



Crop Wild Relatives

An Inventory in the Biosphere
Reserve Kristianstad Vattenrike 2021

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Mora Aronsson, Senior Advisor at SLU, Swedish Species Information Centre, 2022-05-29.

Cover photo and all other photos by Mora Aronsson.

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Introduction

Inventory of crop wild relatives (CWR), wild populations/species that are closely related to a crop, is a part of the project *Nordic PGR Conservation*. The project is designed for promoting the conservation of these genetic resources in the Nordic countries and facilitating their use in future research and plant breeding efforts.

The Biosphere reserve Kristianstad Vattenrike was selected as an area for inventory as earlier studies has shown a high diversity of crop wild relatives here (Weibull and Phillips 2020). Within the Biosphere reserve, four nature reserves were chosen (out of 32) for detailed study. The selection of sites was made with the aim to include as many species as possible from the Nordic CWR priority list (Fitzgerald et al, 2021). For more details on the selection, see the chapters below regarding each area. The following nature reserves were inventoried in 2021 (and date of inventory): Fjälkinge backe (2021-07-13), Degeberga backar (Söndre klack) (2021-07-14), Sånarna (2021-07-14) and Lyngsjö (2021-07-15).

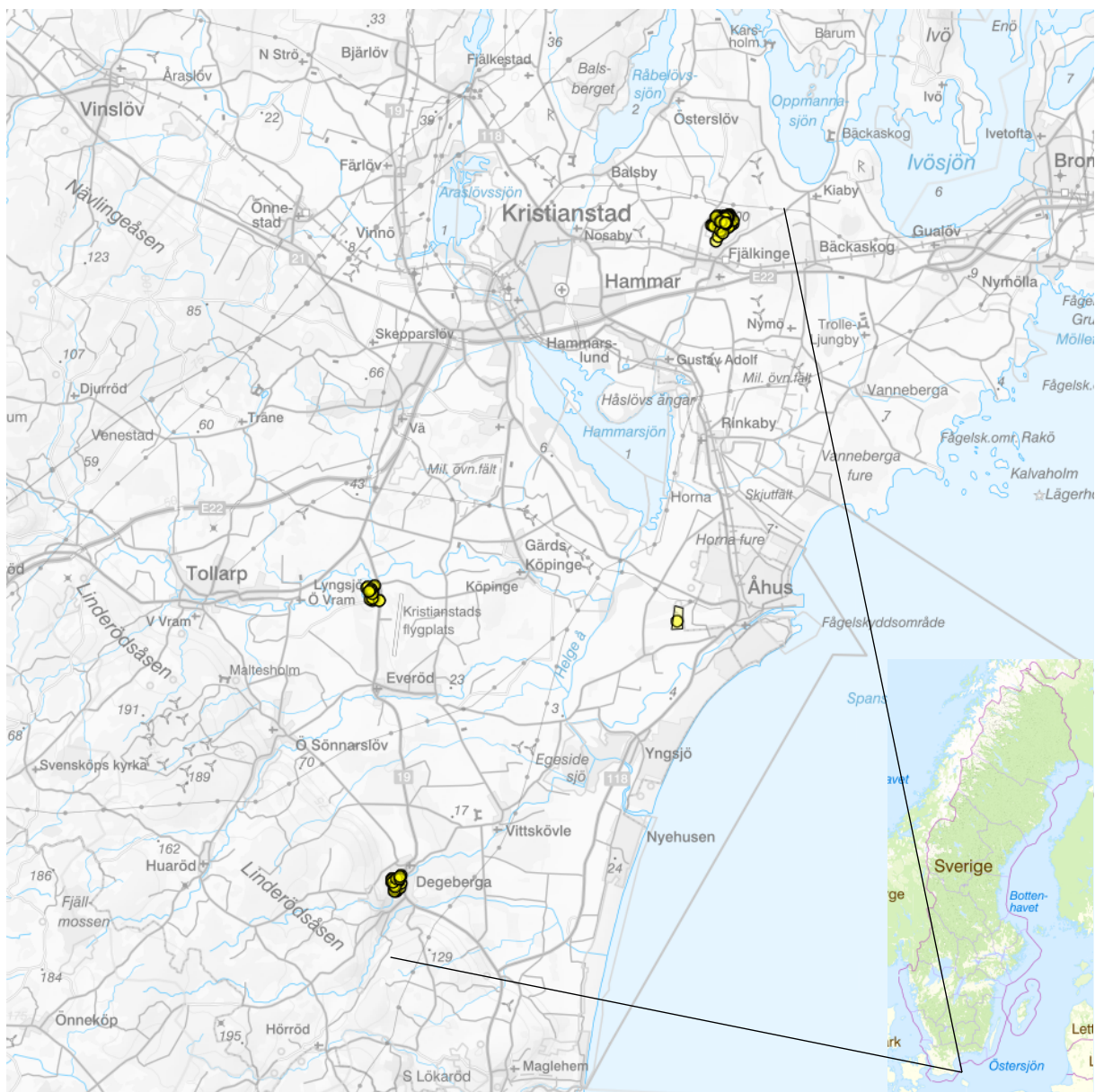
The selected areas are between 31 and 190 ha and are for the most part homogenous and quite easy to do species inventory in. The whole area of each nature reserve was investigated for the target species, but intensely grazed areas and habitats not suitable for the target species (e.g. reed belts) were surveyed in less detail. Data on location, distribution and size of the population was collected, as well as other relevant information, such as threats, management needs and more. Observations of all species from the priority list was recoded, as well as invasive alien species (Strand et al, 2018) and red-listed species (SLU Artdatabanken, 2020).

The result from the inventory is published digitally on Artportalen.se (Swedish Species Gateway) and uploaded to GBIF (Global Biodiversity Information Facility). The dataset is possible to download from Artportalen using the project-parameter "CWR inventering 2021".

Objectives

The main objectives for the inventory 2021 was:

1. To provide background information for recommendations on future management of the selected areas and to promote the conservation of crop wild relatives.
2. Test methods for selection of sites and methods for inventory.
3. Identify populations suitable for *in situ* conservation



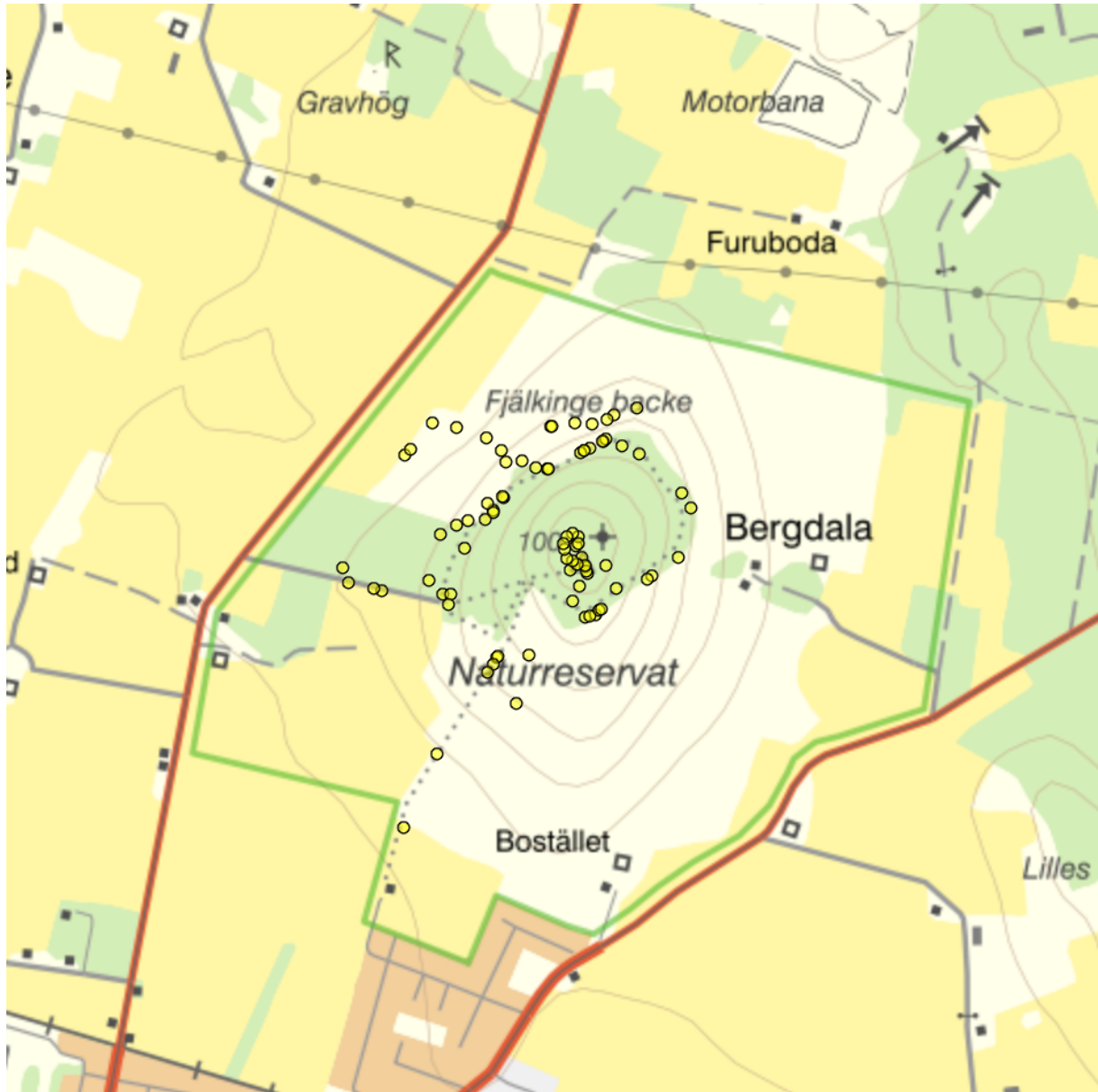
Map 1. Areas included in the inventory (yellow circles). Artportalen.se

Fjälkinge backe

Fjälkinge backe (190.4 ha) is a granite outcrop in an area dominated by calcareous ground and with a highest point about 100 m above sea level. Most of the area is used as pasture and has, at least in part, been intensely grazed and fertilized. Additionally, in the western part, some old gravel pits are found. The outcrop itself is covered with forest, beech at the margins and pine forest dominating the central parts. The pine forest is dominated by species typical for lime-poor forests (uncommon in the area), such as blueberry. Stone walls are frequent in the area and are remnants after former landscape division based on agricultural land use. The border between the pasture and the forest has a big and largely intact stone wall. In the central forest there are several alien species that have escaped from gardens in the surrounding area (some could even have been planted within Fjälkinge backe), such as *Robinia pseudoacacia*, *Parthenocissus inserta* and more. In addition, the red-listed species *Pulsatilla vulgaris* subsp. *vulgaris* and *Potentilla heptaphylla* were found and they were

monitored according to the Swedish Flora Guardian's methodology and subsequently reported in Artportalen.

This site was selected for inventory since it is located in the northern part of the reserve and has, at least in part, a different geology and species composition than the rest of the Biosphere Reserve.



Map 2. Fjälkinge backe. Yellow dots are observations of crop wild relatives reported during the inventory (Artportalen.se).



Figure 1. Fjälkinge backe from south.



Figure 2. One of the *Vaccinium myrtillus* stands.



Figure 3. The invasive *Robinia pseudacacia*.

Table 1. Taxa of observed crop wild relatives at Fjälkinge backe Nature Reserve. Population amount: C=common, F=Frequent, S=Scattered, R=Rare.

Taxon	Threat category*	Number of observations	Population frequency	Alien species [#]
<i>Acer pseudoplatanus</i>		1	S	YES
<i>Aesculus hippocastanum</i>		4	R	YES
<i>Armeria maritima</i>		1	R	
<i>Corylus avellana</i>		2	F	
<i>Dactylis glomerata</i>		5	S	
<i>Festuca rubra</i>		1	C	
<i>Fragaria vesca</i>		2	S	
<i>Lactuca muralis</i>		3	R	
<i>Ligustrum vulgare</i>		1	R	YES
<i>Malus domestica</i>		1	S	YES
<i>Malus sylvestris</i>		2	S	
<i>Medicago lupulina</i>		2	S	
<i>Medicago sativa</i> subsp. <i>falcata</i>		13	S	
<i>Medicago sativa</i> subsp. <i>sativa</i>		1	R	
<i>Medicago sativa</i> subsp. <i>x varia</i>		1	R	
<i>Parthenocissus inserta</i>		1	S	YES
<i>Philadelphus coronarius</i>		1	R	YES
<i>Phleum pratense</i> subsp. <i>nodosum</i>		1	S	
<i>Poa pratensis</i>		1	C	
<i>Poa pratensis</i> subsp. <i>angustifolia</i>		1	R	
<i>Potentilla heptaphylla</i>	NT	1	R	
<i>Prunus avium</i>		5	F	
<i>Prunus spinosa</i>		3	S	
<i>Pulstatilla vulgaris</i>	VU	2	S	
<i>Quercus rubra</i>		1	R	YES
<i>Ribes uva-crispa</i>		1	S	
<i>Robinia pseudoacacia</i>		1	R	YES
<i>Rubus caesius</i>		2	S	
<i>Rubus idaeus</i>		2	S	
<i>Sambucus racemosa</i>		1	S	YES
<i>Symphoricarpos albus</i>		1	R	YES
<i>Syringa vulgaris</i>		1	R	YES
<i>Trifolium arvense</i>		1	S	
<i>Trifolium medium</i>		1	S	
<i>Trifolium pratense</i>		2	F	
<i>Trifolium repens</i>		3	F	
<i>Vaccinium myrtillus</i>		16	S	

*IUCN threat categories (Artdatabanken, 2020); [#] Definition of alien species (Strand et al, 2018)

Degeberga backar (Söndre klack)

Degeberga backar (31,4 ha) is one of the famous xeric steppe sites in Sweden, with extended areas of calcareous sand at the surface, which results in special conditions suitable for several in Sweden rare and red-listed species. The main part of the reserve is pasture with some scattered trees, but it also includes a brook with some small wetlands surrounding it.

This site was selected for inventory since it is located in the southern part of the Biosphere Reserve and has a diverse flora rich in threatened plants.



Map 3. Degeberga backar (Söndre klack). Yellow dots are observations of crop wild relatives reported during the inventory (Artportalen.se).



Figure 4. Degeberga backar, western part of the reserve.



Figure 5. Degeberga backar, southern part of the reserve.



Figure 6. The red-listed *Medicago minima* growing in Degeberga backar.

Table 2. Taxa of observed crop wild relatives at Degeberga backar Nature reserve. Population amount: C=common, F=Frequent, S=Scattered, R=Rare.

Taxon	Threat category*	No of observations	Population frequency
<i>Alyssum alyssoides</i>	NT	1	S
<i>Dactylis glomerata</i>		1	F
<i>Dianthus arenarius</i>	VU	1	F
<i>Festuca rubra</i>		1	F
<i>Humulus lupulus</i>		1	R
<i>Lolium perenne</i>		5	F
<i>Medicago lupulina</i>		5	S
<i>Medicago minima</i>	VU	1	R
<i>Medicago sativa subsp. falcata</i>		10	F
<i>Phleum arenarium</i>	VU	3	S
<i>Phleum pratense subsp. nodosum</i>		7	S
<i>Poa pratensis</i>		2	C
<i>Silene conica</i>		1	S
<i>Trifolium arvense</i>		1	F
<i>Trifolium pratense</i>		3	F
<i>Trifolium repens</i>		1	F

*IUCN threat categories (Artdatabanken, 2020)

Sånnarna

Sånnarna (44,6 ha) is a flat sandy, calcareous area (the elevation differs only a few meters within the area). In former times, it was used as a traditional shifting cultivation area with up to 50 years in rotation time. Today it is used for pasture. In the northern part there are newly constructed ponds for frogs and some ruderal areas, which were not included in the inventory. In the area some demonstration farming is being carried out to show how the land was used in former days. Moreover, there are some areas to test different management approaches to increase the lime content in the topsoil. Due to the historical use and geological homogeneity, the area is species poor as far as vascular plants are concerned. The region where the inventory was made is very homogenous and most species present were evenly distributed across the whole area, and therefore species are only recorded once for the whole area (Table 3).

This site was selected since it is a new nature reserve and several restoration activities are currently taking place, which could be of interest for crop wild relative conservation.



Map 4. Åhus, Sånarna. Yellow dots and areas are reported observations of crop wild relatives during the inventory (Artportalen.se).



Figure 7. Sännarna from the south.



Figure 8. Sännarna from the west.

Table 3. Taxa of observed crop wild relatives at Sännarna Nature reserve. Population amount: C=common, F=Frequent, S=Scattered, R=Rare.

Taxon	Threat category*	No of observations	Population frequency
<i>Anthericum ramosum</i>		1	F
<i>Festuca arenaria</i>	NT	1	R
<i>Medicago sativa</i> subsp. <i>falcata</i>		1	C
<i>Phleum pratense</i> subsp. <i>nodosum</i>		1	F
<i>Trifolium arvense</i>		1	C

*IUCN threat categories (Artdatabanken, 2020)

Lyngsjö

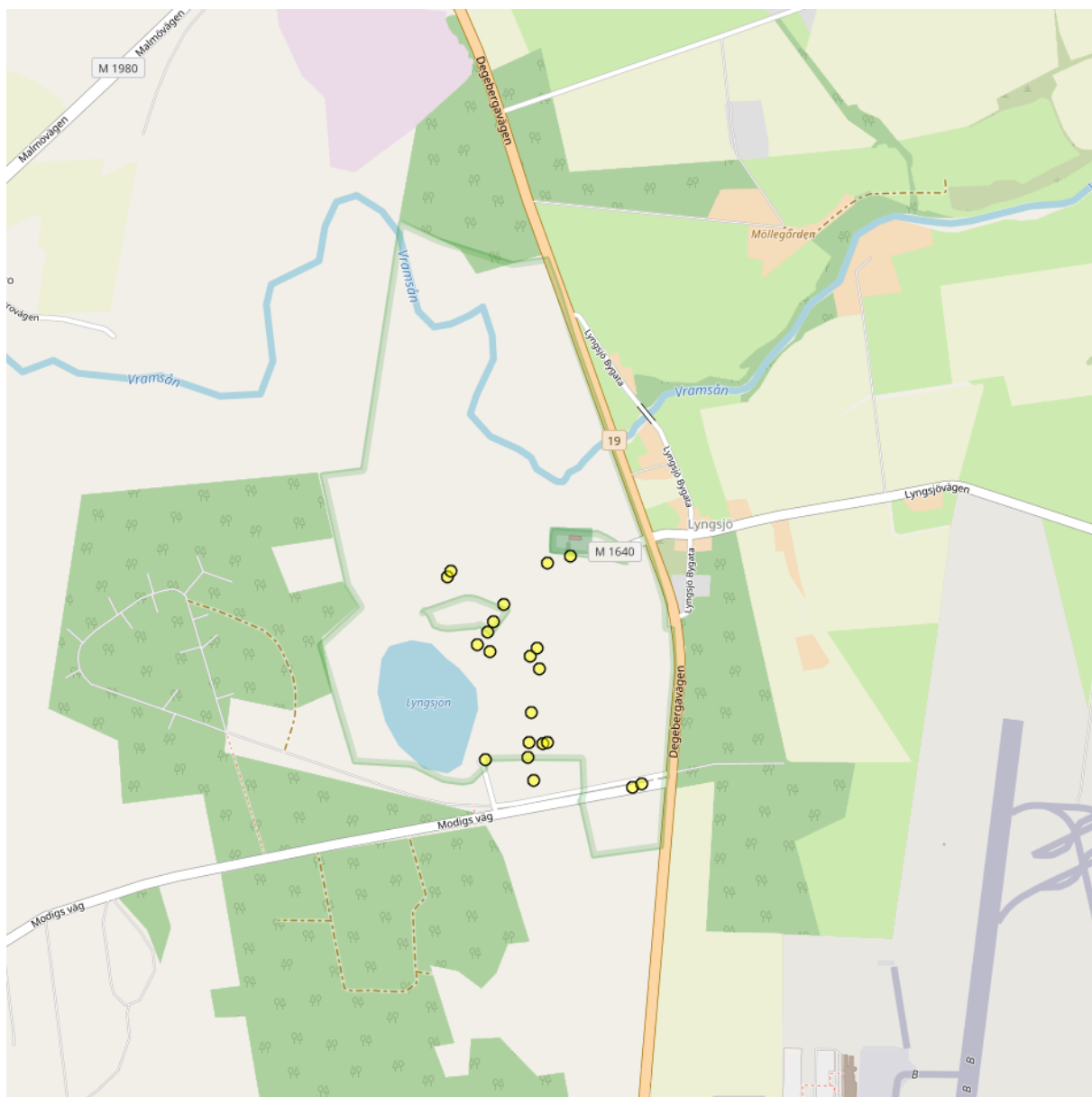
Lyngsjö (80.3 ha) Nature Reserve has recently been enlarged from a small xeric steppe reserve (Map 5) to a bigger area including a lake and part of old farmland and pastures (Map 6). Today the reserve includes a calcareous lake, calcareous wet meadows surrounding the lake and former shifting cultivation fields (today used as pastures) and some small parts with xeric sandy steppe. The area has a long history with traditional agricultural land use and includes the last site for one of the most threatened plants in Sweden (*Sabulina viscosa*), a species adapted to this type of shifting cultivation practice.

The main part of the dry area has been intensively used as pasture for the past decades and it has been fertilized, which has resulted in a species poor flora. However, it has a great potential for conservation of crop wild relatives in the future, if managed in an optimal way.

Lyngsjö was selected since it is known to be an outstanding site, with a high diversity of vascular plants for this part of Sweden. The site also has a new management plan, one of the first in Sweden to include conservation of crop wild relatives.



Map 5. Lyngsjö, old reserve with green borders. Yellow dots are observations of crop wild relatives reported during the inventory (Artportalen.se)



Map 6. Lyngsjö, new and old reserve with green borders. Yellow dots are reported observations of crop wild relatives during the inventory (Artportalen.se).



Figure 9. Restored area in pasture, southern part of Lyngsjö nature reserve.



Figure 10. Management at work in the northern part of Lyngsjö nature reserve.



Figure 11. The red-listed *Sabulina viscosa* growing in Lyngsjö nature reserve.



Figure 12. Open sand area in the northern part of Lyngsjö nature reserve.

Table 4. Taxa of observed crop wild relatives at Lyngsjö Nature reserve. Population amount: C=common, F=Frequent, S=Scattered, R=Rare.

Taxon	Threat category*	No of observations	Population frequency
<i>Alyssum alyssoides</i>	NT	1	R
<i>Apera spica-venti</i>	NT	1	S
<i>Consolida regalis</i>	NT	1	F
<i>Dactylis glomerata</i>		2	S
<i>Epipactis palustris</i>		1	R
<i>Medicago lupulina</i>		3	F
<i>Medicago sativa</i> subsp. <i>falcata</i>		4	F
<i>Medicago sativa</i> subsp. <i>sativa</i>		3	S
<i>Medicago sativa</i> subsp. <i>x varia</i>		2	S
<i>Orchis militaris</i>		1	R
<i>Phleum pratense</i> subsp. <i>nodosum</i>		1	F
<i>Rubus idaeus</i>		1	R
<i>Sabulina viscosa</i>	CR	1	R
<i>Schedonorus pratensis</i>		1	S
<i>Trifolium arvense</i>		4	F
<i>Trifolium pratense</i>		3	S

*IUCN threat categories (Artdatabanken, 2020)

Results and recommendations

During the three days in the field, the weather was not optimal, with 30C°, no clouds and no wind. This made the work hard, and the focus was not optimal in the afternoons. The days before the inventory, the weather had been cooler and with some rain, so the vegetation was green and fresh, but after just one day of heat, the vegetation started to dry up and become grey and brown. Some of the areas were suffering from very heavy grazing and most of the grasses were not possible to identify, and at least Fjälkinge and Lyngsjö could host more crop wild relatives than were identified.

The selection of sites was representative of the diversity in the Biosphere in the sense of including as many crop wild relatives as possible, within a limited time span and the number of sites possible to visit during that time. Most of the relevant species known from the area were found during the inventory.

The methods used for the inventory in the selected areas as free search worked well. The first step was a quick walk around the area to get an impression of what species were common in the area and where the hotspots occurred. Areas with homogenous vegetation were searched more extensively and areas that are more diverse were searched in further detail. Species that were common in the area were registered as occurring in the nature reserve, or in a particular part of the reserve, and rare species were investigated in more detail. Sännarna reserve is an example of a

homogenous area where most of the target species occurred in low density over the whole area. Some areas were investigated very briefly as they were too heavily grazed, and therefore most species were impossible to find and identify. However, they were searched in an attempt to find some “unharmful” individuals, so positive occurrences of the species could be registered.

The result from the inventory will be suitable as background for updating of management plans and for on site management (further details below, site by site). But it should not be seen as a complete inventory of the areas, such more detailed inventories must be done in accordance with updated management plans, specific management goals, and with the long-term monitoring system.

Fjälkinge backe

In total, 23 crop wild relatives were identified in this reserve. All the grass species are more common than the inventory shows, as most open areas were intensively grazed and very dry at the time of the inventory. The grasses were only searched for until the first specimen was found. The same situation is probably relevant for the clover species that were only registered in the open area close to the forest where they get some shade and are not dried out completely. The forest part is of special interest as it is an isolated forest patch, which is more or less cut off from nearby forest areas and has, according to the species composition, been forested a long time. It is also unique in the area as a forest on a granite outcrop. All the registered species in the forest have small but viable populations and just need a monitoring program to make sure that they are not declining. All wood species such as *Prunus*, *Corylus* and *Rubus* seem to be in healthy populations, and just in need of some attention regarding management, this to ensure that they are left in place if some other trees or shrubs are removed. The *Melilotus* species seems to behave very well in the open areas that are not extensively grazed. Two red-listed species were also found during the inventory, but they were monitored and reported within the scope of another project. The grazing is one issue that must be taken into account in the management of the site. To get a more optimal preservation of crop wild relatives, the grazing regime must be more flexible and adjusted to support the different species in the grazed area. This must be done in combination with setting up a monitoring program to follow the progress. The other important issue regarding management is the identified 11 alien species, some of them identified as invasive in the Swedish national list of alien species (Strand et al. 2018). It is important that these species are eradicated as soon as possible. They are both a threat to the crop wild relatives and to nature conservation values in the reserve.

Degeberga backar

In total 12 crop wild relatives were registered from the area, one of them red-listed (*Phleum arenarium*). Also, three other red-listed species were registered. During the inventory, the grazing looked optimal for the targeted species. The most common, *Melilotus* (*M. officinalis* subsp. *falcata*), should not be more common than it is today, because of the risk that it will compete with more rare crop wild relatives in the area. The need in this reserve today is to set up a monitoring program so that the grazing becomes optimal for the crop wild relatives in combination with the long-term conservation of the other red-listed species.

Sånnarna

Only four crop wild relatives were found in the area (one of them also red-listed). The reserve is, as mentioned earlier, very homogenous and all target species, except *Festuca arenaria*, were found all over the area. The reserve has a great potential to preserve crop wild relatives and, in combination with the experimental farming in the area, have demonstrations of crop wild relatives for the public. The actual management with creating bare patches with calcareous sand should continue, as it in

the long-term could get more target species to enter the area, as several more are known from the surroundings. A monitoring program has to be set up to follow the management development.

Lyngsjö

In all 12 crop wild relatives were registered in the area, in addition to four red-listed species. The reserve is the first protected area in Sweden that has preservation of crop wild relatives (genetic resources) included in the management plan. The reserve is newly extended to cover a substantial part of former arable fields and has great potential to promote the conservation of all target species found in the area. A monitoring program has to be set up, so the management with grazing and soil disturbance become optimal for the crop wild relatives. Part of the area is also suitable for demonstration practices for the public.

Acknowledgements

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