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Ancient trees and their fauna and flora in the agricultural landscape in the County of Östergötland

Recent work on the ancient trees started around 1990 with an inventory of an area of about 500 km² south of Linköping in the county of Östergötland, Sweden.
Many people were aware that this area was of special interest for nature conservation and biological diversity, but how important was it and how could the nature values of the area be preserved?

Earlier experiences taught us that it is important that landowners and people living in the actual areas are involved and informed about what was going on. So we started by informing the newspapers and other media in the area about our nature conservation plan and followed this up with information meetings in the evenings in many places. The plan was to make a general inventory first. This would be followed by more detailed inventories of different groups of organisms, which will tell us something about the nature values in the area and on the different sites. Then we became aware of the importance of the ancient trees so we decided to start a complete inventory of all the big and hollow trees in the area. This tree inventory has later been extended to cover the whole of the county and the idea has also been spread to other parts of southern Sweden. The long-term plan is to use the maps of the ancient trees together with other data, to produce plans for each area and, in co-operation with landowners, create strategies for the future.

In parallel with the work descibed above, and sometimes as a result of it, various similar projects have been started in different regions in Sweden. In 5-10 years time we believe that we will have a good picture of how many and where our ancient trees are in Sweden. One of the reasons why we are so concerned about the ancient trees is that we believe that they are of great importance when considering nature values and qualities in forests, agricultural landscapes etc.

METHODS

The purpose of the inventory at a landscape level was to establish where the highest conservation values were found. The main methods used were infrared aerial photographs for the initial survey and then, in the field, estimate and classify the values of the different sites.

Next was to make a more detailed inventory of the most interesting groups of organisms, in this case, saproxylic invertebrates, lichens and fungi. This will give us an instrument to validate the site in more detail and provide a better opportunity to state which kinds of management will be most suitable for different sites. The inventories were carried out with different kinds of traps for invertebrates. We have focused on the species living inside the hollow trees, under the bark and in other woody substrates. When using a ladder you can reach cavities higher up in the tree. The lichen and fungi inventories were made by other specialists who visited different sites and documented threatened species. We have also chosen some of the best sites to be monitored in more detail.

Early in this study we discovered there was a need for a simple method to describe what age and state of development the tree was in. When two people talk about an old tree they often mean two different things. We had also read reports of many inventories without getting any information about what the old trees on the site looked like. It is crucial to know about this when it is necessary to decide if the site is interesting or not for threatened cryptogams or invertebrates. A development scheme (**Fig. 1**) was therefore constructed, mainly for old oaks, but the scheme can be used for all kinds of old hollow trees (Jansson 1995).

Then it was possible for us to start an inventory of old and hollow trees in our county. The first part of this inventory started in winter 1998/1999. A project leader instructed many unemployed people to look almost everywhere for all kinds of hollow trees and old trees with a girth of 0.7m or more. For oaks the minimum size was 1.0m in girth.

When we had identified which kinds of tree were hosting most of the threatened species it was time to catalogue them and put them on digital maps on the computer. We then had the information to make maps for future landscape planning and to start discussions with landowners and others who make decisions on how to use the land in the future. We have to consider the species that has the lowest capacity for dispersal. One example is the big Hermit beetle (*Osmoderma eremita*); when measured in field research in Sweden work has shown that the beetle only moved 200-300m maximum (Ranius 2000).

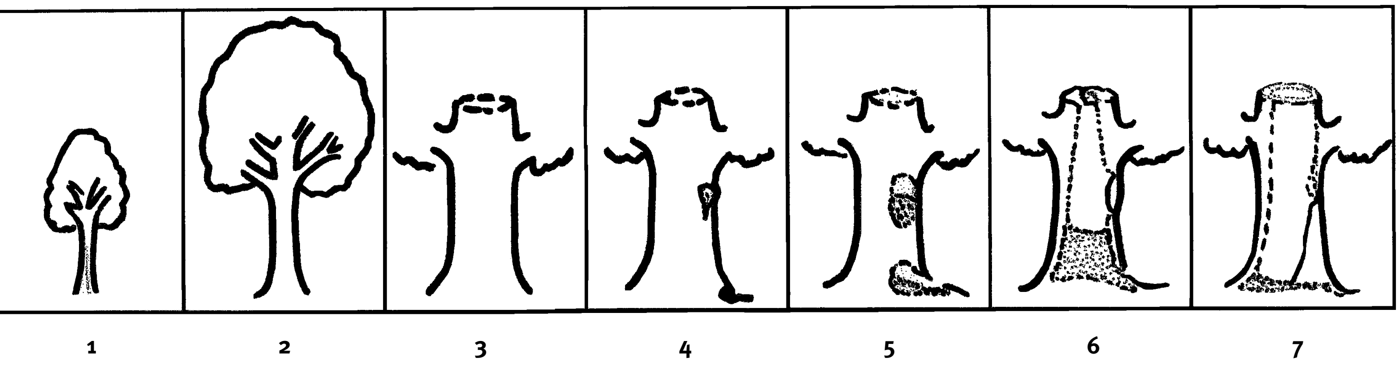

Figure I. *Development scheme for hollow trees, especially made for oaks but can also be used for other tree species especially broad-leaved deciduous trees. The numbers used represent the development stage of the tree and also indicate the age. In stage 7 oaks have normally reached an age of 300-600 years, depending on the climate. (Antonsson & Jansson 1997)*

RESULTS

One of the more sensational discoveries was the high numbers of threatened species in this habitat and the fact that, when compared with other parts of Sweden and other countries, we have an important responsibility for the survival of many species living in this habitat.

Another discovery was the uneven spread of important trees in the area. It was only the largest sites with many hollow trees that hosted a complete list of species.

In spite of this, small and isolated sites with only a few trees can host relict populations of many threatened species for a long time. We can expect that these populations will become extinct unless there are some alternative trees that can reach a suitable age for hosting this specialist species community.

Lichens and fungi

The most important groups apart from the invertebrates in this habitat are lichens and fungi. There have been many new interesting records of species over the years in the County of Östergötland. Some of the species are very rare but the most remarkable results are the number of records for some of Sweden's rare and threatened species (**Table 1**).

Saproxylic invertebrates

There is a remarkable fauna connected with old hollow trees, especially oaks. This investigation has given us thousands of new records for threatened species in this area. We have also discovered that using traps, both as a pitfall trap inside the tree and window traps outside the tree, is much more efficient than looking at the trunk and sifting bark and wood mould from tree cavities. We have noticed that there is higher invertebrate activity in the cavities higher up in the tree. One reason may be that predation, on for example beetle larvae, in a cavity at the bottom of the tree is greater than higher up in the tree.

A consequence of using this method at 75-80 sites has given us an opportunity to use the NSS-analyze (Nested species subset). With this method you can predict similar habitats where key species occur at the same time as the majority of the rarest and most threatened species. In the future you can then carry out a much faster inventory. By finding some of the key species you can be almost sure that there is a rich fauna on the site.

Table 2 gives a list of some Red Data Book saproxylic invertebrates (highest threat categories) in Sweden that have been found in this investigation.

TABLE I
SPECIES OF LICHEN AND FUNGI IN IUCN THREAT CATEGORIES CR (critically endangered), **EN** (endangered) and **VU** (Vulnerable) in Sweden that have recently (since 1980) been recorded on oaks in the County of Östergötland. **IUCN** categories are according to Gärdenfors 2000.

Taxonomic group	scientific name	Threat category	No of recent records (after 1980) in the county of Östergötland
Fungi	*Hapalopilus croceus*	CR	5
Lichen	*Arthonia arthonioides*	EN	1
Lichen	*Bactrospora dryina*	EN	2
Lichen	*Sphinctrina leucopoda*	EN	1
Fungi	*Piptoporus quercinus*	EN	4
Lichen	*Arthonia byssacea*	VU	46
Lichen	*Arthonia pruinata*	VU	2
Lichen	*Bactrospora corticola*	VU	5
Lichen	*Calicium quercinum*	VU	138
Lichen	*Chaenotheca hispidula*	VU	22
Lichen	*Cyphelium sessile*	VU	44
Lichen	*Lecanographa amylacea*	VU	260
Lichen	*Lecanora sublivescens*	VU	1
Lichen	*Pannaria conoplea*	VU	1
Fungi	*Hymenochaete subfuliginosa*	VU	1
Fungi	*Inonotus dryadeus*	VU	11
Fungi	*Inonotus dryophilus*	VU	30
Fungi	*Polyporus umbellatus*	VU	1

TABLE 2.
RED DATA BOOK BEETLES AND PSEUDOSCORPIONS IN SWEDEN FROM IUCN THREAT CATEGORIES CR, EN AND VU

(see table of lichens and fungi above) recorded (since 1980) in old hollow trees in the county of Östergötland. Species names follow Lundberg (1995) and IUCN categories are according to Gärdenfors (200

Invertebrate group	Family taxa	Name of species	Threat category
Coleoptera	Leiodidae	*Liodopria serricornis*	EN
Coleoptera	Catopidae	*Dreposcia umbrina*	EN
Coleoptera	Staphylinidae	*Batrisodes adnexus*	EN
Coleoptera	Scarabaeidae	*Gnorimus variabilis*	EN
Coleoptera	Mycetophagidae	*Mycetophagus quadriguttatus*	EN
Coleoptera	Tenebrionidae	*Corticeus fasciatus*	EN
Coleoptera	Tenebrionidae	*Allecula rhenana*	EN
Coleoptera	Tenebrionidae	*Prionychus melanarius*	EN
Coleoptera	Cerambycidae	*Leptura revestita*	EN
Coleoptera	Histeridae	*Abraeus granulum*	VU
Coleoptera	Scydmaenidae	*Scydmaenus perrisii*	VU
Coleoptera	Staphylinidae	*Velleius dilatatus*	VU
Coleoptera	Staphylinidae	*Plectophloeus nitidus*	VU
Coleoptera	Staphylinidae	*Batrisodes delaporti*	VU
Coleoptera	Staphylinidae	*Trichonyx sulcicollis*	VU
Coleoptera	Staphylinidae	*Hapalarea vilis*	VU
Coleoptera	Staphylinidae	*Thamairaea hospita*	VU
Coleoptera	Staphylinidae	*Tachyusida gracilis*	VU
Coleoptera	Staphylinidae	*Cypha nitida*	VU
Coleoptera	Scarabaeidae	*Liocola marmorata*	VU
Coleoptera	Scarabaeidae	*Osmoderma eremita*	VU
Coleoptera	Scarabaeidae	*Gnorimus nobilis*	VU
Coleoptera	Lucanidae	*Lucanus cervus*	VU
Coleoptera	Elateridae	*Athous mutilatus*	VU
Coleoptera	Elateridae	*Calambus bipustulatus*	VU
Coleoptera	Elateridae	*Procaerus tibialis*	VU
Coleoptera	Elateridae	*Ampedus cardinalis*	VU
Coleoptera	Elateridae	*Elater ferrugineus*	VU
Coleoptera	Buprestidae	*Agrilus biguttatus*	VU
Coleoptera	Dermestidae	*Globicornis rufitarsis*	VU
Coleoptera	Bostrichidae	*Bostrichus capucinus*	VU
Coleoptera	Ptinidae	*Ptinus sexpuntatus*	VU
Coleoptera	Anobiidae	*Anitys rubens*	VU
Coleoptera	Lymexylidae	*Lymexylon navale*	VU
Coleoptera	Trogositidae	*Grynocharis oblonga*	VU
Coleoptera	Malachidae	*Hypebaeus flavipes*	VU
Coleoptera	Tenebrionidae	*Pentaphyllis testaceus*	VU
Coleoptera	Tenebrionidae	*Tenebrio opacus*	VU
Coleoptera	Tenebrionidae	*Allecula morio*	VU
Coleoptera	Melandryidae	*Orchesia fasciata*	VU
Coleoptera	Melandryidae	*Hypulus quercinus*	VU
Coleoptera	Cerambycidae	*Grammoptera ustulata*	VU
Coleoptera	Cerambycidae	*Anoplodera sexguttata*	VU
Pseudoscorpionidea		*Larca lata*	VU
Pseudoscorpionidea		*Anthrenochernes stellae*	VU
Pseudoscorpionidea		*Cheridium museorum*	VU

Hollow tree and inventory of old trees

We have now mapped over half of the area of the county and there is individual information for more than 30 000 trees.

All this information is important when evaluating a site for nature conservation and for monitoring and future landscape planning together with the landowners. One example of the results is shown in **Figures 2 and 3**.

Spin-off effects

Projects like this create many spin-off effects. One of the most important for future work with nature conservation in this area is the positive media response. A lot of people start to make connections between oak landscapes and positive things such as high diversity, beautiful nature, good conditions for the threatened Hermit beetle (*Osmoderma eremita*) and so on.

The mapping of all the old trees is also a spin-off, together with the ecological research from different universities especially University of Linköping. One event that received a lot of attention was a competition to find the largest tree in the county. Information films about old trees and information brochures have also been produced and there is a book in production about this landscape.

We can also see a greater awareness about old trees and the understanding that this kind of nature needs to be managed in order to keep the values in the future.

Almost every country in Europe has smaller or larger regions with old and hollow trees. In summary it is almost always rare to have such large areas with a lot of hollow trees so each such landscape has nature values that are unique or have a very rare distribution. It is hoped that increased communication between nature conservation people from different countries with interests in old trees can help people to realize that all these places of unique biological diversity can be protected in the near future.

NATURE CONSERVATION

Nature conservation work has achieved good results in the last few years. A lot of nature reserves have been established in the area and, together with other nature conservation instruments and the EC Agricultural Environmental Scheme, there is a good hope for preserving a high level of diversity in these landscapes in the future.

In Sweden the state pays an economical compensation to the landowners of nature reserves because the rules do not allow them to get an ordinary income from the land. The regulations and the management plan for the nature reserve helps to decide what is allowed or not.

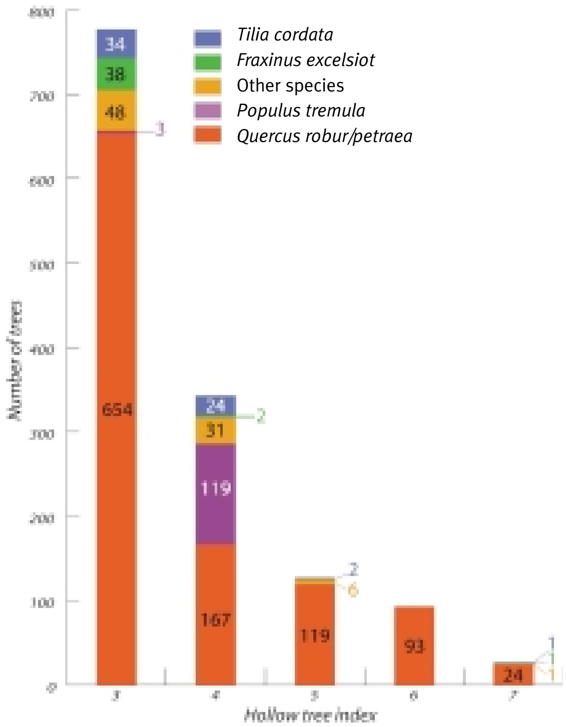

Figure 2. *Diagram showing how many and which tree species occur inan area near Bjärka-Säby, south of Linköping, Östergötland, Sweden. This figure is from the same area as illustrated in the map below. The major tree is oak (*Quercus robur *L.) and this particular area has one of the highest densities of old oaks in the County of Östergötland.*

FUTURE PLANNING ON THE LANDSCAPE LEVEL

The two most important problems are the large distances between old trees in some areas and the recruiting of new host trees to prevent a big age gap between the generations.

One way to solve this problem is to create a plan at a landscape level and especially for the future trees. The fundamental statement of the plan is that if there has been specific old trees in an area with high values for biodiversity the plan should make sure that there always will be old trees of the right kind and with the right qualities in this area. In some exceptional cases there will perhaps be some very special efforts needed, such as speeding up the work of wood living fungi in the tree so it will develop rotten wood and wood mould in a shorter time, or protecting small plants from browsing animals by putting small fences around them.

We hope that the consistency of approach in the work as described above will be enough to preserve this and other beautiful and important landscapes for our children and the future●

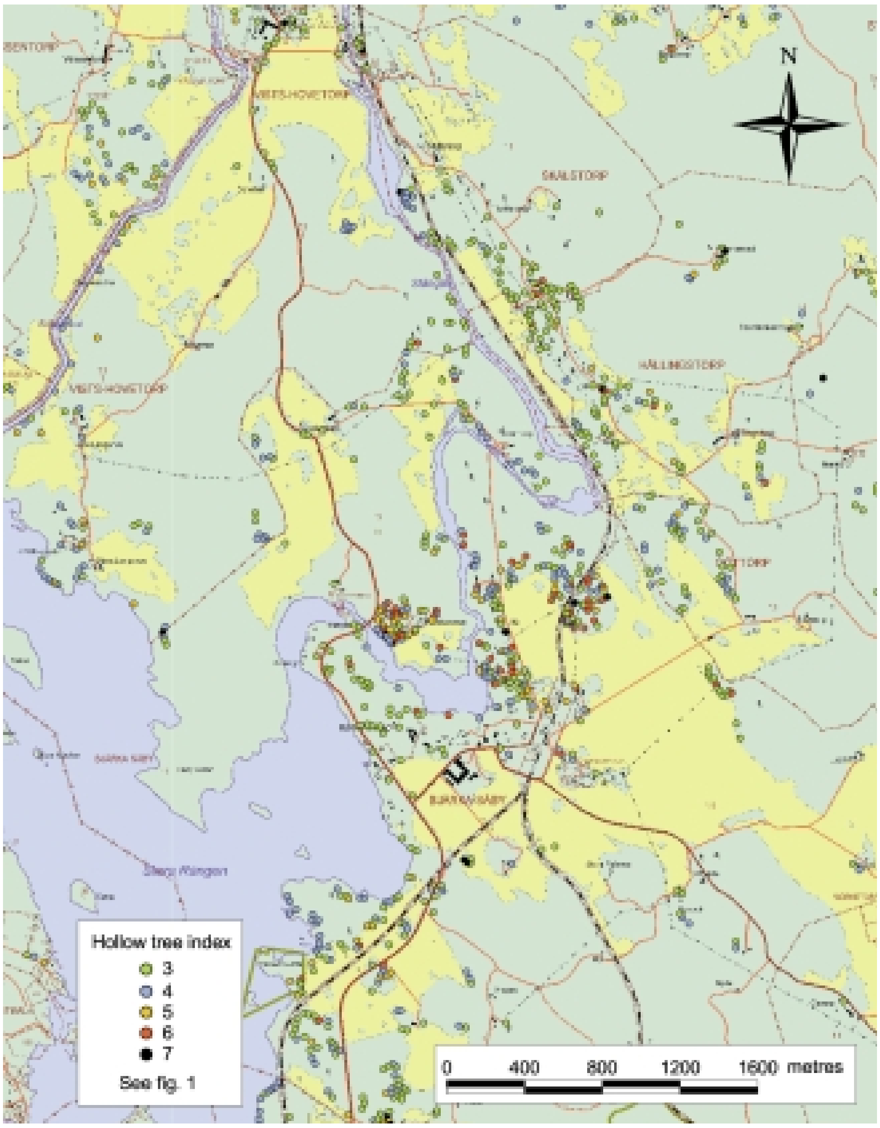

Figure 3. *An example of the old tree mapping project that is ongoing in the County of Östergötland, Sweden. The dots represent hollow trees or trees over 1.0m (oak) or 0.7m in trunk diameter (1.3m above ground) for all other tree species.*

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