 new nature reserves had been established. In general, one reserve per landscape was established. However, in the landscapes of Fjornshöjden, Dalälven and Sommen there are two nature reserves in each landscape. No nature reserve has been established in the landscape Hemshyttan, but an interim reserve has been made and the process of making the site a reserve

continues. The total area of the reserve is 1 247 hectares, containing 976 hectares of land. The mean size for the land area in the nature reserves is 81 ha.

The process of establishing new, or extending old, nature reserves will continue in the near future for the landscapes at Hemshyttan, Dalälven, Fjornshöjden and Stora Le at least.

Land purchase/compensation for the nature reserves

In order to be able to make nature reserves containing western taiga and other forest habitats, SEPA has to buy the area concerned or pay economic compensation to the landowners. Altogether 625 ha should have been bought or paid compensation for by the end of the project. The affected areas should be distributed in all the ten landscapes and contain a larger proportion of priority habitats, have high conservation values, be core areas, be not severely affected by forestry, and must be threatened.

The area objectives for the different landscapes have changed during the project according to results achieved and future possibilities of successful negotiations (Table 6). For the contract and earlier reports, the objectives include both the protected land area and purchased land area. Finally, they have been separated due to results of negotiations. There is no detailed description of all the steps taken during the project concerning the size of the reserves that are described in the table.

Table 6. Changes of the objectives in each landscape during the project. Finally, the objective has been separated into two objectives: protected land area and purchased land area

"Landscape"	Contract	Earlier activity reports Protection and purchase				Final report Protection		Final report Purchase	
		1st	2nd	3rd	4th	Land area in ha	No. of NR	Land Area in ha	No. of NR
Långbro	115	100	100	90	138	135	1	135	1
Dalälven	130	25	90	26	27	263	2	26	1
Villingeskogen	10	30	30	30	30	30	1	30	1
Hemshyttan	100	115	115	94	0	0	0	0	0
Örten	15	10	10	10	10	10	1	0	0
Alken	30	25	25	25	36	40	1	4	1
Fjornshöjden	100	95	100	83	124	224	2	136	2
Stora Le	50	130	20	140	125	122	1	0	0
Råvarp	60	83	83	60	68	83	1	80	1
Sommen	15	40	55	67	67	69	2	69	2
Total	625	653	628	625	625	976	12	480	9

When the project was finished 480 ha had been affected by land purchase/compensation. That is 77% of what should be achieved when the project was ready. These measures have been taken in nine nature reserves distributed in seven of the "landscapes.

The areas affected by land purchase/compensation have a large proportion of suitable habitats, slightly more than 80%. This is less than expected. Many of the large remaining estates that should have been purchased have a larger proportion of priority habitats compared with the estates where the results have been achieved. This would have affected the output (Table 3).

Negotiations will continue for the remaining estates in all nature reserves until all the estates in the reserves are either purchased or compensation has been paid. The negotiations at Hemshyttan will also continue.

Biotope management

How to deal with the biotope management in the reserves should be part of the management plans, but the management itself did not have to take place during the project. Some measures, for example some of the arranged forest fires, will take place many years from now. Restoration measures will take place in some of the reserves. For example, spruce plantations will be cut down and the area left to regenerate naturally. Grasslands will be restored and managed by hay cutting or grazing at Bredforsen. In some management areas that process has already started. Wooded pastures will be grazed continuously.

Public awareness

Information signs concerning regulations, conservation values and the LIFE fund would be available at all the nature reserves. This has been fulfilled.

Public access

Everyone already has access to nature due to the Swedish legislation, no further measures have to be introduced. Eventually some areas might be closed in order to protect bird life, etc. In such a case, restrictions like that would be part of the restrictions for the nature reserve.

The Counties have not included any restriction against public access in the nature reserves except at parts of Bokullen NR. The islands in the lakes are closed to the public during the breeding season. The few expected visitors will not affect bird life in a way that the conservation status will be affected. So public access is ensured.

Public facilities

Convenience for the public visitor should be arranged as part of the management plans, but the fulfilment of the management plans did not have to take place during the project.

For most sites only a few measures will be introduced. For example, all the sites will be demarcated so that everyone can see that there is a nature reserve. Footpaths and small parking lots in some of the areas will also be arranged. In nature reserves that may have more visitors, there might be toilets, arranged picnic sites and parking lots, etc. The need to fulfil the plans will be reviewed after analysing the numbers of visitors at the site and the national funds available. Some measures will only be made

if visitors threaten the conservation status and arrangements like footpaths, etc., will solve such problems.

The work of fulfilling the management plans has started.

Biotope reserve

Definition and strategy

Smaller areas with high nature values have been protected as Biotope Reserves (BR). These areas are not purchased by the government, but they are protected by the Nature Protection Law, §21, and no forestry activities that decrease nature values are allowed. About 20 different habitat types can be protected as biotope reserves. Examples of habitat types that may be of interest here are: Cliffs, primeval-type broad-leaf forests, primeval-type coniferous forests, alder marsh forests and stream gullies.

Biotope protection is an expensive measure. Often these areas with high nature conservation value also are productive, and the economic value of the forest is high. However, both the landowners and the County Forestry Boards generally consider this to be a good method for conservation (Gustafsson et al.1997a).

The strategy is to use biotope reserves for forest areas in a late succession phase. The area should be relatively small, but still contain high nature values, and the nature values should be possible to conserve within this area. Sometimes it is difficult to conserve nature values in small areas. Logging nearby might change the conditions in the reserve. Therefore the position of the reserve might be important, and a combination of Nature reserves, Biotope reserves and Conservation agreements is the optimal solution.

Management

The area is marked by signs, and anyone can visit the area. Normally, nothing is done to make the area more accessible or easier to find. There are no management plans for these areas, but free development without any forestry activities is often the rule.

Results

The total area with habitat protection is 172 ha. However, almost 50% of this is from one landscape, Långbro. If the Långbro area is deleted, the mean area of habitat protection is about 10 ha per landscape. This is a very small proportion, about 0.5%, of each landscape, but probably this area includes a large part of the biodiversity in the landscape (Gustafsson 1997b). The mean area of the Biotope reserves is 4.4 ha.

The Western Taiga habitat is the dominating habitat in the Habitat Protection areas. Western Taiga covers 78% of the protected area. The other protected habitats are: Bog Woodlands 13%, Eutric screes 5%, Residual alluvial forest 2%, Siliceous screes 1%, and Mixed Oak-Ash-Elm forests of major rivers 1%.

Comparison between the contract, the plan and the result

According to the contract, the National Board of Forestry is responsible for establishing Biotope Reserves on 100 ha in the landscapes. The distribution of the

Biotope Reserves was not regulated in the contract, and there is a big variation in area and number of Biotope Reserves in each landscape.

The total area of Biotope Reserves (172.0 ha) is less than the planned area (215.4). The explanation is mainly that the plan was unrealistic compared with the resources in four landscapes: Örten, Alken, Stora Le and Råvarp (Fig. 3, Table 7).

Conservation agreements (Civil rights agreements)

Definition and strategy

Areas with high nature values that do not fit into the present design of the Biotope Reserves or have been protected as Nature Reserves, are given priority for Conservation agreements (CA). Since these agreements are limited in time (maximum 50 years) they are foremost suitable for deciduous successions that naturally convert into coniferous forests. The agreements are given priority for stands where nature values are foremost linked with broad-leaf trees and where disturbances in connection with felling initiate a new succession of broad-leafs. When large parts of the coniferous volume are felled, the broad-leafs are released. The habitat thereby created allows increased sun exposure, which is, for example, favourable for many wood-living insects and thus also the woodpeckers that eat them.

Conservation Agreements are only possible to use when the landowners are interested in nature conservation and are willing to conserve areas without total economic compensation. In general, the payments to the landowners do not compensate them for not using the area in a rational way for timber production. In spite of this, many landowners consider it to be an acceptable measure. Also the County Forestry Boards consider it to be a good and efficient way of conserving biodiversity.

Management

The management of the area is regulated in the contract between the landowner and the County Forestry Board. In many CA-areas in this project some kind of management is necessary, e. g. removal of coniferous trees. Normally this only has to be done on one or a few occasions during the contract period, and the Conservation agreement is therefore often combined with Adapted forestry.

Results

The total area with Conservation agreements is 761 ha. Thus, the mean area is 76.1 ha per landscape. However, the variation is big, from 1.5 ha at Sommen to 161.1 ha at Stora Le. The mean area of the Conservation agreements is 6.1 ha.

Conservation agreements should not only be used in climax habitats such as old growth forest, but also in deciduous-rich successions. Therefore there is a difference in habitat composition between Habitat protection areas and Conservation Agreements. The western taiga habitat dominates with 80%. A relatively large part, 5%, has been identified as “Other habitats”. This is often old pastureland or mixed deciduous forest with single old trees and a lot of dead wood on old pastures. Other habitats are: Residual Alluvial forest 8%, Eutric screes 5%, Siliceous screes 1% and Mixed Oak-Ash-Elm forest of major rivers 1%.

Comparison between the contract, the plan and the result

The total area of Conservation agreements (761 ha) is less than the planned area (1105.7). An unrealistic plan at two landscapes, Stora Le and Råvarp, and difficulties at two other landscapes, Hemshyttan and Sommen, where the landowners did not accept the measure, explain most of this difference. Also at Fjornshöjden, relatively few landowners accepted Conservation agreements. According to the contract, 675 ha should be protected as Conservation agreements (Fig. 3, Table 7).

Adapted forestry

Definition and strategy

Areas with certain natural values and areas where active measures favour certain natural values are given priority for adapted forestry management (AF). Usually these measures concern converting conifer-dominated stands to broad-leaf dominated forests. The landowner then receives compensation for the loss of income this involves and for the more expensive felling. The AF grant is compensation for measures that have already been carried out and does not imply any time-limited protection. Consequently, it is often suitable to use a civil rights agreement, which will protect the values created for a longer period. This is happening already today in several places outside the study areas covered by this project. Other active measures that have been used are burning for nature conservation, creation of dead wood by topping trees or by detonations.

In Sweden, subsidies for adapted forestry (in Swedish NOKÅS) are given for many different types of restorations to increase the value for nature conservation or the cultural heritage. Unfortunately, among the landowners it is not as well known as Habitat protection and Conservation agreements, and has not been used as much as planned. Also in this LIFE project we feel that adapted forestry should have been used more. It is not enough to conserve habitats. There is also an urgent need of restoration. In this LIFE project, adapted forestry has been used for burning, thinning (removing spruce to increase the proportion of deciduous trees and to increase sun exposure), killing trees by use of explosives or girdling, and fencing.

The economic compensation to the landowners is small and generally does not cover the cost. Adapted forestry is therefore only possible when the landowner is interested in nature conservation and willing to work more or less voluntarily to increase the nature value (which often means a decrease in timber production).

Management

Landowners who want to do any forestry activities (thinning, cutting fire-wood etc) that are not regulated in the contract, at sites with Conservation agreements or adapted forestry agreements, are obliged to contact the County Forestry Board. Also after the contract period the landowners have to inform the County Forestry Board about forestry activities at these sites.

Results

The total area with adapted forestry is 251 ha. This measure has been used in all landscapes except Långbro. The area with adapted forestry varies between 0 and 51.7 ha per landscape, and the mean value is 25 ha per landscape. The mean area of sites with Adapted forestry is 5.2 ha.

Adapted forestry has been used on western taiga (85%), residual alluvial forest (1%), Eutric screes (1%) and other habitats (12%). Quite often, adapted forestry is used in combination with Conservation agreements. Totally, 162 ha (63%) of the area with adapted forestry is combined with conservation agreements.

Comparison between the contract, the plan and the result

The total area of adapted forestry (251 ha) is less than planned (408.9 ha). This was the case in most landscapes, but not in Stora Le and Sommen. The reason is mainly little interest from the landowners. Often Habitat protection and Conservation agreements have had higher priority. According to the contract, 475 ha should be restored by adapted forestry (Fig. 3, Table 7).

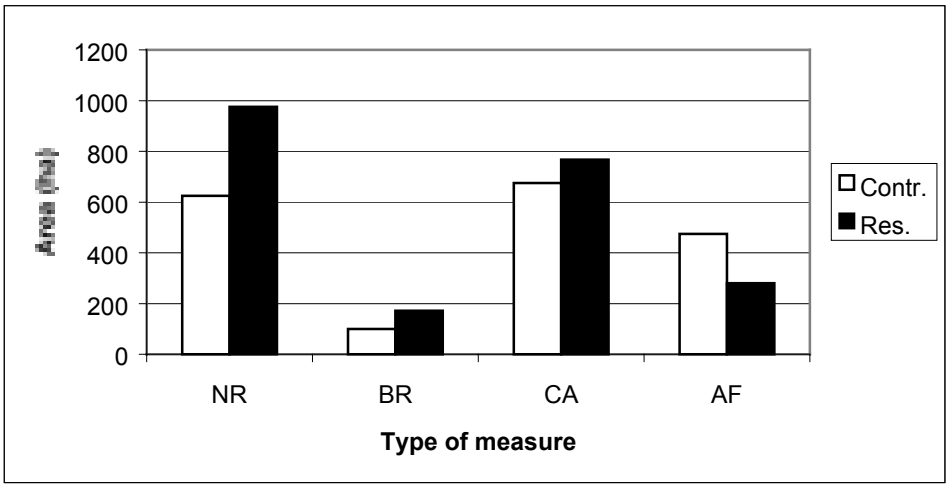

Fig. 3. Comparison between the area of Nature reserve (NR), Biotope reserve (BR), Conservation agreements (CA) and Adapted forestry (AF) in the contract (Contr.) and the resulting area (Res.).

Extension service

Even if the protected area will increase in the future this will probably only cover a small part of the forest area. It is most likely that intensive forestry for timber production will cover most of the area of productive forest in Sweden. In the LIFE woodpecker landscapes, about 90% of the productive area is unprotected. On this area the landowners have to pay general consideration to Nature conservation according to the Forestry Act §30. This includes leaving big and old trees, dead wood, trees with nests and some smaller areas with important habitats, e.g. along streams and lakes. However, this general respect for nature conservation is not enough to protect all species. At some locations, e.g. where specific species occur, more care is needed. The White-backed woodpecker is one example of such species. In the LIFE landscapes, good general care outside the protected sites is necessary. Therefore, advice to the landowners is important. In this LIFE project all landowners have been informed

about the project and about the general care in the forestry that is needed to conserve the White-backed woodpecker. All landowners have received a brochure about the project and they have been invited to meetings to discuss the project and the forestry in the landscape. Some landowners, especially those with forest with high nature values, have been informed on several occasions, and sometimes also on excursions.

Environmentally managed forests

Voluntary conservation by the landowners without any economic compensation is also important. The landowners could conserve areas of productive forest with some nature values as "Environmentally managed forests". This could include both conserving habitats and changing forestry practises, e.g. leaving all deciduous trees or dead wood when cutting the forest. Some sites originally planned as biotope reserves or conservation agreements have been changed to voluntary conservation without economic compensation. The reasons why the landowners accept to conserve these areas vary. Apart from the nature values it might be for aesthetic or cultural values, or to improve the habitat for game species. It might also be that the area is located far away from the farm and of little importance to the owner. Many of these "environmentally managed forests" are documented on maps and will be followed by the County Forestry Board. However, there is no contract between the owner and the authorities, and the owner is allowed to change the land use. In such cases, if the nature values are high, it might be necessary to conserve the area as a biotope reserve or with a Conservation agreement.

The total area of environmentally forest management is about 3 390 ha, which is 16% of the total land area.

Table 7. Area of Nature Reserve (NR), Habitat protection (HP), Conservation Agreements (CA) and Adapted Forestry (AF) at each landscape. The result is compared with the planned area of each measure. In several landscapes (Hallaren, Hemshyttan, Örten, Alken, Fjornshöjden, Stora Le, Råvarp and Sommen) some areas with adapted forestry are located in the same area where Conservation agreements are used. See text below for further description

Site No.	Name	Planned area (ha)					Result (ha)				
		NR	BR	CA	AF	Total	NR	BR	CA	AF	Total
1	Långbro	100	53.9	15.1	7.7	176.7	135	85.5	35.1	0	255.6
2	Dalälven	90	4.8	97.7	64.8	257.3	263	15.5	96.4	6.6	381.5
3	Hallaren	30	4.7	118.4	82.8	235.9	30	8.4	101.7	44.9	185.0
4	Hemshyttan	100	10.3	77.3	25.0	212.6	0	3.8	24.0	0	27.8
5	Örten	10	35.7	113.3	37.4	196.1	10	4.1	92.7	34.9	141.7
6	Alken	30	28.6	95.1	25.4	179.1	40	18.5	108.0	38.3	204.8
7	Fjornshöjden	95	9.5	87.9	79.0	271.4	224	7.1	26.2	16.7	274.0
8	Stora Le	20	36.7	213.8	32.4	302.9	122	10.5	161.1	37.9	331.5
9	Råvarpen	83	23.0	226.8	46.8	379.6	83	12.9	114.3	31.0	241.2
10	Sommen	56	8.2	60.3	7.3	131.3	69	5.8	1.5	16.5	92.8
Total		614	215.4	1105.7	408.9	2344	976	172.1	761	226.8	2135.9

8. Results site by site

Maps of each landscape are not included in this report. However, they can be ordered from the National Board of Forestry, as well as a complete list of all sites with Biotope protection, Conservation agreements and Adapted forestry. Maps of the Nature reserves and all other documents about the nature reserves can be ordered from the County Administrations.

Långbro

General description

The total area of the landscape is 2 026 hectares and the land area is 1 956 ha. It is located in a hilly region in the central part of Gävleborg County, about 20 km from the Baltic Sea. The elevation above the sea is 150-260 m. One lake and two streams are included within the landscape. The bedrock is dominated by gneiss.

The landscape is totally dominated by a forest ecosystem. Lakes and mires are also present in the valley bottoms. Forest fires used to be the normal disturbance regime in the area. The latest fire occurred 1915. The area has a long history of forestry and relatively intensive land use. The forest was used for charcoal and timber production, and cattle have grazed most of the forest area. However, during the 20th century the forestry has been less intensive in some parts of the landscape.

The most common habitats according to the Directive are western taiga, bog woodland and aapa mires. 13 Annex 1 species in the Birds Directive are recorded as present in the landscape area. The White-backed woodpecker does not occur in Långbro, but the area is potentially important. This is mainly due to relatively large amount of dead wood, high proportion of deciduous trees, and a strategic position close to areas where the White-backed woodpecker has been observed. A number of other nationally red-listed species have been recorded, mainly bryophytes, lichens and fungi.

The landscape and the Natura 2000 connection

There is one SPA containing all the sites, protected or co-financed by LIFE during the project. There is also a pSCI, which is demarcated in the same way as the nature reserve (Tables 8, 9).

Table 8. Total area of the habitats in the pSCI at Långbro (SE0630168), and in the protected and purchased land area

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Oligotrophic waters	3130	19	0	0
Transition mires	7140	9	9	9
Western taiga	*9010	123	123	123
Bog woodland	*91D0	3	3	3
Total		154	135	135

*NUTS are codes used in the database for Natura 2000, etc.

Table 9. Bird species occurring in the SPA Långbrosbodarna (SE0630185, 276 ha) and in the protected and in the purchased part of the area

Bird species	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. size	Pop. size	Pop. size
Black-throated diver (Gavia arctica)	*A002*	*C p <= 2%*		
Hazel grouse (Bonasa bonasia)	*A104*	*C p <= 2%*		
Capercallie (Tetrao urogallus)	*A108*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Grey-headed green woodpecker (Picus canus)	*A234*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Black woodpecker (Dryocopus martius)	*A236*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Three-toed woodpecker (Picoides tridactylus)	*A241*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Black grouse (Tetrao tetrix tetrix)	*A409*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*

**NUTS are codes used in the database for Natura 2000, etc. The population size is described as in the database for Natura 2000. The letters A-D correspond to the total population size within the country. A = More than 15% of the population is present, B = 2-15% of the population is present, C = 0-2% of the population is present, D = The species is occasionally present

Långbro Nature Reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's pSCI. The whole nature reserve is also part of a larger SPA. Tables showing the habitats and species and how they relate to the nature reserve can be found in the text above describing the landscape and the Natura 2000 connection.

General description: The site is situated in hilly terrain and consists of a hilltop and the slopes to the north and the south. The site is covered by western taiga but there are also some small transition mires, screes and boulder-rich terrain at the site. Parts of the western taiga have rejuvenated after a forest fire. The site was affected by extensive forestry in the beginning of the 20th century and after that the forest has been left to develop naturally.

The forests differ in composition depending on the water resources and forest history. In the driest parts of the nature reserve, pine dominates the taiga. The individual trees in the pine forest are approximately 200 years old. Taiga dominated by spruce is present in less dry parts of the site. There is also mixed coniferous forest at the site. Parts of the western taiga have a large proportion of deciduous trees, especially aspen.

The site is rich in lichens and bryophytes, especially the forest stands with a large feature of deciduous trees. Rare species present at the site are *Orthotrichum gymnostomum, Collema subnigrescens, Leptogium saturnium, Collema subflaccidum, Microcalicium ahlneri, Phellinus ferrugineofuscus, Phellinus chrysoloma* and *Inonotus oblicuus*. The avifauna is rich in species as regards owls, woodpeckers and other species nesting in holes in the trees.

The establishment of the nature reserve: The establishment of the nature reserve was ready in December 1997. It contains 154 hectares. The land area is 135 hectares (Fig. 4).

Land purchase/compensation: Three areas have been bought during the project and all of them are co-financed by LIFE. Altogether 135 hectares of land has been bought at the cost of 3 180 000 SEK. This includes an old Domän reserve of 7 hectares in the northern part of the site that have been obtained for a small administrative cost.

Biotope management: The management plan prescribes natural development, the habitats will be better off left without human impact.

Public awareness: Information signs have been produced and erected at the site.

Public facilities: A footpath will be arranged in the northern part of the nature reserve.

Biotope reserves, Conservation agreements and Adapted forestry

The work with biotope reserves and conservation agreements was successful. The area achieved (120.6 ha) is almost twice the area planned (69 ha), and the area of biotope reserves is larger than in any other landscape in the project. The cost per ha is higher than planned, but still relatively low (4 706 SEK/ha for Conservation agreements, and 10 979 SEK/ha for Habitat protection). The reason for this is that several landowners accepted Habitat protection and Conservation agreements without economic compensation (Fig. 4, Table 7).

Co-operation with the landowners and individual consultations

The process at Långbro has been relatively slow. The local personnel at the County Forestry Board have spent a lot of time discussing and explaining the project with the landowners. The final result shows that this was a good strategy. The co-operation has been very good.

Environmentally managed forest

Some of the areas, which were planned to be conserved as habitat protection or conservation agreements, will be conserved voluntarily. The total area of voluntary conservation is 167 ha. This includes also some new areas that not were planned to be conserved as biotope reserves or conservation agreements (Fig. 5).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve has changed a lot during the project, depending on existing and future possibilities of results of negotiations. The nature reserve in this landscape has been increased by 20 hectares compared with the contract due to poor results of negotiations in other landscapes. The present LIFE reserve consists of the land area in the Långbro NR, 135 hectares.

There are some changes from the plan: 7 biotope reserves and 7 Conservation agreements have not been accepted by the landowners. Some of these sites were valuable for timber production. Instead, 6 new areas with Habitat protection and 13 new areas with Conservation agreements were achieved. Several other areas have also been enlarged.

Only 7.7 ha of adapted forestry were planned at four sites, but none of these were carried out. The reason is that no landowners were interested. Långbro and Hemshyttan are the only landscapes where adapted forestry not has been used.

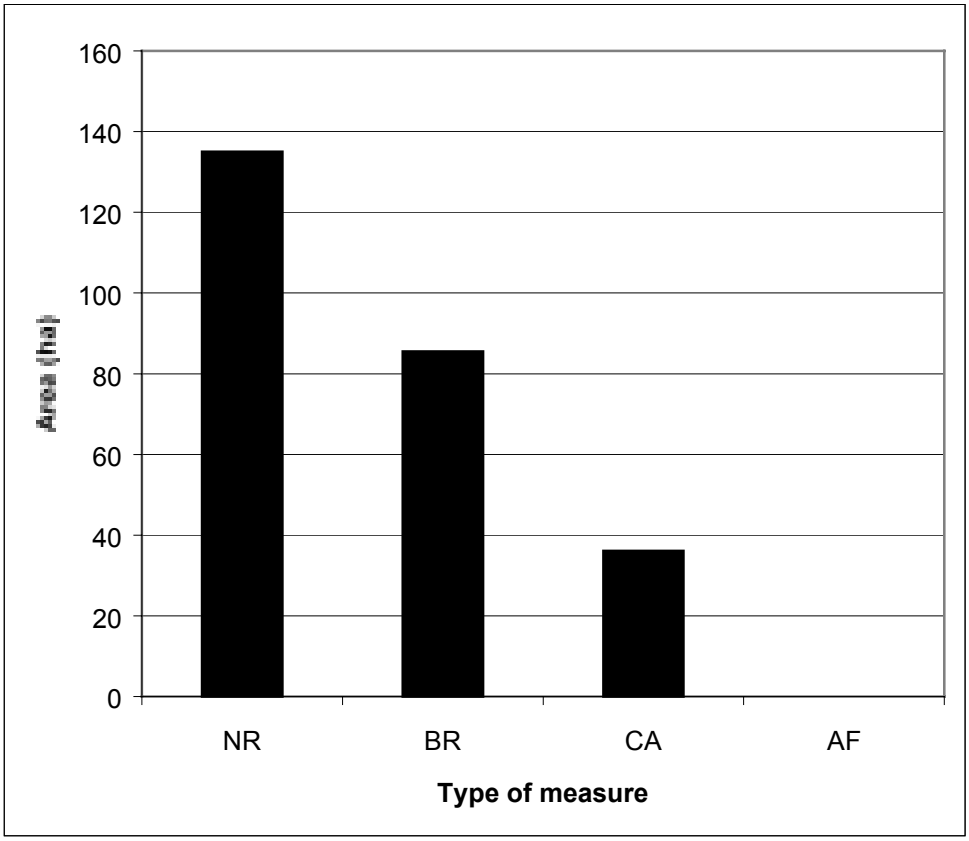

Fig. 4. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Långbro.

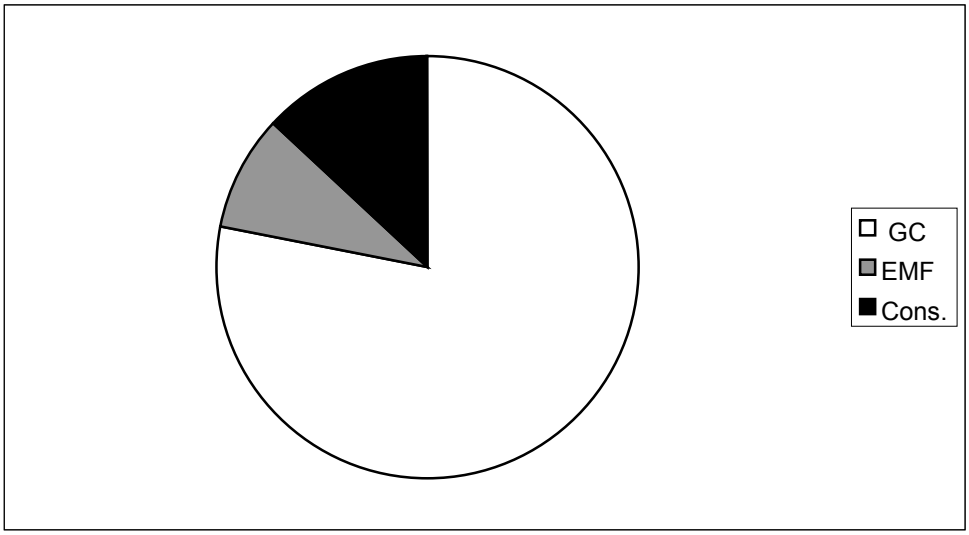

Fig. 5. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Långbro. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Dalälven

General description

The total area of the landscape is 8 454 hectares (3 028 hectares in Uppsala County and 5 426 hectares in Gävleborg County). The total land area is 4 089 (1 364 in Uppsala County and 2 725 in Gävleborg County). The landscape is situated in the eastern part of Sweden at the border between two sub-regions in the boreal region, (the hemiboreal and the boreal). This border is called Limes Norrlandicus and this is the northern limit for the distribution of many species that are common in south Sweden. The oak *Quercus robur* is one example. Along this border there are a large number of endangered species due to the presence of both hemiboreal and boreal species.

The lower parts of the River Dalälven divide the landscapes in two parts. The river forms a mosaic of lakes, islands and streams. The landscape is flat and in former days large areas were flooded every year. Today the river is regulated, but the legal statement about the water flow allows some rapids, and there is no full section of the river that is dry.

Coniferous forests with a large feature of mires cover most of the land in the landscape, but there are also some small villages with arable land. Due to the former large flooding and the recent smaller flooding there are both deciduous forest and coniferous forests with the presence of numerous deciduous trees along the river. The swamp forests along the water contain a large amount of dead wood and have high nature conservation values. There are also open wet and regularly flooded grasslands in the area. Several of them have been managed by hay cutting and grazing in the old agriculture system. The most common habitats are western taiga, bog woodland, residual *Alnus* forest and broad-leaved forest along large rivers. Nowadays most of the forest is intensively used for timber production and on drier land deciduous trees are uncommon due to the use of herbicides in the 1960s and 1970s.

Altogether 18 species in the Annex 1 in the Birds Directive are present in the landscape. The number of Whooper swan *(Cygnus cygnus)* is equal to 1% of the population in the northwestern part of Europe. All woodpecker species in northern Europe have been observed in the area. The area used to be famous for the big population of breeding White-backed woodpeckers. A number of scientific studies have been carried out here, and the area has been surveyed every year and almost all individuals have been mapped. The population has continued to decrease during the last 20 years. In 1998 only 3 females were recorded, and that was the first year with no reproduction of the White-backed woodpecker at Dalälven. However, habitat restoration in this area is important. Migrating birds from the east may find the area again, and active reintroduction of the species by the Swedish Society for Nature Conservation will continue at Dalälven. Other species present includes Otter (*Lutra lutra)* and Lynx (*Lynx lynx)*, both listed in the Habitats Directive, Annex II. More than 70 nationally red-listed species of insects and cryptograms are known to occur in the landscape.

Due to the high conservation values along the Limes Norrlandicus and the River Dalälven there have been several conservation measures earlier. Upstream of the landscape is the national park Färnebofjärden and the nature reserves Jordbärsmuren, Pellesberget and Östa situated. The nature reserve Båtfors is situated down-stream.

The landscape and the Natura 2000 connection

There are two SPAs containing all the sites, protected or co-financed by LIFE during the project, one on each side of the county border. There are also two pSCIs. One for the reserve in Gävleborg County and one containing the reserve and some other land that will be included in the reserve later on, in Uppsala County. They are demarcated in the same way as the nature reserves. Tables showing name, site code, total area, species and habitats for all the Natura 2000 sites are listed below (Tables 10, 11, 12, 13, 14).

Table 10. Total area of the habitats in the pSCI at Bredforsen (SE0630187, Gävleborg County), and in the protected land area and purchased land area

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Wet Molinia meadows	6410	7	7	5
Tall herb meadows	6430	4	4	0
Western taiga	*9010	59	59	10
Wooded pastures	9070	4	4	4
Deciduous swamp woods	*9080	25	25	2
Bog woodland	*91D0	5	5	2
No FFH habitat		78	11	3
Total		182	115	26

*See explanation in Table 8.

Table 11. Total area of the habitats in the pSCI at Bredforsen (SE0210240, Uppsala County), and in the protected land area and purchased land area

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Boreal alluvial meadows	6450	66	48	0
Western taiga	*9010	25	25	0
Deciduous forests of great rivers	91F0	38	38	0
No FFH habitat		221	37	0
Total		350	148	0

*See explanation in Table 9.

Table 12. Species occurring in the pSCI Bredfors (SE0210240, Uppsala County) and in the protected land area and in the purchased part of the land area

Species (Organism group)		NUTS*	Total area protected	Protected land area	Purchased land area
			Pop. Size	Pop. size	Pop. size
Dicranum viride		*1381*	*C p <= 2%*	*C p <= 2%*	-
Buxbaumia viridis		*1386*	*C p <= 2%*	*C p <= 2%*	-
Dytiscus latissimus		*1081*	*C p <= 2%*	*C p <= 2%*	-
Xyletinus tremulicola		*1928*	*C p <= 2%*	*C p <= 2%*	-

*See explanation in Table 9.

Table 13. Bird species occurring in the SPA Hedesunda (SE0630186, 206 ha, Gävleborg County) and in the protected land and in the purchased part of the land area

Bird species in the SPA	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. Size	Pop. Size	Pop. Size
Black-throated diver (Gavia arctica)	*A002*	*C p <= 2%*	-	-
Whooper swan (Cygnus cygnus)	*A038*	*C p <= 2%*	*C p <= 2%*	-
White-tailed sea-eagle (Haliaeetus albicilla)	*A075*	*C p <= 2%*	*C p <= 2%*	-
Osprey (Pandion haliaetus)	*A094*	*C p <= 2%*	*C p <= 2%*	-
Hazel grouse (Bonasa bonasia)	*A104*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Capercallie (Tetrao urogallus)	*A108*	*C p <= 2%*	*C p <= 2%*	-
Common tern (Sterna hirundo)	*A193*	*C p <= 2%*		
Arctic tern (Sterna paradisaea)	*A194*	*C p <= 2%*		
Eurasian pygmy owl (Glaucidium passerinum)	*A217*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Grey-headed green woodpecker (Picus canus)	*A234*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Black woodpecker (Dryocopus martius)	*A236*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
White-backed woodpecker (Dendrocopos leucotos)	*A239*	*B p <= 15%*	*B p <= 15%*	-
Three-toed woodpecker (Picoides tridactylus)	*A241*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Black grouse (Tetrao tetrix tetrix)	*A409*	*C p <= 2%*	*C p <= 2%*	-

*See explanation in Table 9.

Table 14. Bird species occurring in the SPA Untra (SE0210241, 459 ha, Uppsala County) and in the protected land area and in the purchased part of the land area

Bird species in the SPA	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. Size	Pop. size	Pop. Size
Black-throated diver (Gavia arctica)	A002	C p <= 2%	-	-
Whooper swan (Cygnus cygnus)	A038	C p <= 2%	C p <= 2%	-
White-tailed sea-eagle (Haliaeetus albicilla)	A075	C p <= 2%	C p <= 2%	-
Osprey (Pandion haliaetus)	A094	C p <= 2%	C p <= 2%	-
Hazel grouse (Bonasa bonasia)	A104	C p <= 2%	C p <= 2%	-
Capercallie (Tetrao urogallus)	A108	C p <= 2%	C p <= 2%	-
Eurasian pygmy owl (Glaucidium passerinum)	A217	C p <= 2%	C p <= 2%	-
Grey-headed green woodpecker (Picus canus)	A234	C p <= 2%	C p <= 2%	-
Black woodpecker (Dryocopus martius)	A236	C p <= 2%	C p <= 2%	-
White-backed woodpecker (Dendrocopos leucotos)	A239	B p <= 15%	B p <= 15%	-
Three-toed woodpecker (Picoides tridactylus)	A241	C p <= 2%	C p <= 2%	-
Black grouse (Tetrao tetrix tetrix)	A409	C p <= 2%	C p <= 2%	-

*See explanation in Table 9.

Bredforsen Nature Reserve (Gävleborg County) (earlier mentioned as Kåbo Nature reserve)

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's pSCI in Gävleborg County. The whole nature reserve is also part of a larger SPA. In the text describing the landscape and the Natura 2000 connection above, there are tables showing the habitats and species and how they relate to the nature reserve. The reserve's buffer zone does not include any habitats according to the Habitats Directive.

General description: The nature reserve is situated in Gävleborg County. Its eastern limit borders the nature reserve in the neighbouring county. The nature reserve includes part of the River Dalälven, some islands and the area closest to the shoreline. The land area consists of forests, wetlands and grasslands.

The forests are of many different kinds. There are natural forests dominated either by coniferous or deciduous trees. Mixed forests are also common. Some deciduous trees, for example *Quercus, Tilia, Fraxinus* and *Ulmus* that are uncommon so far north in Sweden, are present in some of the forest stands. The river floods several of the forest stands during periods of high water, for example during spring. Some forest stands are grazed. There are numerous dead and dying trees. The flora and fauna connected with the forests are rich in species. Approximately 100 species that are nationally red-listed are present in the area. The organism groups of large interest for nature conservation are bryophytes, lichens, birds and insects. There are also managed forest stands, without conservation values, in the area.

In low-lying areas along the shores, wet grasslands are situated. Several of these grasslands have been used for hay production, but during recent decades this

traditional management has ended. The lack of management and the unnatural water regime have affected negatively the grasslands. Many of the grasslands have already, or are starting to, become to woodlands or shrublands. Northwest of Kågbosundet, there is an area where grazing has been reintroduced. The area includes different grazed habitats.

The river itself has been dammed upstream of the reserve for some decades. The dam has decreased the conservation values of the river, for example the populations of *Salmo trutta* and *Thymallus thymallus* have decreased. Today, fish have been re-introduced in the area. The legal assessment by the Water Court allows a small water flow during the whole year and there are some rapids in the reserve.

The establishment of the nature reserve: A nature reserve was established in March 1999. The nature reserve's total area is 182 hectares. The land area of the reserve is 115 hectares. The reserve is divided into a core area and a buffer zone. The core area has restrictions that are optimal for nature conservation. Ordinary forestry with general care is allowed in the buffer zone, 11 hectares. The nature reserve will be extended in the near future.

Land purchase/compensation: Some small estates have been bought during the project. Altogether, 26 hectares of land have been bought for 599 000 SEK. All the co-financed estates are situated in the core area. Negotiations will continue for the remaining estates.

Biotope management: The management plan prescribes that the flooded and natural forest will be left to develop naturally. In some of the forest stands some active management will take place. The management will include cutting away invading spruce and helping the deciduous trees with a more southern distribution to remain in the area. In the buffer zone, ordinary forestry with general silviculture will take place.

An area northwest of Kågbosundet has been restored to pastureland, and grazing will continue regularly. If possible due to economic and practical reasons, restoration of grasslands will take place at the island Runön. The County Administrative Board will try to introduce a new legal assessment concerning an increased minimum water flow and restoration of the natural fish fauna.

Public awareness: Two information signs will be put at the main entries to the reserve.

Public facilities: A long footpath already passes through the reserve. No other measures are planned.

Bredforsens Nature Reserve (Uppsala County)

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's pSCI in Uppsala County. The whole nature reserve is also part of a larger SPA. The text about the landscape and the Natura 2000 connection above, includes tables showing the habitats and species and how they relate to the nature reserve.

General description: The nature reserve is situated in Uppsala County. Its western limit borders the nature reserve in the neighbouring county. The site is very similar to the bordering site. The nature reserve includes part of the River Dalälven, some islands and the area closest to the shoreline. The land area consists of a mosaic of forests, wetlands and grasslands.

The forests are of many different kinds. There are natural forests dominated either by coniferous or deciduous trees. Mixed forests are also common. Some deciduous trees for example oak *Quercus*,lime *Tilia* ,ash *Fraxinus* and elm *Ulmus* that are uncommon so far north in Sweden are present in some of the forest stands. The river floods several of the forest stands during periods of high water, for example during spring. Some forest stands are grazed. The amount of dead and dying trees is large. There are also managed forest stands, without conservation values, in the area.

The flora and fauna connected with the forests are rich in nationally red-listed species. The organism groups of large interest for nature conservation are bryophytes, lichens, birds and insects. There are approximately 100 species that are nationally red-listed present in the area. For example there are *Ceruchus chrysomelinus, Dicranum viride, Pholiota squarrosoides* and *Dimarella lutea* present at the site. Some of these species are listed in the Birds- and Habitats Directives.

In low-lying areas along the shores are wet grasslands situated. Several of these grasslands have been used for hay production, but during recent decades this traditional management has ended. The lack of management and the unnatural water regime have affected the grasslands negatively. Many of the grasslands have already or are on the way to turn into woodlands or shrubs. A summer farm (i.e. a shieling) had once been established here, it has now been abandoned for many years and no buildings remain.

The river itself has been dammed upstream of the reserve for some decades. The dam has decreased the conservation values of the river, for example the populations of *Salmo trutta* and *Thymallus thymallus* have decreased. Today, fish are being reintroduced in the area. The legal assessment by the water court allows a small water flow during the whole year and there are some rapids in the reserve.

The nature reserve: The nature reserve has been established. It covers 320 hectares. The LIFE part of the reserve is 148 hectares and is the same as the land area. The nature reserve will be extended in the near future and will then consist of 350 hectares.

Land purchase/compensation: There has not been any land purchase yet, but negotiations continue. The future possibilities are either an agreement according to results of negotiations or a fixed price by a court after legal negotiations. The Foundation Upplandsstiftelsen will probably help SEPA to co-finance the land purchase. In such a case, the Foundation might become the landowner.

Biotope management: Most of the nature reserve will be left to develop naturally. Forest stands that are affected by forestry will be partly cut and then burned or cleared with favouring of deciduous trees. Stumps will also be made in order to create more dead wood. In areas suffering from the lack of flooding, spruce will be cut away regularly. The management plan prescribes that wet meadows along the river shall

remain as meadows. The best management would be early hay cutting and grazing, but more irregular clearings may also suffice. Young deciduous trees will be cut around old former solitary trees.

Public awareness: An information sign has been placed at the main entry to the reserve.

Public facilities: A small parking lot will be made at Bockholmen. There are already three sites for boats. No toilets and paper bins, etc., are planned.

Biotope reserves, Conservation agreements and Adapted forestry

The total area of Biotope reserve, Conservation agreements and Adapted forestry is 117.8 ha (Fig. 6).

Examples of adapted forestry in the area include burning, thinning near big oaks and removal of spruce in young forest to increase the proportion of deciduous trees.

Co-operation with the landowners and individual consultations

This landscape is divided into two parts, which are located in different counties and with different composition of landowners. In the western part, which is located in Gävleborg County, there are several private landowners, each with small forest areas. In the eastern part, which is located in Uppsala County, one big company owns most of the area. It was more difficult for the private landowners to accept our suggestions and several of our proposed measures were not possible to carry out.

Environmentally managed forest

In Gävleborg County no area will be conserved voluntarily or used by environmentally managed forestry. However, in Uppsala County about 965 ha will be used by environmentally managed forestry. This is the largest area of all landscapes (Fig. 7).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve have changed considerably during the project, depending on existing and future possibilities of results of negotiations. Initially, it was only thought that there should be one nature reserve in this landscape affected by the LIFE project. But due to lacking results of negotiations in some of the other landscapes it was decided that both nature reserves should be part of the project. Compared with the contract, the land area affected by the project has been increased by 133 hectares. The present LIFE reserves consist of the land area in the two Bredforsen nature reserves, altogether 263 hectares.

The total area of BR, CA and AF is 48.8 ha smaller than planned (Table 7). This is mainly explained by decreased area of AF (-58.2 ha). The area of adapted forestry is, both in Gävleborg and in Uppsala, less than planned. However, the area of BR increased (+10.7 ha). There is an obvious difference between the two counties in the result. In Gävleborg the total area is smaller, while in Uppsala the total area is larger than planned. It takes long time to negotiate with many landowners who own small areas of forest, and the economic value of the forest is often very important to this type of landowner.

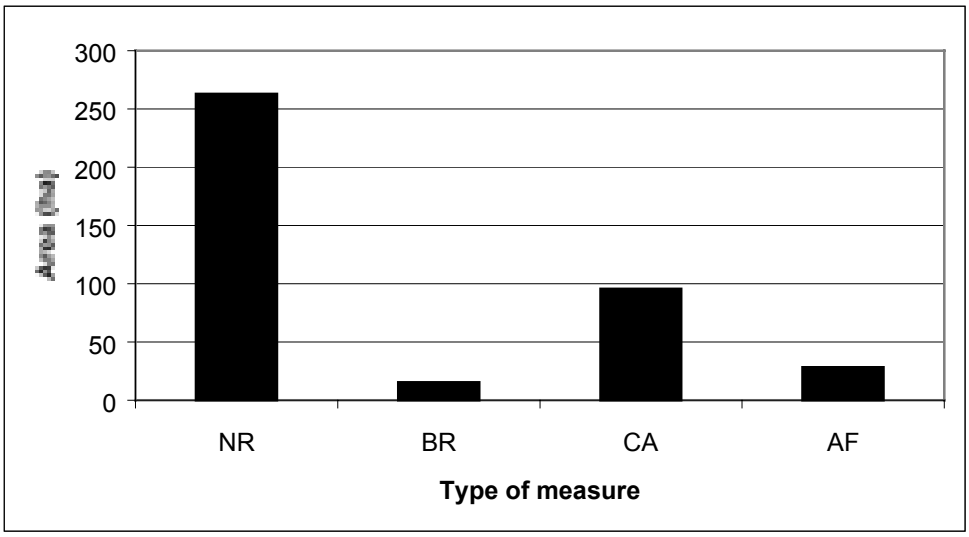

Fig. 6. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Dalälven.

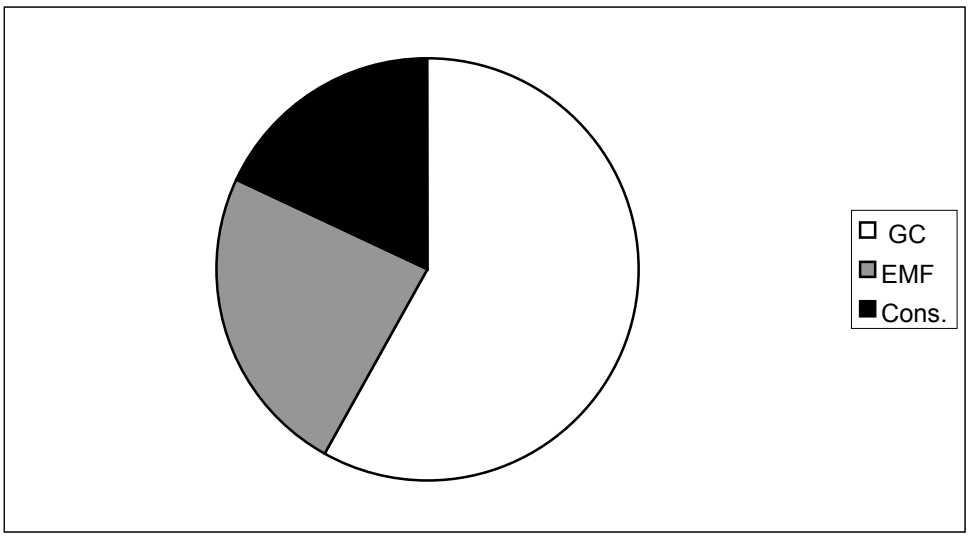

Fig. 7. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Dalälven. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Hallaren

General description

The landscape covers 2 710 hectares, of which the land area is 2 148 hectares. It is situated on the plains in the very northern hemiboreal part of eastern Sweden close to the lower parts of the River Dalälven. In this part of the country Dalälven is said to be the border between two sub-regions in the boreal region (the hemiboreal and the boreal). This border is called Limes Norrlandicus and this is the northern limit for the distribution of many species that are common in south Sweden. The oak *Quercus robur* is one example. Along this border there are numerous endangered species due to the presence of both hemiboreal and boreal species.

The bedrock is dominated by gneiss, but there are also some parts with more nutrient-rich bedrock and soils. The topography is flat except a small ridge close to the eastern shore of the large Lake Hallaren, which is situated in the centre of the area. The landscape is a mixture of forests, mires, lakes and arable land. Coniferous trees dominate the forests. Parts of the landscape have lost the natural feature of deciduous trees due to the use of herbicides in the 1960s and 1970s. The most common habitats are western taiga, bog woodland and residual Alder (*Alnus)* forest.

Altogether 22 species in the Annex 1 in the Birds Directive are present in the landscape. Interesting species in addition to those present in the SPA are White-tailed sea-eagle (*Halieetus albicilla)*, Ural owl *(Strix uralensis)* , Eurasian bittern *(Botaurus stellaris)*, Three-toed woodpecker *(Picoides tridactylus)* and Lesser spotted woodpecker *(Dendrocopos minor),* which occur regularly in the landscape. There are suitable areas for the White-backed woodpecker but it has not been breeding here for the last two decades. Even if breeding has stopped the Hallaren area is important for foraging for the woodpeckers in the national park close by and as a potential breeding area. Visiting specimens has been observed on a few occasions. A number of nationally red-listed species of insects, lichens and bryophytes have been found.

Due to the high conservation values along the Limes Norrlandicus and the River Dalälven there have been several conservation measures earlier. To the north of the reserve is the national park Färnebofjärden. There is also a small nature reserve to the west of the landscape.

The landscape and the Natura 2000 connection

There is one SPA containing all the sites, protected or co-financed by LIFE during the project. There is also a pSCI, which is demarcated in the same way as the nature reserve. Tables showing name, site code, total area, species and habitats for all the "Natura 2000" sites are shown below (Tables 15, 16, 17).

Table 15. Total area of the habitats in the pSCI at Villingeskogen (SE0250111) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Western taiga	*9010	30	30	30
Total		30	30	30

*See explanation in Table 8.

Table 16. Species occurring in the pSCI Villingeskogen (SE0250111) and in the protected and purchased part of the land area

Species (Organism group)		NUTS*	Total area protected	Protected land area	Purchased land area
			Pop. Size	Pop. Size	Pop. size
Herzogiella turfacea		*1984*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*

*See explanation in Table 9.

Table 17. Bird species occurring in the SPA Hallaren (SE0250171, 192 ha) and in the protected and purchased part of the land area

Bird species	NUTS*	Total area	Land area protected as NR	Land area purchased
		Pop. Size	Pop. size	Pop. size
Hazel grouse (Bonasa bonasia)	*A104*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Capercallie (Tetrao urogallus)	*A108*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Eurasian pygmy owl *(Glaucidium passerinum)*	A217	C p <= 2%	C p <= 2%	C p <= 2%
Tengmalm's owl (Aegolius funereus)	*A223*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Black woodpecker (Dryocopus martius)	*A236*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*
Black grouse (Tetrao tetrix tetrix)	*A409*	*C p <= 2%*	*C p <= 2%*	*C p <= 2%*

*See explanation in Table 9.

Villingeskogens Nature Reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's pSCI. The whole nature reserve is also part of a larger SPA. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The nature reserve consists of western taiga dominated by spruce. In parts of the reserve aspen is a common feature. The site is situated in a plain area that is poorly naturally drained. There are some springs at the site. Consequently, parts of the site consists of wet forest stands. The flora in the wet part of the forest contains, for example, *Chrysosplenium alternifolium*, *Cardamine amara*, *Carex loliacea* and *Carex disperma*. There are several species of bryophytes and lichens present at the site that are uncommon or rare, for example; *Anastrophyllum hellerianum, Cephalozia catenulata, Herzegiella turfacea, Collema subnigrescens* and *Anthrodia pulvinascens*.

The NR and the Natura 2000 connection: The area in the nature reserve is both an SPA and a pSCI. Tables showing the present habitats and species that are represented in the reserve are given above.

The establishment of the nature reserve: The nature reserve is established and covers 30 hectares.

Land purchase/compensation: The land purchase is ready and one area of 30 hectares has been bought for 1 755 000 SEK.

Biotope management: There will not be any active biotope management, the site will be better off if left for natural development.

Public awareness: An information sign has been placed at the main entry to the reserve.

Public facilities: Cars can be parked along a road close to the reserve. No measures for increasing the facilities will be taken.

Biotope reserves, Conservation agreements and Adapted forestry

The work at Hallaren has been very successful and it has been one of the best landscapes concerning the area of BR, CA and AF. The total area of BR, CA and AF is 155.0 ha. There are also several sites with protection or agreements that not are co-financed with the LIFE fund. If we include these areas, the total area of BR, CA and AF is 188.6 ha. The area of AF is larger than in any other of the landscapes (Fig. 8).

At Hallaren, as well as several other landscapes, Conservation agreements and Adapted forestry has been combined at several sites. Therefore the total area targeted for action is less. If we remove the area with adapted forestry, where it is combined with Conservation agreements, the total area will be 117.1 ha. Adapted forestry is often some kind of restoration, which is done to increase the nature values. By combining this with a Conservation agreement the restored area will be conserved for 50 years.

Examples of adapted forestry at Hallaren include burning and increasing the proportion of deciduous trees by removing spruce.

Co-operation with the landowners and individual consultations

In general, the landowners at Hallaren have been positive to our conservation suggestions, and it has been easy to co-operate.

Environmentally managed forest

There are several examples of voluntary conservation at Hallaren. The total area of such sites is 366 ha (Fig. 9).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve were increased in the first activity report and have been stable since then. Compared with the contract the nature reserve in this landscape has been increased by 20 hectares. This was done since it was obvious after the first investigations that the reserve would buy either 30 hectares or none at all, as there was only one landowner at the site. The present LIFE reserve consists of the land area, 30 hectares, in the Villingeskogen NR.

Several sites targeted for action have been deleted, and replaced by others. In some cases, areas with higher nature values have been found, and it is possible that the final result is even better than the original plan.

The total area of BR, CA and AF is 50.9 ha less than planned in the second report (Table 7). Both the area of Conservation agreements and Adapted forestry are smaller than planned, while the area of Biotope reserve is larger. The reason why the area is smaller than planned is that the plan was too optimistic concerning the time available for negotiations, etc. Several new high priority sites have been found during the work. These have replaced sites with lower value, or where the landowners not are interested in any measures.

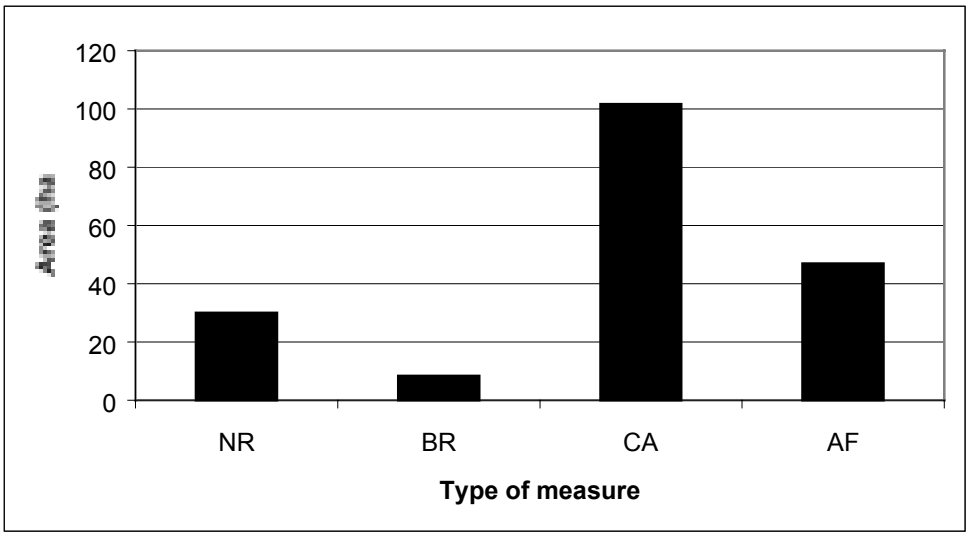

Fig. 8. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Hallaren.

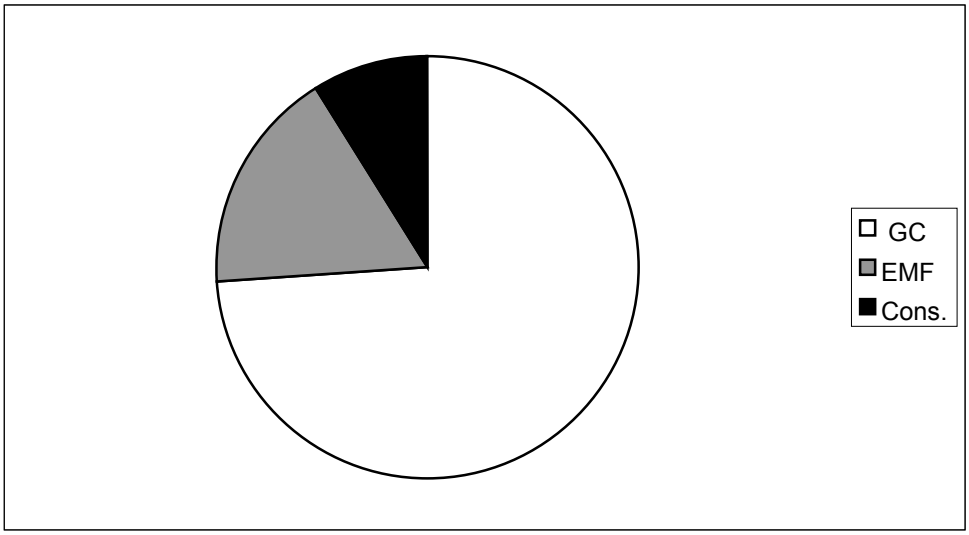

Fig. 9. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Hallaren. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Hemshyttan

General description

The landscape is 1 408 hectares and the land area is 1 214 hectares. Hemshyttan is located in the southern part of Dalarna County. This is a central part in Bergslagen, an area dominated by mining activities for several hundred years. Some of the oldest known mines are located in the landscape. The mining activities required a lot of wood, and the forests near the mines are seriously affected. However, at Hemshyttan

most of the mines have been closed for a long time and the forestry has been less intensive.

The landscape is characterised by a broken hilly terrain. There are about 10 lakes, several streams, many bogs, and a number of woodland key habitats present. Coniferous forests are the most common and the feature of deciduous trees is quite large in some forest stands. There are also some small villages with arable land. The most common habitat is western taiga, bog woodlands, residual alluvial forest and Tilio-Acerion ravine forests.

Thirteen Annex 1 species in the Birds Directive are recorded as present in the landscape area.
The White-backed woodpecker is not known from the area. However, the species has been observed quite close to the landscape. Totally, 8 nationally red-listed plants have been recorded, but no regular survey of the area has been made and the number of nationally red-listed animals and plants is probably higher.

The landscape and the Natura 2000 connection

There is one SPA containing all the sites, co-financed by LIFE during the project. There is no pSCI in the landscape. See Table 18 for name, site code, total area and species for the SPA. Since no nature reserve has been established, there are no facts about this for this SPA as there were for the others.

Table 18. Bird species occurring in the SPA Hemshyttan (SE0620211, 28 ha) and in the protected and purchased part of the land area

Species	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. Size	Pop. size	Pop. size
Hazel grouse (Bonasa bonasia)	*A104*	*C p <= 2%*	-	-
Eurasian pygmy owl (Glaucidium passerinum)	*A217*	*C p <= 2%*	-	-
Black woodpecker (Dryocopus martius)	*A236*	*C p <= 2%*	-	-
Black grouse (Tetrao tetrix tetrix)	*A409*	*C p <= 2%*	-	-

*See explanation in Table 9.

Hemshyttan future Nature Reserve

It was first planned that an area in the landscape should become a nature reserve during the project. This objective has failed and SEPA suggested in the latest activity report that the site should be excluded from the project. Therefore, there is no detailed information about the site.

No nature reserve has been established or any land purchase made for a future nature reserve. An interim nature reserve was established in late 1997 to stop cuttings during the negotiations. The County and the landowners are now negotiating about a smaller reserve. The area that was supposed to become a nature reserve has either become a SPA or a pSCI.

Biotope reserves, Conservation agreements and Adapted forestry

The total area with BR and CA is 27.8 ha. Adapted forestry was not used in this landscape. Among all landscapes, Hemshyttan has the smallest area of Biotope Reserve (Fig. 10).

Co-operation with the landowners and individual consultations

Early in this process it was obvious that nature conservation at Hemshyttan would be difficult. Few landowners were interested in any measures to conserve or restore nature values. However, the landscape contains high nature values and it was important to continue.

Environmentally managed forest

Many sites with high nature values at Hemshyttan will be conserved voluntarily. However, there are no guarantees that this will apply forever. Especially when there is a change of landowners the area may be logged. Therefore, it is important to continue to follow the situation in the area. The total area with environmentally managed forest is 121 ha (Fig. 11).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve have changed considerably during the project, depending on existing and future possibilities of results of hard negotiations. Since there have not been any results there will not be any nature reserve in the project for this landscape. The site size objective been deceased from 100 hectares to zero.

Several sites targeted for actions have been deleted. The total area with BR and CA is 27.8 ha, which should be compared with the planned area of 87.6 ha in the second report (Table 7). This means that 32% of the area planned for these actions has been carried out. All sites where Biotope reserves were planned have been deleted due to problems with negotiations. However, one new site with high nature values has been registered as a Biotope reserve. In the 2nd report Adapted forestry was planned on 25 ha, and later on 29.4 ha was planned for conservation burning. However, due to several factors (e.g. unsuitable weather conditions) it was not possible to carry out this burning during the project period.

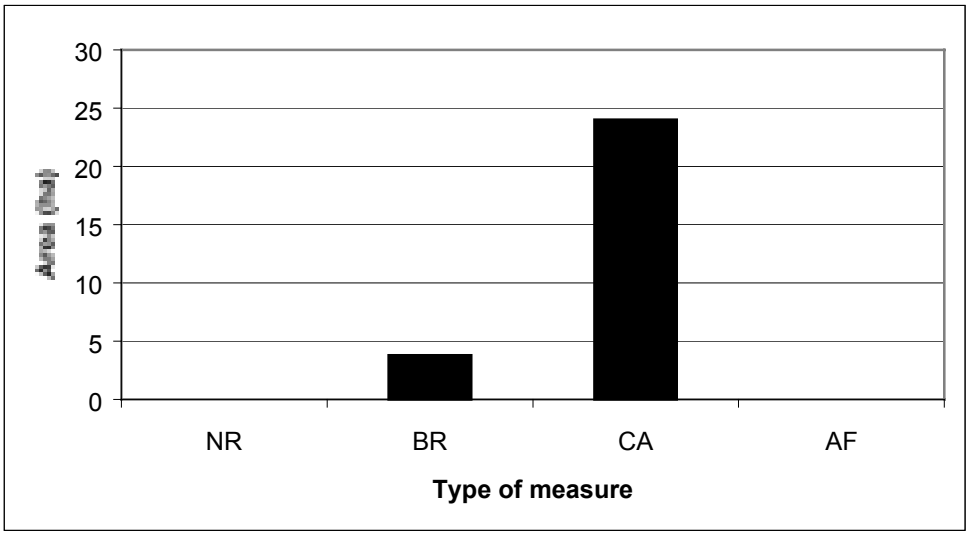

Fig. 10. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Hemshyttan.

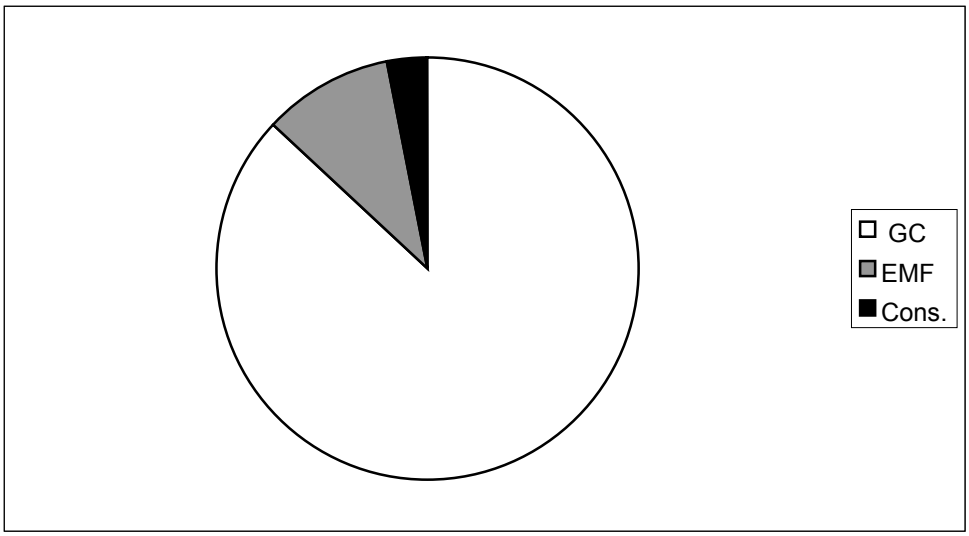

Fig. 11. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Hemshyttan. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Örten

General description

The landscape is 2 814 hectares and the land area is 2 349 hectares. It is located in the south-central part of Värmland County. The Örten area is characterised by a broken hilly terrain in a landscape dominated by two lakes, Västra Örten and Östra Örten. The lakes are surrounded by steeply rising hills with precipices, many of them with numerous boulders at the bottom. The difference in altitude between the lake and the crests of the highest hills is 100 metres. Most of the landscape is situated above the highest marine limit. The warm local climate and the hyperite diabase bedrock that gives rise to nutrient-rich soils, contribute to good conditions for the flora and fauna.

Coniferous forests cover most of the hills. Natural forest fires have affected the forest stands repeatedly during former centuries, which has made the feature of deciduous trees quite large. The most valuable sites for nature conservation are to be found in hyperite diabase precipices and steep slopes with naturally regenerated and deciduous forests. Fire refuges, such as marshy areas, small areas of wet forests or forested habitat "islands" in mires, are quite common. Lakes and mires are situated in small valley bottoms. There are also some small villages with arable land in the area.

The area has a history of intensive forestry. However, it is dominated by several private landowners each with a small forest area, which increases the variation in the landscape. Old forest (>100 year) is very rare. The young forest (<60 years) includes a large proportion of deciduous trees, mainly birch, but also aspen, sallow, and more rarely lime, maple and ash.

The most common habitats according to the Directive are western taiga, Tilio-Acerion ravine forests, bog woodland and residual Alnus forests. Ten Annex 1 species in the Birds Directive are recorded as present in the landscape area. The landscape Örten is an important area for the White-backed woodpecker. Within 15 km from the Örten area 7 pairs have been found breeding regularly. One of these pairs is located in the southern part of the Örten landscape. Individuals of the White-backed woodpecker have occasionally been observed foraging in other parts of the landscape.

The landscape and the Natura 2000 connection

There is one SPA containing all the sites, protected or co-financed by LIFE during the project. There is also a pSCI, which is demarcated in the same way as the nature reserve. No species listed in the Habitats Directives Annex II are present (Tables 19, 20).

Table 19. Total area of the habitats in the pSCI at Råglandaberget (SE0610146) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Eutric screes	8120	2	2	0
Herb-rich spruce forests	9050	5	5	0
No FFH habitat		3	3	0
Total		10	10	0

*See explanation in Table 8.

Table 20. Bird species occurring in the SPA Örten (SE0610151, 127 ha) and in the protected and purchased part of the land area

Bird species in the SPA	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. size	Pop. size	Pop. Size
Honey buzzard (Pernis apivorus)	*A072*	*D*	*D*	-
Osprey (Pandion haliaetus)	*A094*	*D*	*D*	-
Hazel grouse (Bonasa bonasia)	*A104*	*D*	*D*	-
Capercallie (Tetrao urogallus)	*A108*	*D*	*D*	-
Eagle owl (Bubo bubo)	*A215*	*D*	*D*	-
Eurasian pygmy owl (Glaucidium passerinum)	*A217*	*D*	*D*	-
Tengmalm's owl (Aegolius funereus)	*A223*	*D*	*D*	-
Grey-headed green woodpecker (Picus canus)	*A234*	*D*	*D*	-
Black woodpecker (Dryocopus martius)	*A236*	*D*	*D*	-
White-backed woodpecker (Dendrocopos leucotos)	*A239*	*B p <= 15%*	*D*	-
Three-toed woodpecker (Picoides tridactylus)	*A241*	*D*	*D*	-
Red-breasted flycatcher (Ficedula parva)	*A320*	*D*	*D*	-

*See explanation in Table 9.

Råglandaberget Nature Reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's pSCI. The whole nature reserve is also part of a larger SPA. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The site consists of a slope towards the northwest on a small hill. The bedrock consists of hyperite diabase, which gives rise to nutrient-rich soils at the site. At the top of the hill a pine forest is situated. Below this forest is a steep scree and further down a boulder-rich area with a sparse forest. At the bottom of the slope is a herb-rich spruce forest with quite large features of pine, birch and aspen. Hazel is common in parts of the site and deciduous trees with a more southerly distribution in Sweden are also present. An Alnus forest is situated close to the road in the western part of the site.

Due to the rich soils the flora is rich. Species like *Daphne mezereum, Actea spicata, Lathyrus vernus, Lathyrus niger, Astragalus glycyphyllos, Chimaphila umbellata, Asplenium trichomanes* and *Woodsia ilvensis,* for example, are present in the reserve. Lichens and bryophytes include some uncommon and rare species like *Anastrophyllum hellerianum* and *Collema subnigrescens*. The avifauna, dependent on natural forest, is rich in species. At least four different species of woodpeckers, for example, are present. *Black grouse (Tetrao tetrix tetrix)* is present at the top of the hill and Red-breasted flycatcher *(Ficedula parva)* and Nutcracker *(Nucifraga caryocatactes)* are present in the part with numerous deciduous trees.

The nature reserve: The nature reserve is established and covers 10 hectares.

Land purchase/compensation: It has not been possible to reach an agreement with the landowner during the project, due to different opinions about the value of the estate. There have also been unsuccessful discussions about a land exchange. The future possibilities are either an agreement according to results of negotiations or a fixed price established by a court of law.

Biotope management: The reserve will be left to develop naturally. No biotope management is planned.

Public awareness: An information sign is located at the entry to the reserve. A small folder about the nature reserve will be made.

Public facilities: Parking will be arranged at a farm close to the reserve.

Biotope reserves, Conservation agreements and Adapted forestry

The total area of BR, CA and AF is 131.7 ha. At Örten a relatively large area has been used for adapted forestry. The most important activity has been removing spruce to increase the proportion of deciduous trees. No burning has been carried out at Örten. Several areas with Adapted forestry are combined with Conservation agreements and the total area targeted for inputs is therefore 96.8 ha (Fig. 12).

Co-operation with the landowners and individual consultations

Most of the landowners at Örten were interested and showed a positive reaction to our proposals. Therefore the process at Örten was relatively fast. It will probably be possible to continue with conservation projects in the area.

Environmentally managed forest

The landowners at Örten will conserve 405 ha of forest without economic compensation (Fig. 13).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve have been slightly decreased during the project. Compared with the contract, the nature reserve in this landscape has been decreased by 5 hectares. The present LIFE reserve consists of the land area in the Råglandaberget NR, 10 hectares.

The main difference between the plan and the result at Örten is explained by one relatively large area (20.3 ha) proposed as a biotope reserve. This area was deleted due to lower nature values than expected. Besides this, there are small differences between the plan and the result. However, both the areas covered by Conservation agreements and Adapted forestry are smaller than planned. Several of the sites that have been deleted are prepared and will be possible to include later on. The total area with BR, CA and AF is 54.4 ha smaller than planned in the second report (Table 7).

The most important areas at Örten have been conserved or restored in this LIFE project. There are still some areas that contain high values, or potentially high values, which should be protected as soon as possible. However, we feel that the resources

used from the LIFE fund have been used in the most efficient way, and that important values have been conserved.

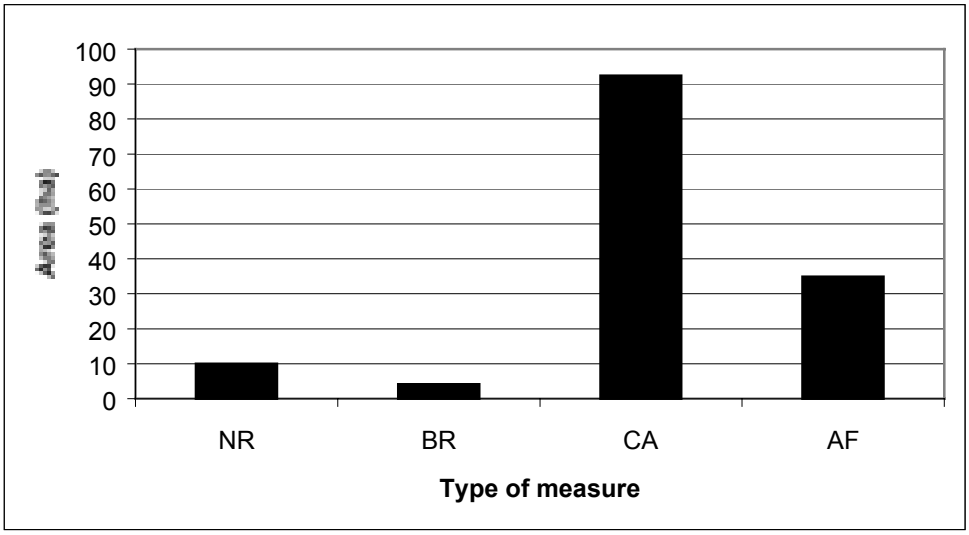

Fig. 12. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Örten.

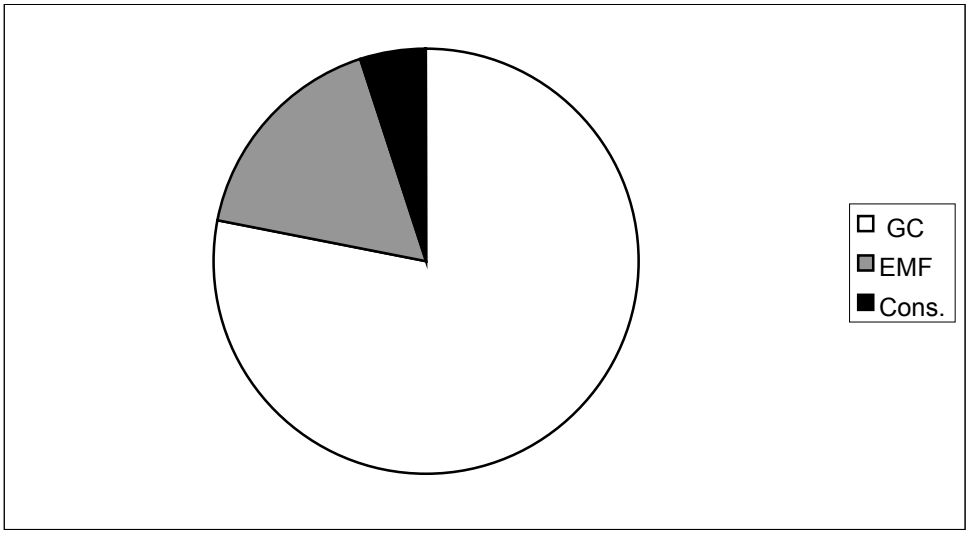

Fig. 13. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Örten. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Alken

General description

The landscape is 1 788 hectares and the forest area is 1 644 ha. Located in the southwestern part of Värmland County, between two large lakes, Racken and Mangen situated in two depressions along escarpments. The lake Alken, which is quite small, has given name to the landscape. The landscape has a varied topography and steep

screes are common. The altitude within the area is 150 metres and the highest peaks are about 330 metres above sea level. The landscape is situated above the highest marine limit. The bedrock causes nutrient-poor soils and the flora and fauna is adapted accordingly.

Forest ecosystem and wetlands dominate the area. Spruce forests are most common but in the drier parts there is a relatively large content of pine. The older clumps have the character of naturally regenerated forests, often with large features of big aspens. The precipices with numerous aspens, facing south, are characteristic of the area. Natural forest fires have affected the forest stands repeatedly during the former centuries, and there are several remnants of these fires. They have created a varied forest with high abundance of dead wood and deciduous trees. It is known that the latest big fire occurred in 1862. Today this disturbance is prevented and modern forestry is the common land-use. However, in this area the proportion of old forest and deciduous trees are still relatively high. In young forest (<60 years), the proportion of deciduous trees is 23%. Fire refuges such as marshy areas, small areas of wet forests or forested habitat "islands" in mires, are quite common. Lakes and mires are also present in the valley bottoms.

The most common habitats according to the Directive are western taiga, bog woodland, Tilio-Acerion ravine forests and aapa mires. Thirteen Annex 1 species in the Birds Directive are recorded as present in the landscape area. The White-backed woodpecker is regularly observed in the area. Within 15 km seven localities are known where the species probably breeds yearly. One of these pairs normally forages within the Alken landscape. All other species of woodpeckers of northern Europe have been observed at Alken. Totally, 26 nationally red-listed species are known, but this does not include insects.

The landscape and the Natura 2000 connection

There is one SPA containing all the sites, protected or co-financed by LIFE during the project. There is also a pSCI, which is demarcated in the same way as the nature reserve. No species listed in the Habitats Directive Annex II are present (Tables 21, 22).

Table 21. Total area of the habitats in the pSCI at Örvattnet (SE0610137) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Transition mires	7140	4	4	4
Western taiga	*9010	18	18	0
No FFH habitat		18	18	0
Total		40	40	4

*See explanation in Table 8.

Table 22. Bird species occurring in the SPA Alken (SE0610150, 166 ha) and in the protected and purchased part of the land area

Species	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. size	Pop. Size	Pop. Size
Honey buzzard (Pernis apivorus)	*A072*	*D*	*D*	-
Hazel grouse (Bonasa bonasia)	*A104*	*D*	*D*	*D*
Capercallie (Tetrao urogallus)	*A108*	*D*	*D*	*D*
Eurasian pygmy owl (Glaucidium passerinum)	*A217*	*D*	*D*	*D*
Tengmalm's owl (Aegolius funereus)	*A223*	*D*	*D*	-
Grey-headed green woodpecker (Picus canus)	*A234*	*D*	*D*	-
Black woodpecker (Dryocopus martius)	*A236*	*D*	*D*	-
White-backed woodpecker (Dendrocopos leucotos)	*A239*	*B p <= 15%*	*D*	-
Three-toed woodpecker (Picoides tridactylus)	*A241*	*D*	*D*	*D*
Black grouse (Tetrao tetrix tetrix)	*A409*	*D*	*D*	-

*See explanation in Table 9.

Örvattnet Nature reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's pSCI. The whole nature reserve is also part of a larger SPA. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The site consists of a southward slope close to a lake. Parts of the slope are quite steep. The site is dominated by forest, partly wet ones. There is a feature of small transition mires at the site. Both western taiga and forestry plantation are present. The western taiga is varied in composition depending on the abiotic conditions of the forest stands. On steep slopes and in some other parts, the presence of deciduous trees in quite large. The western taiga became rejuvenated after a forest fire in the end of the 19th century. The taiga is rich in dead and dying trees. Plantations of *Pinus contorta*, which is an introduced species in Sweden, are also present in the reserve.

The site's western taiga is rich in species as regards lichens, bryophytes and fungi. Uncommon species present at the site are for example; *Collema subflaccidum, Antrodia pulvinascens, Calicium parvum, Microcalicium ahlneri, Clavicorona pyxidata, Lentharia epichnoa* and *Phellinus ferrugineofuscus.*

The nature reserve: The nature reserve has been established and covers 40 ha.

Land purchase/compensation: The work has been delayed due to hard negotiations. One small area has been bought during the project, 4 hectares for 160 000 SEK. For the remaining estates all valuations are completed, the future possibilities are either an agreement according to results of negotiations, or a fixed price established by a court of law. During April 1999 one of the remaining estates, 3 hectares, was bought for 65 000 SEK. An agreement still has to be reached with two landowners.

Biotope management: Parts of the site will be left to develop naturally. In forest stands that are affected by forestry, restoration measures will take place, for example burning, clearing some of the coniferous trees and making stumps and other sorts of dead wood. All *Pinus contorta* will be removed.

Public awareness: An information sign has been made and situated at the parking site. A small folder about the nature reserve will be produced.

Public facilities: A parking lot is situated at a short distance from the nature reserve. Road signs describe the way to the reserve. A footpath will be arranged.

Biotope reserves, Conservation agreements and Adapted forestry

The total area with BR, CA and AF at Alken is 164.8 ha. One area at Alken is burned. Adapted forestry also includes thinning to increase the proportion of deciduous trees. All areas with adapted forestry are combined with Conservation agreements. The area with BR and CA is 126.5 ha (Fig. 14).

Co-operation with the landowners and individual consultations

Also at Alken the landowners have, in general, been positive to nature conservation and our suggestions. Most of the proposed conservation measures have been possible to accomplish.

Environmentally managed forest

At Alken, totally 341 ha will be conserved or managed as environmentally managed forests (Fig. 15).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve have changed considerably during the project, depending on existing and future possibilities of results of negotiations. Compared with the contract, the nature reserve in this landscape has been increased by 10 hectares. The present LIFE reserve consists of the land area in the Örvattnet nature reserve, i.e. 40 hectares.

The difference between the plan and the result at Alken is relatively small. Only two areas (one BR and one AF) have been deleted. The areas at some sites have also been decreased. One area planned as Conservation agreements is 13 ha smaller than planned. In this case only the part with the highest nature values was chosen, and the remaining part will be conserved without economic compensation. Instead, several new areas were added. The total area carried out is larger than planned, 164.8 ha compared with 149.1 in the second report (Table 7). The main difference is due to the area of Adapted forestry, which is almost 20 ha smaller than planned.

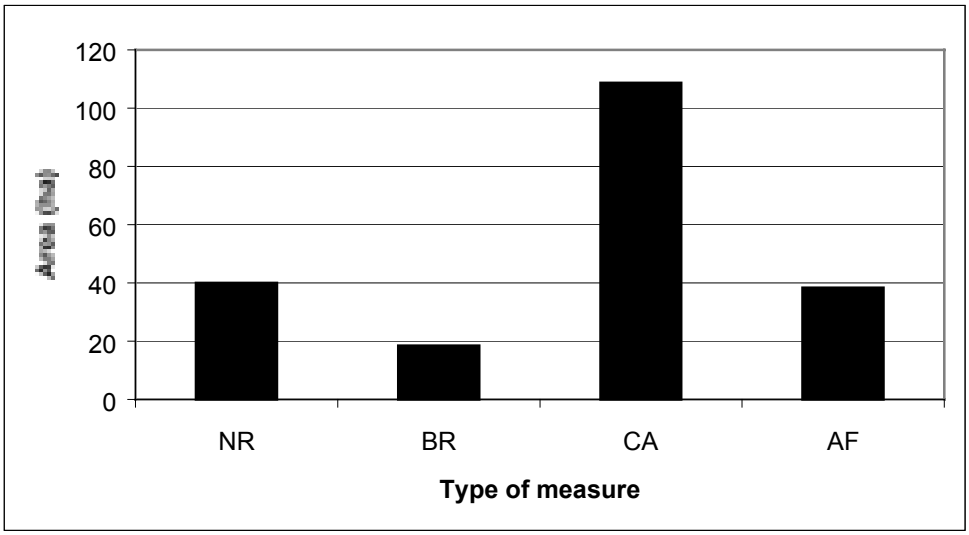

Fig. 14. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Alken.

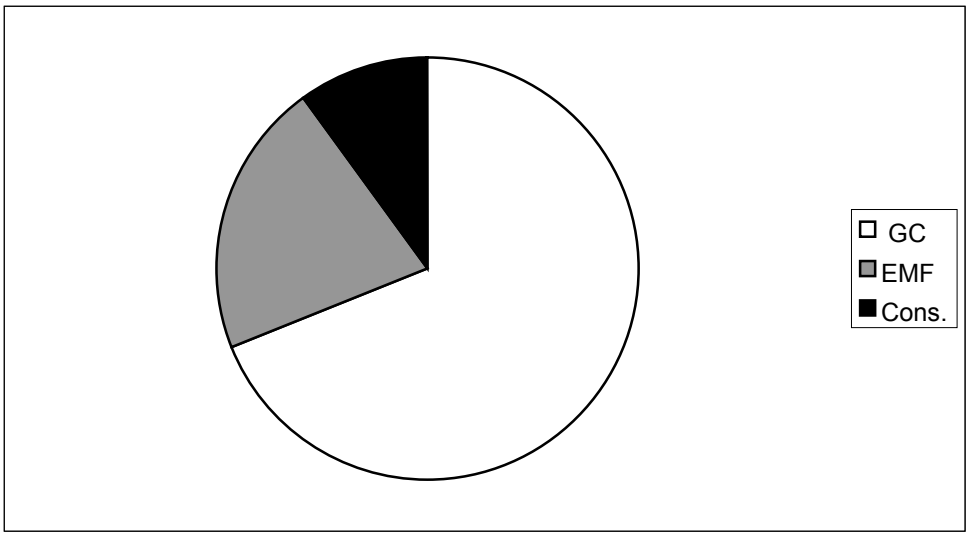

Fig. 15. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Alken. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Fjornshöjden

General description

The landscape is 2 033 hectares and located in the south part of Värmland, close to the Norwegian border. The land area is 1 861 ha, characterised by a broken hilly terrain with several narrow rift valleys. The landscape is almost totally situated above the highest marine level. The bedrock and the soils are poor in nutrients and the soil layer is usually thin.

Coniferous forests dominate the area. Almost half of the forest stands are naturally regenerated, containing 10-30 % of old deciduous trees and a thick underlay of spruce,

contemporary in age. The lack of old and thick pine in several forest stands indicates former forestry. Natural forest fires have affected the forest stands repeatedly during the former centuries, which has made the feature of deciduous trees quite large. Pine used to dominate the area, except in wetter areas where spruce and deciduous trees were common. However, nowadays fires are prevented and spruce is more common everywhere. In the narrow rift valleys there are lakes, small mires, wet woodlands or brooks situated at the valley bottoms. The small areas of former arable land are getting colonised by shrubs and trees.

The most common habitats according to the Directive are western taiga, Tilio-Acerion ravine forests, bog woodland and aapa mires. Twelve Annex 1 species in the Birds Directive are recorded as present in the landscape area. The White-backed woodpecker is regularly observed in the area. One pair might be breeding in or in the vicinity of the area. All other species of woodpeckers in northern Europe are breeding in the Fjornshöjden area. Totally, 27 nationally red-listed species have been observed.

The landscape and the Natura 2000 connection

There are two SPAs containing all the sites, protected or co-financed by LIFE during the project together. There are also two pSCIs, one for each of the reserves. They are demarcated in the same way as the nature reserves. No species listed in the Habitats Directive Annex II are present (Tables 23, 24, 25, 26).

Table 23. Total area of the habitats in the pSCI at Kesebotten (SE0610120) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Transition mires	7140	19	19	2
Western taiga	*9010	119	119	70
Bog woodland	*91D0	10	10	2
No FFH habitat		47	44	34
Total pSCI		195	192	108

*See explanation in Table 8.

Table 24. Total area of the habitats in the pSCI at Håltebyns brandfält (SE0610138) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Western taiga	*9010	23	23	20
No FFH habitat		9	9	8
Total pSCI		32	32	28

*See explanation in Table 8.

Table 25. Bird species occurring in the SPA Kesebotten (SE0610120, 195 ha) and in the protected and purchased part of the land area

Species	N U T S*	Total area	Land area in the NR	Land area purchased in the NR
		Pop. Size	Pop. size	Pop. size
Grey-headed green woodpecker (Picus canus)	*A234*	*D*	*D*	*D*
White-backed woodpecker (Dendrocopos leucotos)	*A239*	*B p <= 15%*	*B p <= 15%*	*C*
Three-toed woodpecker (Picoides tridactylus)	*A241*	*D*	*D*	*D*

*See explanation in Table 9.

Table 26. Bird species occurring in the SPA Fjornshöjden (SE0610149, 145 ha) and in the protected and purchased part of the land area

Species	NUTS *	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. size	Pop. size	Pop. Size
Honey buzzard (Pernis apivorus)	A072	D	-	-
Hazel grouse (Bonasa bonasia)	A104	D	-	-
Capercallie (Tetrao urogallus)	A108	D	-	-
Eurasian pygmy owl (Glaucidium passerinum)	A217	D	-	-
Ural owl (Strix uralensis)	A220	D	-	-
Tengmalm's owl (Aegolius funereus)	A223	D	-	-
Grey-headed green woodpecker (Picus canus)	A234	D	-	-
Black woodpecker (Dryocopus martius)	A236	D	D	D
Three-toed woodpecker (Picoides tridactylus)	A241	D	-	-
Red-backed shrike (Lanius collurio)	A338	D	-	-
Black grouse (Tetrao tetrix tetrix)	A409	D	-	-

*See explanation in Table 9.

Kesebotten Nature reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's largest pSCI and SPA. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The site is situated in hilly terrain and steep screes are common. The site is dominated by western taiga but there are also forest stands that have been affected by forestry. In the valleys, wet sub-types of western taiga, transition mires and bog woodland are situated. There are also some lakes and small creeks.

The taiga is mostly dominated by spruce. In some parts the presence of deciduous trees is large depending on the fact that large parts of the site were affected by a natural forest fire in the late 19th century. The bog woodlands are dominated either by spruce, pine, birch or alder. The forests are rich in rare and uncommon species of lichens, bryophytes and fungi, e.g., *Collema subflaccidum, Collema subnigrescens,*

Nephroma laevigatum, Phellinus populicola, Degelia plumbea, Neckera pennata and *Cladonia parasitica*. Some rare insects have also been found.

There are also limnological conservation values present at the site. For example there is a local population of *Salmo trutta* present. There are remnants of abandoned shielings (summer farms) in the area.

The establishment of the nature reserve: The nature reserve is established and covers 195 hectares, of which 192 hectares are land.

Land purchase/compensation: Before the project started 69 hectares were bought by SEPA. During the LIFE project purchase and compensation have affected five estates, altogether 108 hectares at a cost of 5 260 000 SEK. Negotiations continue for the remaining part. The future possibilities are either an agreement according to results of negotiations or a fixed price established by a court of law.

Biotope management: Large parts of the reserve will be left to develop naturally in the near future. Later on, the forest stand may be subjected to burning. For the forest stands affected by forestry, restoration measures will take place, e.g., burning, clearing some of the coniferous trees, and making stumps and other sorts of dead wood. Browsing by Moose *(Alces alces)* may be prevented in order to favour young deciduous trees.

Public awareness: An information sign has been made and situated at the parking site. A small folder about the nature reserve will be produced.

Public facilities: A small parking site will be made. Road signs showing the way to the nature reserve will be arranged.

Håltebyn Nature reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's smallest pSCI. The whole nature reserve is also part of the smallest SPA. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The site consists of an eastward slope. A natural forest fire affected a large part of the site during 1994. The fire was intensive and a lot of the pine and birch trees died or are dying. In part of the area the organic layers burned totally and exposed the mineral soil underneath. The taiga has started to rejuvenate at the site and the first step towards a western taiga is a young deciduous forest. Pioneer flora and fauna now inhabit the site. A zone of commercial forest surrounds the area affected by the natural forest fire.

The nature reserve: The nature reserve is established and covers 32 hectares. There is no water area in the reserve.

Land purchase/compensation: Three areas were bought prior to the start of the project even if the day for payment was supposed to be the first day of the project. This was because the banks were closed on 1st of April 1995. The payment had to be

done one day in advance. This was not discovered until the 4th activity report, when the SEPA observed this discrepancy in one of the databases for finance at the Agency. The costs were then excluded from the project. The Commission's opinion on this matter was requested by the SEPA. Soon afterwards the Commission replied that these costs were eligible. The costs have now been included once again. All data about these areas are included in the description below.

Altogether 7 parts of estates affected by the nature reserve have been bought during the project. They contain 28 hectares and SEPA has paid 612 500 SEK for them. Four of the parts have an estimated price depending on SEPA having bought more than needed for Håltebyns nature reserve. The estates are long and narrow and only small parts will be included in the LIFE project as parts of the nature reserve Håltebyns brandfält.

Most of the remaining parts of the bought estates will be part of the planned nature reserve to the northwest, which is not a part of the LIFE project. The parts of the estates between the two reserves that are without values for nature conservation will be used to do land swaps or will be restored and included in the planned reserve. The estimation is based upon an average price per hectare for the estates concerned. Altogether 22 hectares, estimated to the cost of 391 500 SEK have been part of such an estate. The SEPA believes that no detailed valuation of the special LIFE part is necessary since the project has become more expensive than estimated in the application and SEPA will have to pay the extra cost.

For the only remaining (7/7-99) estate, the future possibilities are either an agreement according to results of negotiations or a fixed price established by a court of law.

Biotope management: The main part of the reserve will be left to develop naturally. Selective cutting in order to favour deciduous trees will restore the parts that have not been affected by the forest fire.

Public awareness: An information sign has been made and situated at the parking site. A small folder about the nature reserve will be produced.

Public facilities: A small parking lot and a footpath will be arranged. No further measures will be taken.

Biotope reserves, Conservation agreements and Adapted forestry

The area of BR, CA and AF at Fjornshöjden is small (50 ha), and only Sommen and Hemshyttan have smaller areas conserved. Apart from the nature reserve no conservation measure had been successful (Fig. 16). There is also one site (16 ha) with a Conservation agreement that is not is co-financed with LIFE. One of the two sites with adapted forestry is combined with conservation agreement and the total area targeted for action and supported by LIFE is therefore only 34.8 ha.

The most important Adapted forestry measure at Fjornshöjden is one burned area. Unfortunately, the area carried out is smaller than planned, but this is still a very important type of restoration of the preferred habitat.

Co-operation with the landowners and individual consultations

The landowners at Fjornshöjden are less interested in nature conservation than at Alken and Örten, and there have been some problems in carrying out our proposed conservation measures.

Environmentally managed forest

Although the landowners were relatively uninterested in our suggested conservation measures, about 375 ha will be used as environmentally managed forest (Fig. 17).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve have changed considerably during the project, depending on existing and future possibilities of results of negotiations. Compared with the contract, the nature reserves in this landscape have been increased by altogether 124 hectares due to poor results of negotiations at other landscapes. The present LIFE reserve consists of the land area in the Kesebotten and Håltebyns brandfält nature reserves, containing altogether 224 hectares.

The difference between the plan and the result is relatively large. Several sites have been deleted, and the areas at several others have been decreased. In some cases the reason is that the areas will be included in the nature reserve, one will be conserved without economic compensation, and in some cases the nature values were found to be lower than expected. Unfortunately it has not been possible to compensate this by obtaining new areas. The total area with BR, CA and AF is 126.4 ha smaller than planned in the second report (Table 7).

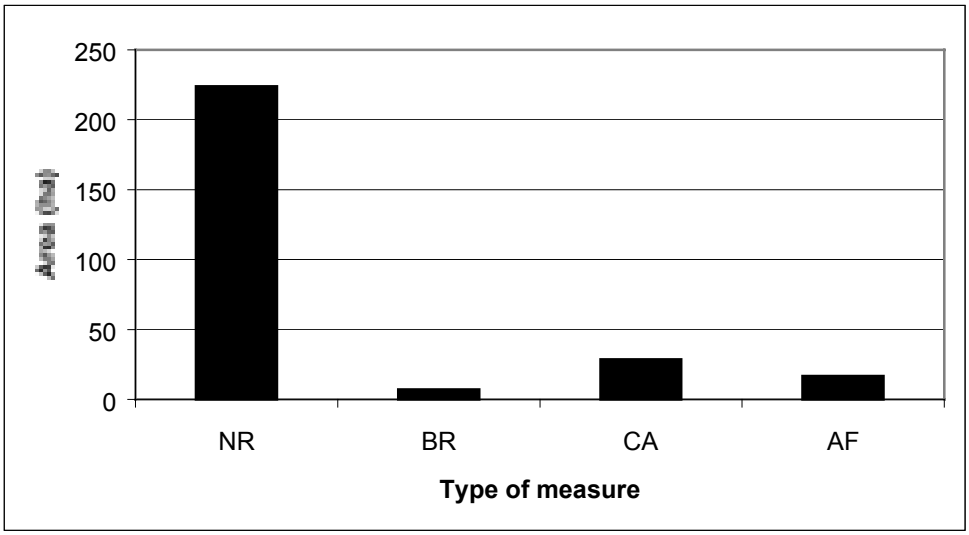

Fig. 16. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Fjornshöjden.

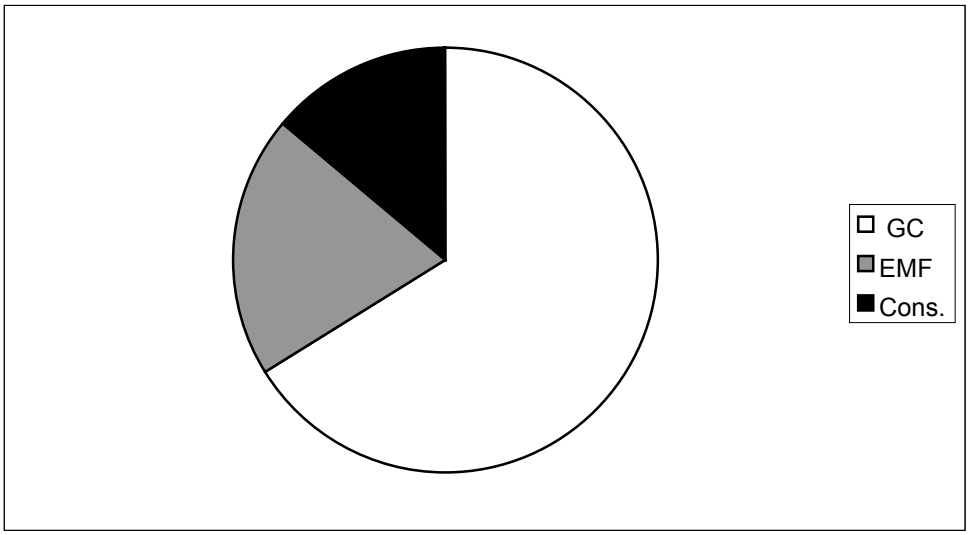

Fig. 17. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Fjornshöjden. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Stora Le

General description

The landscape is 3799 hectares and the land area is 1 556 hectares. The landscape is located in the province of Dalsland, the northwestern part of Västergötland County not far from Norway. The landscape is characterised by a broken hilly terrain with several narrow rift valleys and a larger depression along an escarpment where the oligotrophic Lake Stora Le is situated, dividing the landscape into two parts. The bedrock is dominated by granite and gneiss, mostly covered with thin layers of nutrient-poor till. However, areas with limestone and diabase also occur. In lower parts it is covered with thicker and more nutritious kinds of soils or peat.

Because of the great variation in topography and in the bedrock many different habitats occur, but the landscape is dominated by coniferous forest. The steep shores of Stora Le and the precipices are either covered by pine forest or without a tree-layer. In the bottom of rift valleys and other wetter parts there are spruce forests. Small lakes and mires are also present in the valley bottoms. The terrain is difficult to access in several parts, which has resulted in quite large areas of coniferous forests with hardly any influences of large-scale modern forestry even if the landscape has a long history of forestry. The proportion of old forests (>80 years) is large. Some of the valleys used to be agricultural land, but several farms are not used nowadays and the successions to forest have started.

The most common habitats according to the Directive are western taiga, bog woodland and Tilio-Acerion ravine forests. 11 Annex 1 species in the Birds Directive are recorded as present in the landscape area. The White-backed woodpecker has been breeding in the area and is observed regularly. Probably at least one pair still breeds in the northern part of the landscape. All other species of woodpeckers of northern Europe have been observed. The epiphytic flora of bryophytes and lichens is very rich,

as with the number of species in general. There are several nationally red-listed species in the area.

The landscape and the Natura 2000 connection

There is one SPA containing all the sites, protected or co-financed by LIFE during the project. There is one pSCI in the landscape, which is demarcated in the same way as the nature reserves. Tables showing name, site code, total area, species and habitats for all the "Natura 2000" sites are shown below (Tables 27, 28).

Table 27. Total area of the habitats in the pSCI at Bokullen (SE0530130) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Western taiga	*9010	122	122	0
Total		122	122	0

*See explanation in Table 8.

Table 28. Bird species occurring in the SPA Stora Le (SE0530128, 470 ha) and in the protected and purchased part of the land area

Species	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. size	Pop. size	Pop. Size
Black-throated diver (Gavia arctica)	A002	C p <= 2%	C p <= 2%	-
Hazel grouse (Bonasa bonasia)	A104	C p <= 2%	C p <= 2%	-
Capercallie (Tetrao urogallus)	A108	C p <= 2%	C p <= 2%	-
Common tern (Sterna hirundo)	A193	C p <= 2%	C p <= 2%	-
Eagle owl (Bubo bubo)	A215	C p <= 2%	C p <= 2%	-
Eurasian pygmy owl (Glaucidium passerinum)	A217	C p <= 2%	C p <= 2%	-
Tengmalm's owl (Aegolius funereus)	A223	C p <= 2%	C p <= 2%	-
European nightjar (Caprimulgus europaeus)	A224	C p <= 2%	C p <= 2%	-
Black woodpecker (Dryocopus martius)	A236	C p <= 2%	C p <= 2%	-
White-backed woodpecker (Dendrocopos leucotos)	A239	C p <= 2%	C p <= 2%	-
Three-toed woodpecker (Picoides tridactylus)	A241	C p <= 2%	C p <= 2%	-

*See explanation in Table 9.

Bokullen Nature reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's pSCI. The whole nature reserve is also part of a larger SPA. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The site is situated on the west side of the large lake Stora Le. The terrain is varied. There are a lot of steep screes and narrow small valleys. Included in the reserve are also the small islands in the lake close to the main part of the site.

The site is dominated by western taiga. Dry pine subtypes at the drier hilltops and spruce dominated subtypes in the slopes. Deciduous trees like aspen, birch, goatwillow, alder and rowan are quite common in parts of the area. There are small bog woodlands and transition mires incorporated in the taiga.

There are a lot of epiphytic lichens present in the reserve, for example *Pannaria rubiginosa, P. mediterriana, Degelia plumbea, Megalaria grossa, Menegazzia terebrata* and *Collema subflaccidum*. Some of them have a sub-oceanic distribution. The avifauna is typical for western taiga in the region but the rare White-backed woodpecker is also present at the site even if its not breeding.

The nature reserve: The nature reserve is established and according to the decision the reserve is 122 hectares. No water area is included in the reserve. The public do not have access to the islands and islets in the lake during the breeding season. There have been complaints from the landowners about the decision to establish the nature reserve. The government is considering their complaints and a decision is expected in August 1999.

Land purchase/compensation: There has not been any land purchase at the site. The landowners have not been interested in negotiating. The future possibilities are either an agreement according to results of negotiations within a year or a fixed price established by a court of law.

Biotope management: The site will be left to develop naturally, but spruce may be removed in order to favour deciduous trees. Arranged forest fires may also take place.

Public awareness: Information signs are present at the reserve's natural entries.

Public facilities: No measure will be taken to improve the public facilities.

Furustad Nature reserve

During the project it has been discussed that the 13-hectare extension of the nature reserve Furustad should be included as part of the project. However, this could not be finalised and therefore there is no detailed information about the site. Negotiations with the landowner will continue. One area was bought during the spring of 1999 after the project was finished. The extension will be made after the project.

Biotope reserves, Conservation agreements and Adapted forestry

Several sites have been deleted and few new sites have been added. Still Stora Le is one of the most successful landscapes. The area conserved as BR, CA and AF, 209.5 ha, is larger than in any other landscape. Especially the Conservation Agreements have been a useful tool.

Adapted forestry in the landscape includes thinning to increase the proportion of deciduous trees, leaving a large number of deciduous trees when clear-cutting, killing trees by use of explosives and girdling, protect young deciduous forest by a fence, and creating high stumps of coniferous trees. Some areas with adapted forestry are combined with Conservation agreements. The total area targeted for actions is therefore 178.6 ha (Fig. 18).

Co-operation with the landowners and individual consultations

The negotiations with the landowners at Stora Le have been complicated. The interest in nature conservation is low, and this is the main reason why several sites have been deleted.

Environmentally managed forest

At Stora Le the landowners want to conserve 265 ha voluntarily (Fig. 19).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve have changed considerably during the project, depending on existing and future possibilities of results of negotiations. Compared with the contract, the nature reserve in this landscape has been increased by 72 hectares. The present LIFE reserve consists of the land area in the Bokullen nature reserve, i.e. 122 hectares.

The total area targeted for different measures is much smaller, 73.9 ha, than planned (Table 7). Several sites have been deleted: 8 Biotope reserves, 2 Conservation agreements and 3 Adapted forestry sites. However, the conserved area is large compared with other landscapes. The reason is mainly the large area with Conservation agreements. Two sites with conservation agreements have been enlarged considerably and compensate the deleted sites. The reason for the difference between the plan and the result is that the plan was too optimistic, and that the negotiation has been difficult at Stora Le.

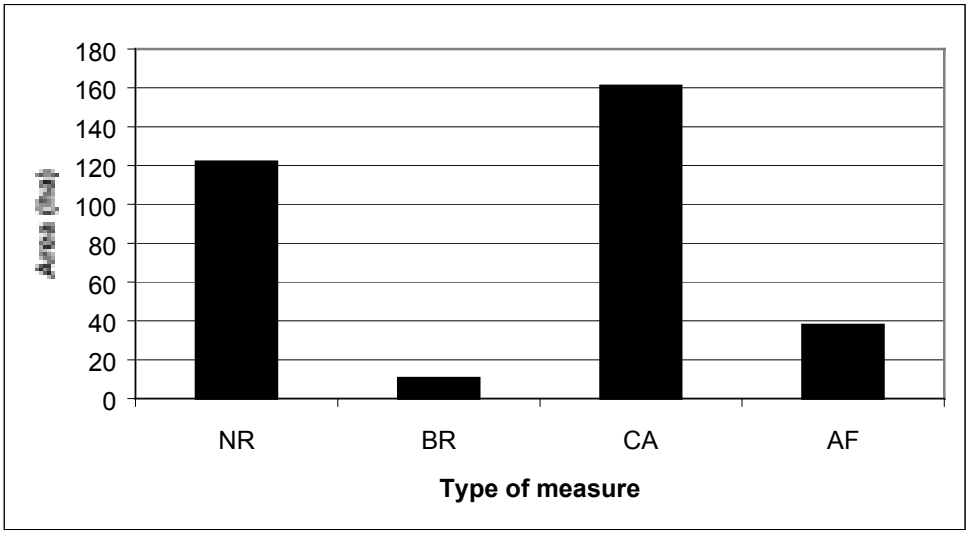

Fig. 18. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Stora Le.

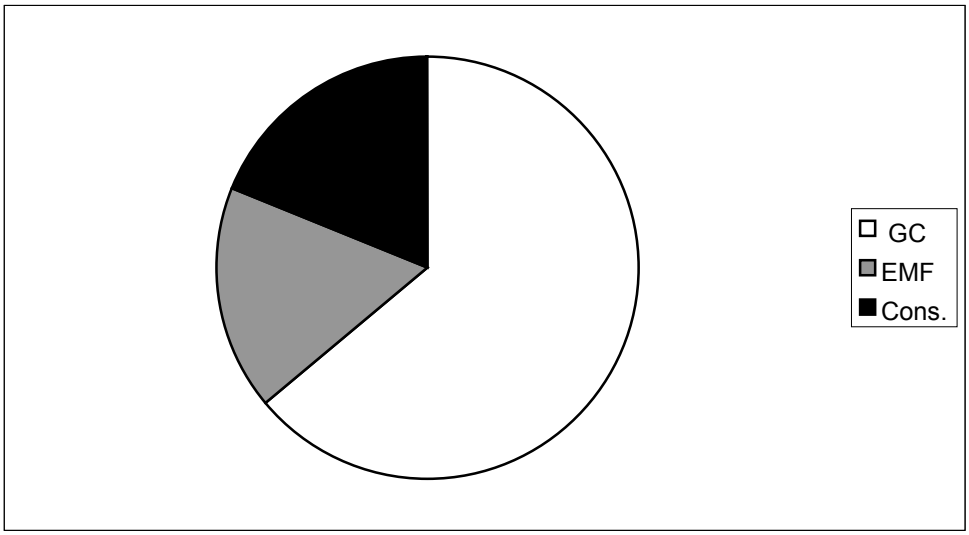

Fig. 19. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Stora Le. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Råvarpen

General description

The landscape is 2 376 hectares and the land area is 1 485 hectares. The landscape is located in the northwest part of Västergötland County, about 10 km from the lake Vänern. The landscape is characterised by a broken hilly terrain with several narrow rift valleys and a larger depression where the lakes Råvarp and Åklången are situated. The bedrock consists mainly of gneiss, but some parts also contain limestone and other alkaline types. It is a part of the "Dalformationen", which is a geological name of the bedrock in this area. The bedrock's different resistance to erosion makes a characteristic dramatic topography of valleys and ridges, heading in north-south direction. The terrain is very varied with steep slopes, caves and chasms.

Pine and spruce dominate the forest, but some areas are mixed or dominated by deciduous forest. The proportion of deciduous trees is about 20-25%. The shores of the lakes are mostly steep and sparsely covered by pine trees. At the eastern side of Lake Åklången is the ridge built up of clay-shale and covered with pine and yew. At the bottom of rift valleys and other wetter parts there are spruce forests. Small lakes and mires are also present in the valley bottoms. The terrain is difficult to access in several parts, which has resulted in quite a large proportion of areas of coniferous forests with hardly any influences of large-scale modern forestry.

The most common habitats according to the Directive are western taiga and Tilio-Acerion ravine forest. Sixteen Annex 1 species in the Birds Directive are recorded as present in the landscape area. The White-backed woodpecker has been breeding in the area. However, only a few observations have been made since 1995. The species is regularly observed in other areas close to the landscape, and the landscape is therefore potentially important. By conserving the best habitats and restoring other habitats there is a good chance that the species will re-colonise the area. The epiphytic flora of bryophytes and lichens is very rich. Because of the occurrence of limestone, the area has high floristic values.

The landscape and the Natura 2000 connection

There is one SPA containing all the sites, protected or co-financed by LIFE during the project. There is also a pSCI, which is demarcated in the same way as the nature reserve. No species listed in the Habitats directive Annex II are present (Tables 29, 30).

Table 29. Total area of the habitats in the pSCI at Ranneberget (SE0530039) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Western taiga	*9010	14	14	13
Broad-leaved deciduous forests	*9020	2	2	2
Herb-rich spruce forests	9050	7	7	7
Tilio-Acerion ravine forests	*9180	39	39	39
Oak woods on sandy plains	9190	11	11	11
No FFH habitat		10	10	8
Total pSCI		83	83	80

*See explanation in Table 8.

Table 30. Bird species occurring in the SPA Råvarp (SE0530129, 232 ha) and in the protected and purchased part of the land area

Species	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. size	Pop. size	Pop. size
Honey buzzard *(Pernis apivorus*)	A072	C p <= 2%	C p <= 2%	C p <= 2%
Hazel grouse *(Bonasa bonasia)*	A104	C p <= 2%	C p <= 2%	C p <= 2%
Eurasian pygmy owl *(Glaucidium passerinum)*	A217	C p <= 2%	C p <= 2%	C p <= 2%
Black woodpecker *(Dryocopus martius)*	A236	C p <= 2%	C p <= 2%	C p <= 2%
White-backed woodpecker *(Dendrocopos leucotos)*	A239	B p <= 15%	B p <= 15%	B p <= 15%

*See explanation in Table 9.

Ranneberget Nature reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's pSCI. The whole nature reserve is also part of a larger SPA. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The site is situated on a long hill with small hilltops. The terrain is varied and there are a lot of steep screes, deep valleys and boulder-rich areas. The bedrock gives rise to nutrient-rich soils. Different kinds of forest cover the area totally. There is western taiga with two subtypes; dry pine forest on the hilltops and spruce-dominated forest on the slopes. Herb-rich spruce forest is also present. There are three

types of deciduous forest at the site. All of them are dominated by tree species that are uncommon in this part of Sweden, for example *Tilia* and *Quercus*.

The vascular flora is rich in species that, among other things, depend on the nutrient-rich soils. *Hedera helix, Polystichum aculeatum, Woodsia ilvensis, Carex sylvatica, Brachypodium pinnatum* and *Festuca altissima* are present at the site. Epiphytic lichens of interest present in the area are *Degelia plumbea, Sphinctrina leucopoda, Pannaria pezizoides, Lobaria amplissima* and *L. virens*. The fauna of terrestrial molluscs is also of interest and includes rare species like *Spermodea lamellata, Ena obscura* and *Macrogasta ventricosa*. The avifauna is rich and includes breeding White-backed woodpeckers.

The nature reserve: The decision about the nature reserve and its regulations and management plan is ready.

Land purchase/compensation: The landowners and SEPA have agreed on economic compensation for altogether 80 hectares at a cost of 1 578 000 SEK. The remaining part of the reserve belongs to two landowners: One has not agreed on any compensation and has lost his right to sue the state in court. This must be done if no agreement has been reached one year after the establishment of the nature reserve. Otherwise the landowners lose their right to compensation. The other landowner has reached a special agreement with the SEPA, i.e. that he is allowed to cut a spruce plantation and gain the profit from it. Accordingly, the compensation from SEPA was low depending on the conditions. This agreement on compensation is not co-financed by LIFE but has been reached during the project. No land purchase remains to be completed.

Biotope management: Large parts of the reserve will be left to develop naturally. Parts of the area will be extensively grazed. Spruce plantations will be cut down during the next 20 years and the areas will be left to regenerate naturally after that. Parts of the deciduous forests at the site will be carefully cleared and grazed afterwards.

Public awareness: Information signs are present at the parking lot and other entries. A folder for the nature reserve should be produced.

Public facilities: A footpath and a parking lot will be arranged. If necessary, sanitary arrangements will be made close to the parking lot.

Biotope reserves, Conservation agreements and Adapted forestry

A relatively large area, 158.2 ha, has been conserved as BR, CA and AF at Råvarpen. Only Stora Le and Hallaren have larger areas. Conservation agreements have mainly been acceptable by the landowners.

The number of sites with adapted forestry has increased, but the total area is larger than proposed. No burning has been carried out at Råvarpen. The adapted forestry includes killing trees, leaving a large number of deciduous trees and creating high-stumps at clear-cuttings and removing spruce in young forest. Several sites with adapted forestry are combined with conservation agreements. The total area targeted for actions is therefore 128.2 ha (Fig. 20).

Co-operation with the landowners and individual consultations

Also at Råvarpen the negotiations have been complicated and time-consuming.

Environmentally managed forest

The landowners have agreed to conserve 252 ha of forests voluntarily (Fig. 21).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve have changed considerably during the project, depending on existing and future possibilities of results of negotiations. Compared with the contract, the nature reserve in this landscape has been increased by 23 hectares, due to poor results in other landscapes. The present LIFE reserve consists of the land area in the Ranneberget nature reserve, i.e. 83 hectares.

There is a big difference between the result and the planned area of BR, CA and AF. The total area of BR, CA and AF is 75.2 ha smaller than planned (Table 7). The reason for the difference is that two big areas proposed as Conservation agreements have been deleted and the area of several sites has decreased. Totally 4 BR, 3 CA and 3 AF have been deleted. One new CA and 5 new AF have compensated this. The reason for the changes is problems with the negotiations. Even though several sites have been deleted or decreased, the total area of BR, CA and AF at Råvarpen is relatively large.

In spite of the changes in area, our opinion is that the work at Råvarpen has been successful. Most of the sites targeted for actions have been accomplished, and compared with the budget and available time the result is very good. However, the area still contains unprotected sites with high nature values, and sites with potentially high values, and it is important to continue the conservation efforts.

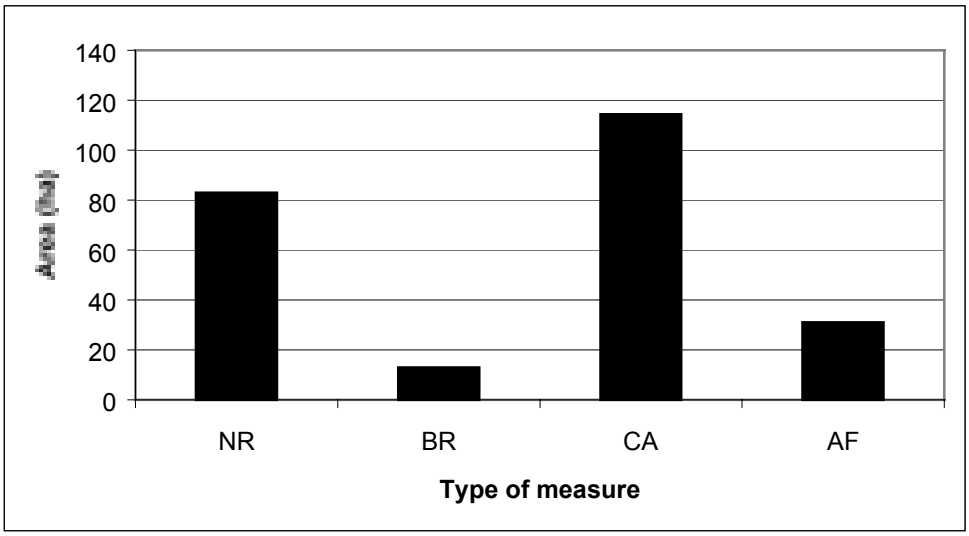

Fig. 20. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Råvarpen.

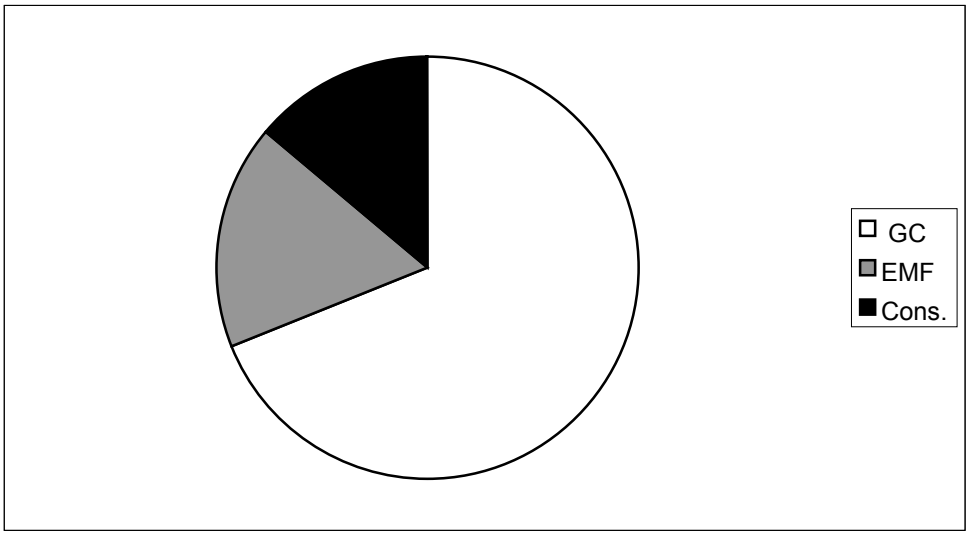

Fig. 21. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Råvarpen. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

Sommen

General description

The landscape is 3 800 hectares and the land area is 2 600 ha. Sommen is a relatively large lake in the south part of Östergötland County. The landscape consists mainly of a large peninsula in the Lake Sommen, but small parts of other shorelines around the lake are also part of the landscape. The landscape is varied with steep ridges and valleys. The bedrock is nutrient-poor granite which is covered with till.

The land area is a mosaic of forest, wetlands, grasslands and arable land. The great variety of forests is characteristic of the area. The stands are often quite small with different species of trees. The most common forest types are different spruce- and pine-dominated forests. The latter is common on the ridges due to the thin soil layers. In the valleys and at old pastures, deciduous forest of different compositions of with oak, maple, lime, aspen, alder and birch is found. Some stands have a large amount of standing dead trees and fallen trees. There are also grazed land with oak-trees or other kinds of wooded pastures as well as uncultivated pastures that are becoming colonised by shrubs and trees. Small mires are present in the valley bottoms. Most of the area has been used for grazing and forestry. However, the nature values are high mainly due to the variable topography and high proportion of deciduous trees.

The most common habitats according to the Directive are western taiga, bog woodland, wooded pastures and residual Alder (*Alnus)* forest. 20 Annex 1 species in the Birds Directive are recorded as present in the landscape area. For many years the Sommen area has been known as the centre of the White-backed woodpecker population in southeast Sweden. It has been breeding in the area but the last time it was observed in the landscape was 1995. Still, some individuals are known from other areas nearby. In general, the flora and fauna in the Sommen area are quite rich due to the varied habitats.

The landscape and the Natura 2000 connection

There are two SPAs in the landscape containing all the sites, protected or co-financed by LIFE or protected. There are also two pSCIs, one for Sjövik NR and one for Ivranäs NR. The pSCIs are demarcated in the same way as the nature reserves. No species listed in the Habitats Directive Annex II are present (Tables 31, 32, 33, 34).

Table 31. Total area of the habitats in the pSCI at Sjövik (SE0230136) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Western taiga	*9010	41	41	41
Total		41	41	41

*See explanation in Table 8.

Table 32. Total area of the habitats in the pSCI at Ivranäs (SE0230194) and the habitat area in the protected and purchased part

Habitats	NUTS*	Total area protected	Protected land area	Purchased land area
		Ha	Ha	Ha
Western taiga	*9010	28	28	28
Total		28	28	28

*See explanation in Table 8.

Table 33. Bird species occurring in the SPA Sjövik (SE0230136, 41 ha) and in the protected and purchased part of the land area

Species	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. size	Pop. size	Pop. size
Hazel grouse *(Bonasa bonasia)*	A104	C p <= 2%	C p <= 2%	C p <= 2%
Capercallie *(Tetrao urogallus)*	A108	C p <= 2%	C p <= 2%	C p <= 2%
Eurasian pygmy owl *(Glaucidium passerinum)*	A217	C p <= 2%	C p <= 2%	C p <= 2%
Tengmalm's owl *(Aegolius funereus)*	A223	C p <= 2%	C p <= 2%	C p <= 2%
Black woodpecker *(Dryocopus martius)*	A236	C p <= 2%	C p <= 2%	C p <= 2%

*See explanation in Table 9.

Table 34. Bird species occurring in the SPA Ivranäs (SE0230232, 67 ha) and in the protected and purchased part of the land area

Species	NUTS*	Total area	Land area protected as NR	Land area purchased in the NR
		Pop. size	Pop. size	Pop. Size
Tengmalm's owl (Aegolius funereus)	A223	C p <= 2%	C p <= 2%	C p <= 2%
Black woodpecker (Dryocopus martius)	A236	C p <= 2%	C p <= 2%	C p <= 2%
White-backed woodpecker (Dendrocopos leucotos)	A239	C p <= 2%	C p <= 2%	C p <= 2%
Red-breasted flycatcher (Ficedula parva)	A320	C p <= 2%	C p <= 2%	C p <= 2%

*See explanation in Table 9.

Sjövik Nature reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's largest pSCI and smallest SPA, which has the same demarcation. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The site is situated on the shore of Lake Sommen in an area with a varied topography. There are two hilltops at the site and the slopes are quite steep. Below the slopes are boulder-rich areas in the bottoms of the valleys. The site is covered by western taiga. Dry pine forest covers the hilltops and on the slopes mixed taiga is co-dominated by pine, spruce and aspen and some oak. Other tree species present are hazel, mountain ash, alder and lime. Wetter parts can be totally dominated by deciduous trees.

The site has large conservation values for lichens and bryophytes and, e.g., *Acrocordia cavata, Chaenotheca hispidula, Schismatomma pericleum* and *Buellia violaceofusca* are present at the site. The site is also of faunistic value, mostly for insects and birds. There are at least four woodpecker species present in the area.

The area has been grazed and grazing continues in the surroundings.

The establishment of the nature reserve: The nature reserve was established during 1996 and is 41 hectares.

Land purchase/compensation: Economic compensation of 1 450 000 SEK for 41 hectares has been paid to the landowner.

Biotope management: The purpose of the area is to protect the old wood with its flora and fauna and natural succession. The site will be left to develop naturally. The forest was being grazed until fairly recently.

Public awareness: The county governor inaugurated the nature reserve on a public occasion. There were some articles written in the local and regional newspaper. The nature reserve at Ivranäs was mentioned at the same time. An information sign has been produced and is located at the parking lot.

Public facilities: A small parking lot will be arranged along the road. There will also be a marked footpath. No other measures are planned.

Ivranäs Nature reserve

The NR and the Natura 2000 connection: The nature reserve has a congruent demarcation with the landscape's smallest pSCI. The whole nature reserve is also part of the largest SPA in the landscape. Tables showing the habitats and species and how they relate to the nature reserve are given in the text above describing the landscape and the Natura 2000 connection.

General description: The site consists of two areas that are partly situated on the shore of Lake Sommen in an area with a varied topography. Most of the site consists

of steep slopes. Below the slopes are boulder-rich areas. The site is covered by western taiga, parts of it are low-productive. Dry pine forest covers the area above the slopes. Below the slopes, mixed taiga is co-dominated by pine, spruce, birch and aspen, also with features of *Quercus*, *Sorbus*, and *Tilia*. Wetter parts can be totally dominated by deciduous trees. The less steep parts of the site have been grazed but the grazing has ceased.

The flora in the field layer is quite rich in species and includes; *Hedera helix, Goodyera repens, Pyrola minor, Vicia sylvatica, Antennaria dioica, Ajuga pyramidalis, Sanicula europaea* and *Lathaea squamaria.* The site has large conservation values for lichens, for example *Lecanactis abietina, Arthonia vinosa, Nephroma bellum, N. parile* and *N. laevigatum* are present at the site. The site is also important for the bryophytes and fungi. *Phellinus pini* among others are present at the site. The site is also of interest for insects and birds. There are at least three woodpecker species present in the area. The White-backed woodpecker was observed in the area during 1995. *Red-breasted flycatcher (Ficedula parva)* is also present.

The establishment of the nature reserve: The site has become an established nature reserve covering 28 hectares.

Land purchase/compensation: Economic compensation of altogether 999 000 SEK for 28 hectares has been paid to the landowners.

Biotope management: The woods will be left to develop naturally. Grazing is allowed, but not necessary, in the northern part. In areas with numerous deciduous trees, young coniferous trees may be removed.

Public awareness: The nature reserve and the co-financing by LIFE were mentioned in an article about the public occasion when the County governor inaugurated the nature reserve Sjövik. An information sign has been produced and located at the parking lot.

Public access: There are no special arrangements for visitors.

Biotope reserves, Conservation agreements and Adapted forestry

The total area of BR, CA and AF (23.8 ha) is smaller at Sommen than any other landscape. This is mainly due to the very small area of Conservation agreements.

Adapted forestry has been easier to carry out according to our plan. One site was deleted, but one new site compensates this, and the total area of adapted forestry is larger than in the plan. One of the sites with adapted forestry is combined with Conservation agreements, and the total area targeted for actions at Sommen is therefore 22.3 ha. Adapted forestry includes killing trees and thinning (Fig. 22).

Co-operation with the landowners and individual consultations

Sommen is one of the landscapes where it has been most difficult to carry out our proposed measures because of the landowners' negative opinions about Conservation agreements.

Environmentally managed forest

Also at Sommen the landowners accept environmentally managed forestry. However, the area, 133 ha, is relatively small, and only the area of EMF at Hemshyttan is smaller (Fig. 23).

Comparison between the planned area and the result

The site size objectives for the LIFE reserve have changed considerably during the project, depending on existing and future possibilities of results of negotiations. Compared with the contract, the nature reserves in this landscape have been increased by altogether 54 hectares. The present LIFE reserve consists of the land area in the Sjövik and Ivranäs nature reserves, altogether 69 hectares.

The difference between the plan and the result is big (Table 7). None of our proposed sites with Conservation agreements have been possible to carry out. One new site has been included, but the area of this site is small and totally the area with agreements has decreased by almost 60 ha compared with the plan. The accomplishment of Biotope reserves and Adapted forestry is much better. One site proposed as Biotope reserve has been deleted and the area has decreased by 2.4 ha. It has not been possible to replace this with another site because there are no other sites that fulfil the definition of Biotope reserve.

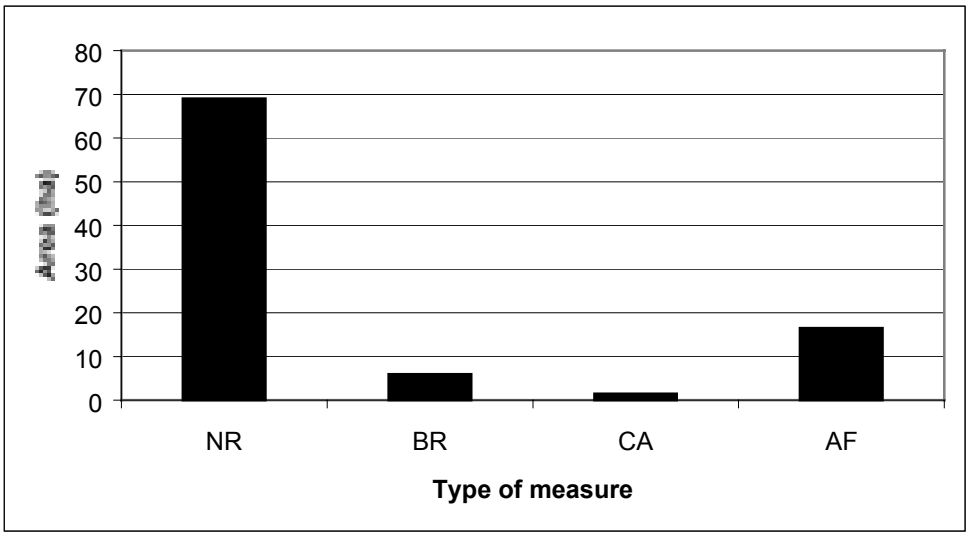

Fig. 22. Total area (ha) of Nature reserves (NR), Biotope reserves (BR), Conservation agreements (CA) and Adapted forestry (AF) at Sommen.

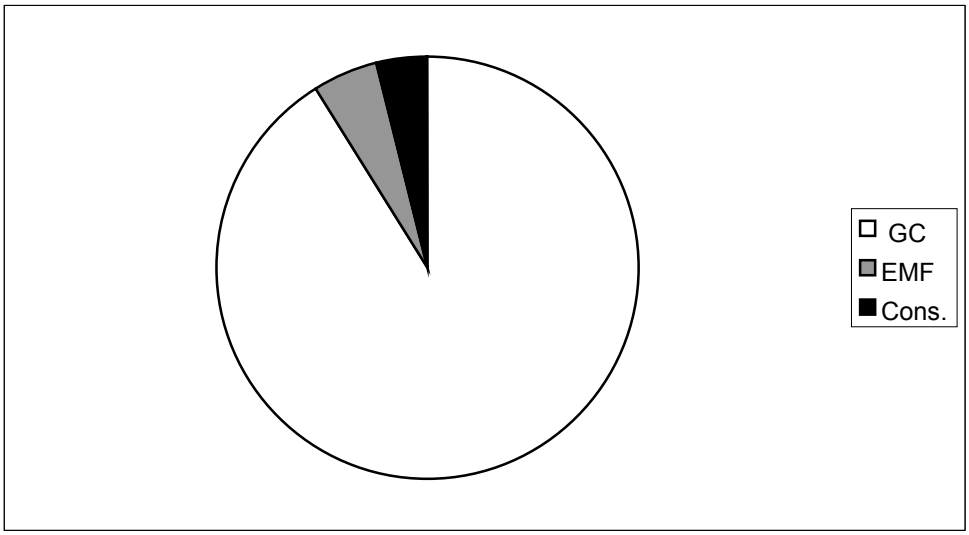

Fig. 23. Proportion of forestry with general care for conservation (GC), environmentally managed forestry (EMF), and conserved area (Cons.) at Sommen. The conserved area includes Nature reserve, Biotope reserve, Conservation agreement and Adapted forestry.

9. Public awareness and dissemination of the results

Newspapers, radio and local TV-stations have shown great interest in the project. The project has been presented on many different occasions for visitors to the National Board of Forestry, for students, and several smaller seminars.

Information to landowners

Information about the project was sent to all landowners as soon as all landscapes were decided. The landowners were later invited to meetings with the County Forestry Boards. Later a brochure was produced and delivered to all landowners. Finally, landowner opinions about the project were investigated with an enquiry.

Seminars and workshops

The project has been presented at numerous seminars and workshops. As a part of the Life co-operations of the Swedish Forest Administration, the project has been highlighted at events in Kinna in Sweden, Riga in Latvia, Tallin in Estonia, Rovaniemi in Finland, Shawinigan in Québec, Canada. It has also been the focus of separate presentations at four international seminars or conferences:

- Jyväskylä, Finland, 22-23 April 1996
- Karlstad, Sweden, 2-3 November 1998
- LIFE WEEK in Brussels October 22nd 1999 and Life-Nature conference in Parma, Italy, 2001

In Jyväskylä the three project co-ordinators from the Swedish project and people from the regional and central authorities, including the Ministry in Finland, participated. Researchers from different universities and representatives from NGOs in the Nordic countries were also present. During the first day, the Finnish and Swedish LIFE projects were presented. The conservation status of the White-backed woodpecker was presented, as well as landscape planning and management strategies. During the second day, there were field visits to some of the sites affected by the Finnish LIFE project. At these sites, the conservation values and management was discussed.

The final seminar presenting the project was organised in Karlstad 2-3 November 1998. At this seminar also researchers from Norway and representatives from the Finnish woodpecker project participated. Totally about 30 persons participated representing the land-owners, forest companies, NGOs, authorities and researchers. The result from the projects both in Sweden and in Finland were presented and evaluated, and the need of continued actions were discussed.

Life-Week was organised by the European Commission and it highlighted experiences and issues of the Life-Programme. Mr Erik Sandström was invited to contribute to Session 9 “Pioneer projects for forest management”. The title of the presentation was “A Life-Nature “forest” project, private owners and Natura 2000”. That presentation was slightly revised and presented by Ms. Josefine Gustafsson at the Life-Nature Conference in Parma, Italy in June 2001.

Conferences

Two posters about the project were produced. These have been shown on several occasions. Some of the most important are two big international conferences: Uppsala, Sweden, June 1997 (de Jong 1998), and Duluth, Minnesota, USA, August 1997.

Subsequently these posters were merged into one. It has been shown at Life-week 1998, GREEN WEEK 2001 and 2002, Swedish Presidency conference "Bridging the Gap 2001 and Natura conference 2001 at Fort Milton, Scotland.

Publications

A two-page article was included in the special Life supplement to SkogsEko nr. 3/2001. This journal was distributed to 270 000 forest owners in Sweden. A translation to English was printed in 4000 copies. The European Commission distributes some 2000 copies at various events 2002. Further information on the project is available at www.svo.se/life/woodpeckers

10. Project assessment

"Successes and failures"

This chapter analyses the output of the project, comparing the objectives, etc., in the contract including clauses/approved changes and the result.

The project has been very successful in terms of nature conservation. Even larger areas than the objective in the contract have been protected as nature reserves. The technical part of the process of making a nature reserve has been less successful, only 77% of the objective was fulfilled. There was also an error when writing the contract. The application contained no FFH habitats, which are not so expensive per hectare, but the contract was changed to expensive FFH habitats without changing the budget accordingly. So the costs have been higher than estimated in the budget.
The support from LIFE has been a large "added value" for nature conservation in Sweden. The amount of approximately 727 000 EURO is the same as funds needed to buy almost 240 hectares of land for making nature reserves. If there had not been any LIFE support these hectares would have remained as potential sites for forestry, without guarantees or obligations from the landowners to maintain the conservation values. Some of the forests might already have been cut down.

Future monitoring and investigations

It is most important for maintaining the conservation values that the restrictions are followed. The management plans for nature reserves should also be fulfilled and if necessary some of them will be revised. The County Administrations are responsible for taking care of that.

For the time being it is not possible to say what kind of future monitoring and investigations will take place but some considered by the SEPA to be important are listed below.
Monitoring of the sites in general should concentrate on the distribution of the habitats and their conservation statues. As regards the western taiga it will be necessary to examine the need for forest fires or other natural disturbances in certain taiga types. Some of the nature reserves, probably Kesebotten and Håltebyn, are expected to be part of local plans for when and where to arrange forest fires. Hopefully these plans will involve both protected and unprotected areas, so that all measures will be made in a timetable that is suitable for the species dependent on forest fires. Apart from the governmental measures there might be private initiatives, for example companies that are certified by the Forestry Stewardship Council. There are already some examples of that.

Areas with vegetation affected by restoration measures should also be monitored, both in forest and on grasslands and wetlands. Analyses about how the measures can be developed are necessary.

At Dalälven there may be a monitoring programme that concentrates on how the vegetation develops due to the absence of large flooding. The monitoring programme

will also analyse if the management trying to copy the natural disturbance is sufficient and how it might be improved.
Some of the endangered species should have their own monitoring programme, especially the White-backed woodpecker. For the time being, the following monitoring programmes, enlarged management plans, and investigations are discussed. In the Sommen area, the County Administration will arrange investigation of the insect fauna at Ivranäs.

Lessons learned during the project

Negotiations; Negotiations have been harder than we anticipated. A lot of landowners are of the opinion that if the SEPA has got economic support from EC we may be able to pay a lot more than in cases with 100% Swedish financing. As a result, the SEPA has made the project period longer for the LIFE projects.
Overall project administration: The National Board of Forestry and SEPA have found that the administration of LIFE projects is much more time consuming than expected, and than it should be. Especially the necessity to submit very detailed activity reports during the project has been underestimated. We cannot understand why the different activity reports during the project have to be so detailed. We believe that it should be possible to establish more time-saving routines as regards the activity reports. This would also decrease the cost of administration. Ultimately, the only report of importance is the final report which, of course, should be detailed.

Has the project achieved its objectives?

The overall objective, which includes conserving 625 ha as Nature Reserves, 100 ha as Biotope Reserves and 675 ha as Conservation Agreements, has been achieved. However, it has not been possible to use adapted forestry on 475 ha. The overall objectives also include public awareness and an advisory service to the forest owner. This has been achieved by several articles in newspapers, information on the TV and radio, meetings with the landowners, individual consultations with landowners, brochures, etc.

Several changes have been made from the original plan both concerning size and location of protected or restored sites. However, all sites established are of highest priority concerning nature values; they are dominated by priority habitats, they are threatened by forestry, and are potential valuable habitats for the White-backed woodpecker. In all landscapes there are still several sites with high nature values that should be protected. This means that the conservation work has to continue. However, we are convinced that the resources from the LIFE fund have been used in the most efficient way in relation to the time schedule and to nature values involved.

Conservation benefits for the species and habitats targeted, and for the Natura 2000 network

Habitat restoration and conservation involve long-term perspectives. We have to continue this work for several decades until we obtain viable populations of the White-backed woodpecker in Sweden. However, this LIFE project has been an important part of this work. Other important parts are the work done by STORA forest company and the Swedish Society for Conservation of Nature.

Socio-economic effects

One of the most important effects of this project, besides the conservation of habitats, is the successful co-operation between different authorities, companies, non-governmental organisations and landowners. Hopefully this will continue after the end of the LIFE project.

The future – Remaining threats

To concentrate the conservation efforts to some specific landscape have many long-term advantages. This type of landscape planning makes it easier for the landowners to increase both the timber production and conservation efforts. The County Forestry Board has informed many landowners, especially those that own forests with high nature values, on several occasions during excursions and other meetings. Well-educated and informed landowners increase the possibility to adapt the forestry to nature values, and combine forest production with conservation.

When preparing this work, surveys were made and all landscapes were mapped according to their nature values. However, during the project period the knowledge about each landscape and its nature values has increased. We are much better prepared if any threat will arise.

The main threat in the future in unprotected sites is the uncontrolled forestry activities such as logging for firewood and thinning. For this type of logging the landowners do not have to inform the County Forestry Board. Unfortunately, these activities often decrease the amount of deciduous trees and dead wood considerably. To solve the problem we have to continue to conserve sites with high values, but must also continue to inform the landowners. To be able to conserve the White-backed woodpecker we have to increase the nature values in the whole landscape. It is not enough with some nature reserves or other protected areas.

11. Conclusions

- The result of this project in terms of conservation and habitat restoration will obviously increase the possibilities for the White-backed woodpecker to survive in Sweden. However, the population size is very small, and there is a risk of extinction due to stochastic events. It is important to continue with different conservation measures, but it is probably also necessary to introduce more individuals to support the existing population. It is most important to change forestry practises towards a more general respect for nature conservation and to increase the abundance of dead wood and the proportion of deciduous trees.

- In this project, about 2 000 ha of forest have been protected as Nature reserves, biotope reserves and Conservation agreements. The nature values of about 250 ha forest have increased as a result of conservation burning, killing of trees by girdling and use of explosives, increasing the proportion of deciduous trees by thinning operations, etc. Further more, about 2 000 ha of productive forest are voluntarily conserved by the landowners. Information campaigns and excursions with landowners have resulted in increasing knowledge about woodpeckers, nature conservation and forestry.

- The project has been a fruitful co-operation between several authorities, universities, forest companies and other organisations. This co-operation will continue after the project period.

- The knowledge of nature values within these 10 landscapes has increased, and the conservation efforts within the sites will continue.

- Negotiations with landowners very important, but are also time-consuming, and initially a lot of time is needed for information, excursions and consultations.

- The project has clearly demonstrated that by using this method it is possible to combine nature conservation with forestry production. The method includes landscape planning, combining different conservation measures, information and discussions with landowners in an early phase etc.. This conclusion has already given rise to new projects. One example is the LEKO-project (In Swedish: LandskapsEkologiska KärnOmråden), which stands for Landscape Ecological Core Areas for Conservation. This project is implemented in landscapes all over Sweden. These landscapes have high conservation values, that are being promoted by work according to the project methodology. special funds have been set aside for this purpose by the National Board of Forestry and the Swedish Environmental Protection Agency. Other examples are projects on Landscape planning for conservation and production values in deciduous forests, which have started in several regions in south Sweden.

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"White-backed woodpecker landscapes and new nature reserves" was a project conducted 1995-1999 with support from EUs' Environmental Fund LIFE-Nature. The beneficiary was the Swedish National Board of Forestry. The partners were the Swedish Environmental Protection Agency and 6 County Administrations as well as 6 County Forestry Boards. Actions took place in ten different landscapes in south and central Sweden.

The White-backed woodpecker is listed in the EU Birds Directives' Annex 1 and measures for protecting it are of high priority. The project strategy was to combine a variety of actions to restore habitats and a diversity of protection measures including Nature reserves and owners' voluntary protection. A number of these habitats, including the main protected habitat, Western taiga, are listed in the Habitats Directives' Annex 1. There were 21 species listed in the Birds Directive and five species listed in the Habitats Directive in the areas suggested for Natura 2000. The joint efforts to promote the White-backed Woodpecker continue and the project methodology has subsequently been duplicated in many areas with important natural values all over Sweden. The project is a unique example of how to combine forestry and nature conservation based on landscape planning

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