



**GARPENBERG
BOLIDEN**

**BIODIVERSITY
GRI REPORT
2021**

BOLIDEN

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Table of Contents

1. GENERAL INFORMATION	4
1.1. Natura2000.....	5
Water Protection Areas.....	5
Nature Heritage	5
Natural Areas of National Interest	5
2. IMPACTS OF OPERATIONS ON BIODIVERSITY	8
2.1. Air Quality	8
2.2. Water Extraction.....	8
2.3. Land use	9
2.4. Vibration	9
3. HABITATS PROTECTED OR RESTORED	10
3.1. Natura2000.....	11
3.2. Nature Reserves.....	13
3.3. Water Protection Areas.....	16
3.4. Biotope Protection Areas and Key Biotope	16
3.5. Nature Heritage	16
3.6. Natural Areas of National Interest	17
4. RED LISTED SPECIES AND SPECIES OF INTEREST	18
4.1. Red Listed Species.....	18
4.2. Bird life.....	21
4.3. Fishing.....	21
5. References	23

1. GENERAL INFORMATION

The purpose of this document is to compile and publicly report data regarding the impacts of Boliden’s operations that are affecting certain aspects of biodiversity (directly and indirectly) in the surroundings of Garpenberg site. By following a more structured method (GRI standards), Boliden is taking initiative to improve its sustainability reporting, showing its environmental contribution and proving accountability towards its stakeholders.

Garpenberg is Sweden’s oldest underground mine that is still in operations (some indications since around 400 BC). Acquired by Boliden in 1957, the site now has a depth of 1,250 meters and extracts a complex of ores bodies comprising zinc, lead, silver, copper and gold. It is located in Hedemora municipality, 180 Km northwest of Stockholm (see figure 1). Garpenberg’s annual production neared about 3.0 M tons in 2020, of which 80% is derived from Lappberget; the largest ore body.

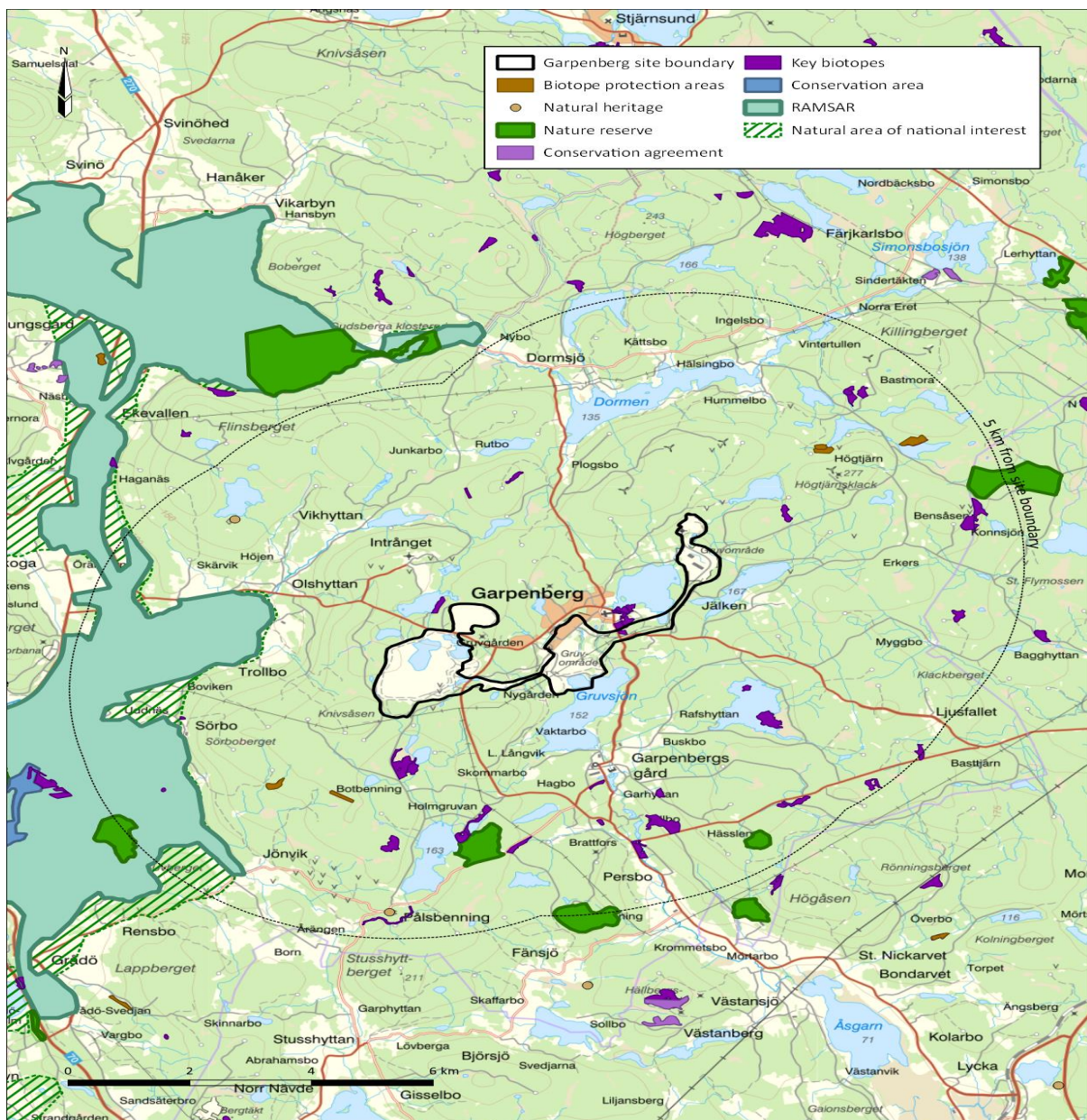


Figure 1. Map Illustrating Garpenberg’s Site Boundary and the Surrounding Areas

1.1. Natura2000

The following areas (Natura2000, nature reserves, water protection areas, etc.) are areas of qualifying interest within vicinity of Garpenberg's site (see table 1). Note that this section only mentions these areas as they are rigorously depicted under Chapter 3. Both Figure 2 and Figure 3 provide a visualization of these different Natura2000 areas.

Table 1: Areas of Qualifying Interest Within Vicinity of Garpenberg's Site.

Areas	Natura2000	Nature Reserves	Water Protection Areas	Nature Heritage	Natural Areas of National Interest
Kloster	X	X			
Stadsberget	X	X			
Stadsjön	X	X			
Lilla Älvgången	X	X			
Stackharan	X	X			
Pålsbenning	X	X			
Hässlen	X	X			X
Realsbo	X	X			
Konnsjön	X	X			
Krokbäcken	X	X			
Vallamosse	X	X			
Tolvsmossen	X	X			
Gårdsjöarna	X	X			
Kvänsen		X			
Blåberget		X			
Grådeösön		X			
Garpenbergs Herrgård			X		
Intrånget			X		
Pettersburg			X		
Horndal			X		
Viggesnäs			X		
Nordansjö			X		
Klotgranen				X	
Vikhyttan				X	
Flyttblock				X	
Hovran Flinesjön					X



Figure 2. Map Illustrating the Different Natura2000 Areas in Garpenberg (15 Km radius)

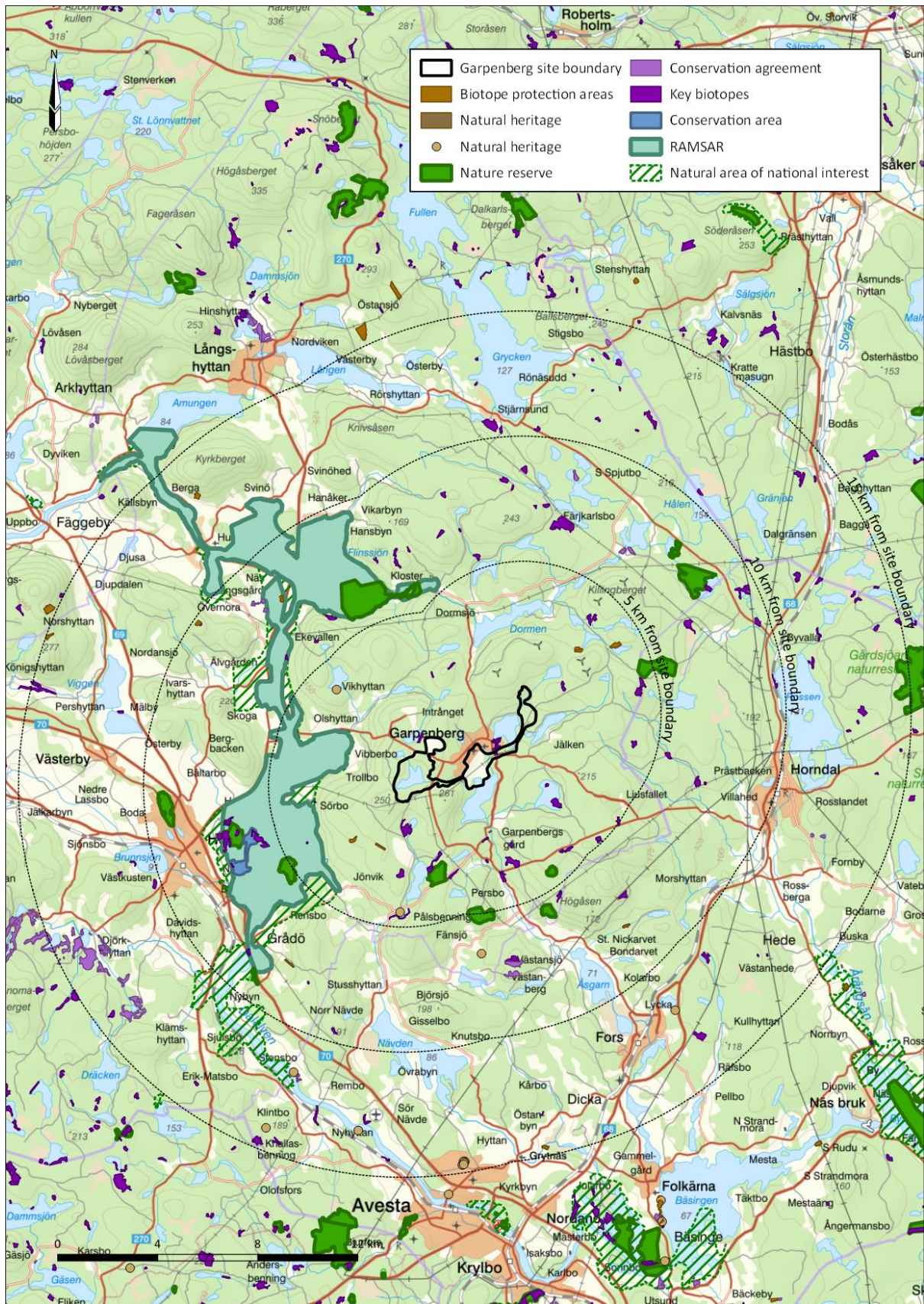


Figure 3. Map Illustrating Land Area in Garpenberg (15 Km radius)

2. IMPACTS OF OPERATIONS ON BIODIVERSITY

Under this section, we go through the various aspects for which impacts on biodiversity are evaluated: **Air Quality, Discharge to Water, Water Extraction and Land use**

2.1. Air Quality

Emissions to air occur when using diesel for the operation of mining vehicles and others transport work and from blasting in the form of “blasting gases”. Transport to/from the plant also contributes to air emissions.

Here within, table 2 shows estimated emissions to air from combustion of fuels as well use explosives. In diesel, consumption is the consumption of all contractors including, including transport to Gävle and Smedjebacken.

Table 2: Estimated air emissions from fuel and explosives for the year 2019

Source	SO2 (kg)	NOx/NO2 (kg)	CO2 (ton)
LPG for heating mining air	0	5100	1318
Diesel	12	428	8925
Petrol	-	-	0
Explosive Gases	-	11	300
Total 2019	12	5539	10543

In an increased production, the combustion of diesel will increase slightly while the use of LPG remains the same. The use of LPG depends on the outdoor temperature in winter and is not production dependent.

The relative consumption of explosives is expected to decrease in the future; however, the planned production increase still means that the total use of explosives can come to an increase. The emissions to air from increased transports entail are very limited.

Diffuse dusting from operations occurs mainly from the tailings management facility. A lot of efforts are focused on dust suppression from the facility. The business currently has limited emissions to air and the zero alternative largely corresponds current activities. The increase in production affected by the application is not considered to affect emissions to air significantly and the consequences are thus insignificant in terms of impact on air quality.

Impacts in the form of dusting to the environment are considered small by means of the dust limiting measures implemented. Consequences for human health and the environment are thus assessed as small.

In a previous application (2010), air measurements were carried out regarding particles. The results showed that there is a good margin for the environmental quality standard. The opportunity to fulfill environmental quality standards for air are not considered to be affected by the changed operations.

2.2. Water Extraction

Garpenberg mining business consumes water for its processes. Water withdrawal takes place from Finnhytte-Dammsjön and Gruvsjön. Excess water is discharged from the clarification reservoir (Kongsjön) to Gruvsjön via Ryllshyttebäcken. The recipients who are mainly affected by emissions from the business are Gruvsjön and Garpenbergsån. Mining water is led to Finnhytte-Dammsjön, i.e., groundwater that is continuously pumped from parts of the mining area without being affected by the mining operations.

Historical objects (mainly older landfills with warp, enrichment sand or waste rock, both post-treated and untreated) account for a large proportion of the metal load that can be observed in the surface water system in sediment and water, both today and from a long-term perspective.

Overall, ongoing mining operations in Garpenberg contribute with a limited proportion of the metal load, while the addition of sulphate and nitrogen compounds are derived from the current operations. Existing operations of about 3.0 Mtons of ore are annually regulated by current levels in outgoing waters for total nitrogen and metals; copper, lead, zinc, cadmium, chromium, and arsenic. Existing conditions for discharges to water were established after a probation investigation, which carried out within the framework of the previous permit examination.

Note that results from this probationary period investigations showed that the purification methods of nitrogen and fenton were assessed as most suitable and effective based on prevailing conditions in Garpenberg. Results also displayed that the toxicity tests were performed on zebrafish (*Danio rerio*) at their early developmental stages in outgoing water. Conclusions here disclosed no toxicity to be expected in the present case. Another conclusion withdrawn from the probationary investigation was concerned with the historical objects which have a large part in the total load on surface water found in Garpenberg's system. As long as the mine is in operation, the pollution load is reduced to a great extent by the leachate from several of the historical objects that are collected and pumped into Boliden's current sand reservoir Ryllshytttemagasinet for cleaning. If this handling process ceases, it is likely that the impact would significantly increase.

As of the environmental quality standards, the water quality in the catchment area is examined through a coordinated recipient control program (SRK) under the auspices of Dalälvens water management association (DVVF). The results are public and are annually reported on DVVF's website. In addition to regular sampling of water chemistry, sediments, fish, phytoplankton and benthic fauna at regular intervals at different sampling stations.

2.3. Land use

New land is used for expansions of operations and through quarries needed for operations. The increased production arising from the permitting process is not expected to have any additional impact regarding land use, groundwater and changes are, thus, not considered to have any negative consequences on the environment.

Overall, the dominant land use in the area around the mine and Garpenberg's urban area is mainly forests. Additionally, there is also active outdoor life and hunting. The activities intended for the application will be conducted within the mine's existing premises and the planned changes do not entail any change in land use.

2.4. Vibration

A vibration investigation has been carried out in connection with the current application for amendment authorization. The investigation states that an increased production from 3.0 M tons/year to 3.5 M tons/year is likely to mean that the number of explosions, and thus the number of vibrations is to increase slightly (17%).

Blasting close to the measuring point or loading more explosive into each borehole results into increasing the vibrations' likelihood. Measurement data for the period January 2017 and August 2020 shows that vibrations in surrounding properties are very low.

Vibrations however does not significantly affect biodiversity.

3. HABITATS PROTECTED OR RESTORED

As mentioned earlier in the document and according to the Natura2000 maps (see figure 2 and figure 3) and specifically the map of Water protection areas, water bodies (ground/surface) and other protected water sources of national interest (see Figure 4), the following section describes the areas of qualifying interest within the vicinity of Garpenberg's site.

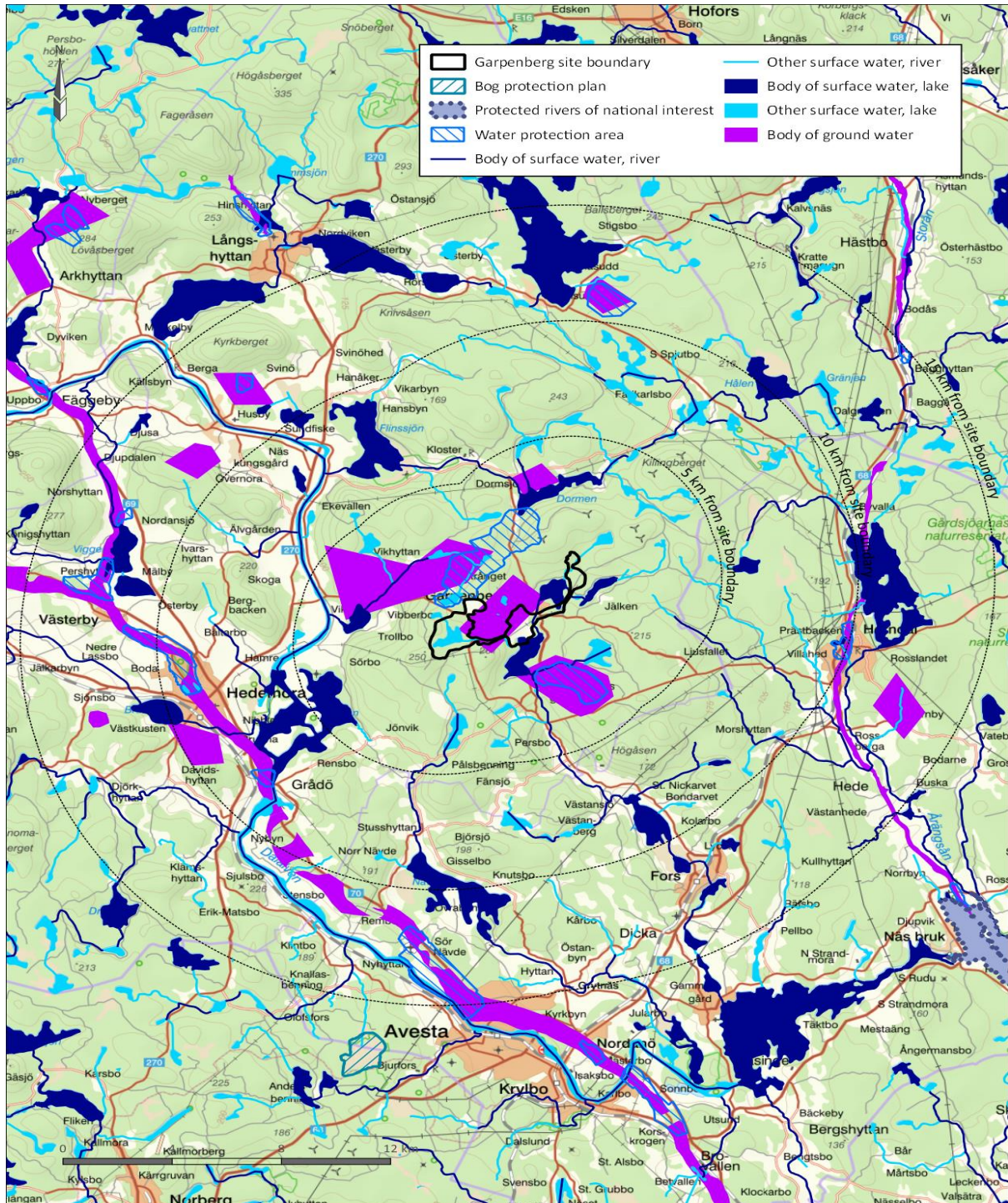


Figure 4. Map of Water Protection Areas, Water Bodies (Ground/Surface) and Other Protected Water Sources of National Interest (15 km radius).

3.1. Natura2000

3.1.1. Landbased

Stadsberget

Stadsberget (47 ha) is a natura2000 area belonging to the County Administrative Board of Dalarna. It is an area under the Habitats Directive that is not related to another Natura 2000 site (SCI). Overall, Stadsberget is 1400 meters long and 500 meters wide with 50 meters high boulder ridge (esker). The surrounding area is topographically flat which makes the site extraordinary in a geomorphologically way. The slopes are steep, and the top plateau is flat.

Stadssjön

Stadssjön is a natura2000 area situated in the County of Dalarna. It is an area with a total size of 50.2 ha of a community interest under the Habitats Directive that is not related to another Natura 2000 site (SCI). Stadssjön partly consists of the river Dalälven and the surrounding shores. Alongside the river, dams have been created, which are always changing due to erosion and sedimentation. Lake Hovran also makes part of the site and is a very valuable bird place, mostly for migratory birds but also for breeding birds. The site is part of the Hovran area which is on the CW-list. When it comes to the quality of species and habitats, we distinguish a special flora existing on the shores and a rich bird life on the wetland, which comes as valuable for the area.

Lilla Älvgången

Lilla Älvgången; also, a natura2000 site found in the county of Dalarna. Its total size is about 63 ha and is as well an area of community interest under the Habitats Directive that is not related to another Natura2000 site (SCI). Characteristics of the area consist in being a part of the Dalälven, which becomes flooded every year when the water level of the river increases. Like Stadssjön, embankments have been created along the river, which are always in changing, due to erosion and sedimentation. As for the quality of habitats and species: the special flora present on the shores and the rich bird life are quite valuable for the area. Four bird-watching towers are situated in the area, which are popular places for birdwatchers.

Stackharan

Stackharen is another area of Community interest under the Habitats Directive that is not related to another Natura 2000 site (SCI). It is a small island (55 ha), but the site also includes the northern part of a nearby island by the name of Brunnaön. The vegetation of the site consists of a deciduous forest surrounded by humid grasslands created by the fluctuations of the river Dalälven. This area has very high values, thanks to the combinations of habitats in the site. The type of habitats is also a rare one and contains a lot of rare species.

Pålsbenning

Pålsbenning is a natura2000 site (41,8 ha) that is also a nature reserve created by the landowners. The forest has an old-growth characteristic with no traces from modern forestry. Felling, however, have been created years ago. Traces from charcoal stacks can also be found. Generally, the forest consists of spruces and pines, still not so many deciduous trees fell off at maturity. Regarding the quality at site, the forest has naturally developed and is not so much affected by human encroachments. Thus, features distinguishing a naturally regenerated forest are present, specifically the richness of coarse trees, dead trees, old windthrows, and species belonging to the site. These circumstances are very infrequent in the forest land of today, and many of the species existing there are rare, red listed and/or threatened. This gives the area very high values.

Hässlen

With a smaller size (10,8 ha) compared with the other natura2000 areas, Hässlan is also a nature reserve created by the landowner. In former times, these large areas consisting of meadows with hazels, were cultivated. Now, only some parts have been overgrown. In between the large hay-making areas, there are several small arable lands. The vegetation has been influenced by the limestone in the bedrock and therefore some rare species occur, such as lungwort (*Pulmonaria obscura*). A small population of nutcracker (*Nucifraga caryocatactes*) is present northernmost in Sweden, thanks to the hazelnut trees. The area has a long history, where the land has been cultivated with continuity. Therefore, a very special flora and fauna, can be found there and which have adapted to the way which the land is cultivated. Many of these species are very rare today and threatened in Sweden.

Realsbo

This natura2000 site is of 19.9 ha. It mostly consists of a moist broad leaved deciduous forest and a small, old coniferous forest. This peripheral forest has naturally developed and is not affected by human intrusions. By this, the characteristics that distinguish this forest do exist, namely a richness of habitats: dead trees and old windthrows and species. Generally, many of the species found here are rare, red listed and threatened. This gives the area very high values. The deciduous forest is very rare in these parts of Sweden. Many rare species of vascular plants, mosses, lichens, and fungi can be found in such habitats. It is also important to the bird- and insect fauna.

Konnsjön

Konnsjön is a natura2000 site also found in the county of Dalarna. Its total size is about 2.3 ha and is, as well, an area of community interest under the Habitats Directive that is not related to another Natura2000 site (SCI). The heat in the southern slope down to the brook forms a favorable condition for large maples to thrive and spontaneously rejuvenate. Fragments of the old meadow form beautiful resting places in the form of sun-lit clearings. As far as the quality of site is concerned, the forest is not affected by modern forestry. Therefore, it has the structures belonging to a natural forest, for example dead wood and trees of different species, age and dimensions. In today's affected forests, this is unusual. Many of the natural forest species cannot live in the modern-day forests. This means that these only remain in the remnants of natural forest that are found in Konnsjön.

Krokbäcken

The site is a natura2000 area found in the county of Dalarna. Its total size is about 8.9 ha and is also an area of community interest under the Habitats Directive that is not related to another Natura2000 site (SCI). On the slopes down to Krokbäcken at the Hedemora border, grows a long and tall spruce forest with elements of large pines and occasional strong birches. Along the creek, comes swamp forest with sticky bales. Richer forest flora up-enters a couple of lanes. A stock of spruce and gray eel reveals an old coal bottom. Forests of this type are rare in this part of the county. The largest conservation values of forest land are linked to the large number of high stumps and flames and the large age spread in the tree layers. The forest is not affected by modern forestry and therefore has the structures that belong to a natural forest which is uncommon in today's affected forests. Many of the natural forest species cannot live in the modern-day forests. This means that these are only left in the remnants of natural forest that are here and there in the landscape. Many of the species found in this area are unusual, endangered, or red-listed.

Vallamosse

Vallamosse is an area that is of both Community interest under the Habitats Directive and protected area under the Birds Directive (SPA / SCI). The total size of the site is around 588,1 ha and is positioned in the County of Västra Götaland. The area is large and has a huge complex of active raised bogs, a herb-rich and slightly sloping fen. The bog-plains are very rich in hydro-morphological structures and the mire is surrounded by coniferous woodlands. The fen supports rare flora including red-listed species in the region. Overall, the area is important for several bird species and including the Black grouse Tetrao Tetrix.

Tolvsmossen

Tolvsmossen is an area of Community interest under the Habitats Directive that is not related to another Natura 2000 site (SCI). The area covers a size of 33.2 ha and is found on the road between Horndal and Grönsinka. It is also noted that Tokvsmossen is dominated of flat, topogenic, forestless marshes drained to the west and south. Myrtjärnen Katthavet; 136 meters above sea level, is according to Landegren; the last remnant of a lake formed when this area was isolated from Lake Ancylus. Several types of marsh and bog vegetation occur including species-rich blue eel marshes. When it comes to subjects of qualifying interest, the largest conservation values of the forest land are linked to the large number of high stumps and flames, the large age spread in the tree layer and the amount of fire tracks in both live and dead wood.

The forest is not affected by modern forestry and therefore has the structures that belong to a natural forest, for example dead wood, dying trees and trees of different species, ages and dimensions. In today's affected forests, this is unusual. Many of the natural forest species cannot live in the modern-day forests. This means that these are only left in the remnants of natural forest that are here and there in the landscape. Many of the species found

in this area are unusual, endangered, or red-listed. The wetland is not affected by ditches. Note that such wetlands are of great hydrological importance, among other things, as equalizers for the local climate.

Gårdsjöarna

Gårdsjöarna is an area of community interest under the Habitats Directive that is not related to another Natura 2000 site (SCI). Characteristics of the area include a varied nature with two lakes, a pond, streams, bogs of various sizes and mostly small forest stands. The original domain reserve includes a 170-year-old pine stand. The expansion of the domain reserve took place i.e, for the sake of bird life. As for the quality of the area, the largest conservation values of forest land are linked to the large number of stumps and flames as well as the large age spread in the tree layer.

The forest is not affected by modern forestry and therefore has the structures that belong to a natural forest, for example very dead wood dying trees and trees of different species age and dimensions. In today's affected forests, this is unusual. Many of the natural forest species cannot live in the modern-day forests. This means that these only remain in the remnants of natural forest that are found here and there in the landscape. Many of the species found in this area are unusual, endangered, or red-listed.

3.2. Nature Reserves

Kloster

Kloster is a nature reserve (226.7 ha) within Dalarna's County, municipality of Hedemora. At Näs Kungsgård, the river "Dalälven" makes a sharp turn south. Right there, the water from Flinesjön flows out and east of that lake is the nature reserve Kloster. The area consists of a large beach grazing area with high values both in terms of flora and bird life. From the bird tower in the southern part of the area, one can observe the large beach meadow changing from solid grassland, via wetter meadows and cataracts to floating leaf communities with islands of flowering water clover.

There are rare plants by the shore such as *Viola persicifolia*, *Hierochloe* (Sweetgrass), *Phragmites australis*, *Schoenoplectus lacustris*, Horsetails, *Carex aquatilis*, *Carex acuta* and reed caterpillars form tall vegetation. Among the aspens you can also see the large aspen butterfly, but it is perhaps easier to study one of the world's richest occurrences of the very rare shore lichen, which grows at the bottom of the aspens' trunks. The rich bird life consists in no less than six species of woodpeckers have been found. Owls, Stock doves, ducks, Graylag geese and Whooper swans are also interesting elements.

Stadsberget

Again, within Dalarna's County (municipality of Hedemora) is located the reserve Stadsberget (49 ha), and it is part of the well-known Badelundaåsen. The ridge formation is unusually powerful around Stadsberget, even though its surface measures about 1400 x 500 meters and its highest parts are about 50 meters above the surrounding plain. In fact, the height difference between the highest parts of the ridge and the bottom of Lake Hönsan is almost 90 meters, which is the largest relative height of any ridge in the county.

The slopes of Stadsberget are relatively steep. On the upper parts of the slopes there are clearly marked shorelines. Also, note that pebble ridges are water-bearing thanks to their good ability to let water through. At Stadsberget, there are two water reservoirs, and due to different soil types and different amounts of access to water in the ground, the vegetation on the mountain changes from the top, down the slopes and to the foot of the ridge. On the dry plateau, a dry pine forest grows with various rice, especially blueberries. Down the slope, the spruces take over and on the ground the rice is mixed with flowers and grass. The proportion of deciduous trees is also increasing towards the lower parts of the slope. These are mainly birch, gray eel, willow, rowan and aspen, but on the southwestern slope of the ridge there are also elements of noble deciduous trees such as oak and maple. Both are probably implanted but have good natural rejuvenation. This may be due to the rock's so-called "southern growth rock effect". The slopes to the west and south, collect the sun's heat and a more favorable local climate arises which means that these trees still thrive this far north. Other trees and shrubs that have been planted are Mountain pine, silver fir, Douglas fir, golden chain tree, Red elderberry and Common Snowberry.

Stadsjön

Around Stadsjön, there is a mosaic of open river meadow and deciduous forest. As part of the CW area Hovran, the primary purpose of the establishment of the reserve is to preserve the environments used by extending and nesting wetland birds. What is then referred to are the star-studded open river meadows that are found around the lake. Large parts of the deciduous forest have also been allowed to develop freely and therefore today show high natural values. It is primarily the presence of coarse deciduous trees and dead wood that makes the forest a suitable habitat for many species.

Another reason for the formation of this reserve is that Stadssjön's nature reserve gives the municipality's (Hedemora) residents and visitors good opportunities for recreation and nature experiences. The hiking trail stretches through the different habitat types and shows well the variety of plant and animal communities that exist within the reserve.

Environmental goals:

- Crowded wetlands;
- Living forests;
- A rich agricultural landscape;
- Good built environment; and
- A rich plant and animal life.

Lilla Älvgången

Nature conservation area in Dalarna (Hedemora Municipality). Lilla Älvgången is part of the Hovran area - Dalarna's most distinguished bird sanctuary. It is a valuable wetland area with hayfields and grazed beach meadows. Indeed, Hovran and Lilla Älvgången are of great importance for resting and nesting wetland birds. The name Lilla Älvgången comes from the natural canal that separates the mainland from the island of Stora Grundet. The island is located in the extension of the Dalälven, which is called Hovran. Hovran is an internationally designated area with great values for resting and nesting birds. Here is a peculiar composition of both northern and southern species. This has become so, as the area is located in the middle of the biological northern border. Several rare plants can be found in Lilla Älvgången. These include the Curly Leaf-pondweed *Potamogeton crispus*, Sweet flag (*Kalmus*) and the red-listed flowing plant species *Scirpus radicans* (bågsäv). Almond willow is another unusual species that grows in the area.

Lilla Älvgången was claimed until the mid-50s as hay meadows and pastures. When the water regulation of the Dalälven was expanded in the mid-fifties, the use of the areas close to the shore decreased. Then began the overgrowth of deciduous trees and shrubs. In the early 1990s, extensive restoration efforts were made that have continued continuously. Now the area is beginning to regain its former character of hayfields and pastures.

Stackharan

Similarly, Stackharan is a nature reserve (total size: 42.4 ha located in Dalarna's County, municipality of Hedemora). It is an island in Dalälven and of course difficult to get to, and hence, has become a haven for bird life. Hovran belongs to Dalarna's most species-rich bird lakes and has recurring nesting birds. Examples are yellow warbler (*Setophaga petechia*), finch (*Fringillidae*), reed warbler (*Acrocephalus scirpaceus*), mimic warbler (*Cuculus canorus*), mallard (*Anas platyrhynchos*), spoonbill (*Platalea*) and herring (*Clupea harengus*). On Stackharan, there is an old bird tower from which one can have a nice view of the entire island. The previously fairly open pastures are now growing again, with leaves but also occasional spruces. In the late 70's, the area was grazed with sheep.

Pålsbenning

A few kilometers southwest of Skogshögskolan in Garpenberg is the former domain reserve Pålsbenning, used in its teaching as the most natural forest-like stand in the vicinity of the area. This nature reserve is positioned in Dalarna's County (Municipalities Hedemora) and has a size of 42 ha. It includes several different populations where, however, the traces of cultural influence, e.g., stumps are found throughout the area. However, it has not been cut down in the last 40 years, which is why the forest condition is approaching naturalness in some places. This mainly applies to the number of older sluggish trees. The stand age in two stands with coniferous mixed forest is stated to be 130 years and the leaf fraction is very low. On the other hand, there are both older larch and larch rejuvenation, which is why the whole area, perhaps with the exception of a few trees and minor spots, probably arose after sowing.

Fomitopsis rosea (Rosenticka) or Polypore species has been found on a single flame in a swamp forest area. Violet-gray tagella lichen is also found on older slow-growing spruces in the mountainside to the east and at the top of the northern slope. What is more, there are yarn lichen and some common beard lichen while in the well-developed moss cover, one can find several roots and spider flowers in different spots of the reserve. As for the bedrock, it mainly consists of metaryolite and is exposed in the higher or steepest parts of the terrain. Otherwise, the bedrock is covered by moraine. The highest parts of the landscape are close to the highest coastline and the moraine slopes can therefore be swollen by the waves. Sometimes the moraine may even have been rearranged as gravel or sand.

Hässlen

Hässlen is a nature reserve (11.6 ha) within Dalarna's County, municipality of Hedemora. In the past, large deciduous meadows claimed presence in there. Now, they are partly overgrown. There are plenty of hazel bushes in the area. About 20 pairs of nut crow nests exist in the adjacent spruce forest. The birds feed during the winter on hazelnuts, which they collect and hide in storage during the autumn. On the hay meadow, one can also find spores, field gentians, trembling grass, etc.

Realsbo

While also being a natura2000 area located in Dalarna's County (Hedemora municipality). At the Realsbo's nature reserve (20 ha), there is an old pasture that has turned into a large deciduous grove after the land has stopped being grazed. Ash mainly grows here, but there are also some hazel and other deciduous trees. The contiguous ash forest lays the groundwork for both a special lichen flora and special soil vegetation because the sparse leaves allow a lot of light to filter down. Closest to the entrance, Realsbobäcken has cut out small ravines. The slopes also have a varied flora. As for fauna, the bird life is rich with kingfishers (Alcedo atthis). Several woodpecker species have been seen, including smaller woodpeckers.

Krokbäcken

Krokbäcken is both a nature2000 area and a nature reserve found in Dalarna's County (Hedemora). The reserve is located at an altitude of approximately between 150 and 200 meters above sea level and has a size of 74 ha.

In the northernmost part of Avesta municipality, Krokbäcken flows throughout a valley. The stream and its surroundings are also part of the area's greatest natural values. In the western part of the nature reserve, the stream has cut deep into a ravine. On the steep slopes, the spruce dominates, but there are also elements of coarse pines and old birches.

The humidity down in the ravine is high and the supply of dead wood is good, both on the slopes and down in the ravine. The flora is partly rich and a number of endangered or rare species occur in the area. Further east, the forest is more affected by felling and within the reserve, there exist both young forest and felling. However, there is also some stand with old pine forest that increases the value of the eastern part of the reserve. The bedrock within the nature reserve and its surroundings consists of metaryolite and the soil type consists of peat.

Gårdsjöarna

This is also another nature reserve located in Dalarna's County (municipality of Avesta), with a total area of 226.8 ha. The zone is dominated by the two lakes Norr-Gårdsjön and Sör-Gårdsjön. Looking at Norr-Gårdsjön, it is the larger lake of the two, and dammed at the southern end. Large areas have a water depth of less than half a meter and consists of a dammed bog. The water is very colorful, and one can spot several floating islands that move from year to year. Some of these islands are more than 50 meters long and are forested (several dozen trees reaching a height of up to seven meters).

The lakes with surrounding wetlands are of great importance for bird life and the remaining mature forest around the lakes is varied. In the northeastern part of the reserve, north of the small lake Stora Finnsjön, there is a number of tree-dominating populations with age of about 250 years. Additionally, the ground is blocky, and the supply of dead wood and coarser trees is good in most places. Generally, the forest consists of pine-dominated mixed forest with occasionally rich deciduous elements. However, one can still note the strong undergrowth of spruce in numerous places, which, in the long run, can impair the natural values associated with pine. Overall, the bedrock consists of Gnejs granodiorit while the soil type consists of peat around the two lakes and the moraine in the surroundings.

Kvännsen

This area is a nature reserve (12.9 ha) with the northern part of it overgrown with coniferous forest. In other respects, the area is characterized by the overgrown lake and consists of marshland with intermediate coniferous forest-covered islets and deciduous forest-covered edge zones. On a spruce flame in the northern part of the reserve is the red-listed fungus *Onnia tomentosa*. In some places there are also some newly formed flames. Throughout the area there are numerous older deciduous trees in various stages of dying. Deciduous trees provide living and feeding places, among other things, for several woodpecker species. The bird life is remarkably rich.

Blåberget

Blåberget is a nature reserve (11.8 ha) within the county of Dalarna. It is also part of an area in the municipality of Leksand, where there are many key biotopes. A forest stream flows through the area, which is the reason behind the high humidity rates. The forest consists mainly of the highest remnant spruce forest which along the river forms a small ravine. There are elements of coarse deciduous trees and there is great variation in the density of the forest.

The main reason for Blåberget to be assigned as a nature reserve is that it represents natural forest in an area where conditions exist in the surroundings for species to be able to spread out from the nature reserve. Trätbodarna is closest, just southeast of the reserve, but it is not far from Skallskog, which is still active today. Just outside the southeast corner, a charcoal plant has been found. Among the environmental goals set for this reserve is to have 12 Living forests.

As for **Konnsjön, Vallamosse and Tolvmossen**, these areas are simultaneously assigned as both nature reserves and natura2000 areas. While no information was found regarding the reserves' aspect in this document, some description is provided under the natura2000 areas' aspect.

Grådeösön: No information found.

3.3. Water Protection Areas

Garpenbergs Herrgård is a water protection area which has gone effective under the regulations since 2012. It is positioned within Dalarna's County (Municipality of Hedemora) and has a total area of 246.9 ha.

Intrånget is also another water protection area which has gone effective under the regulations since 2021. It is positioned within Dalarna's County (Municipality of Hedemora) and has a total area of 671.1 ha, of which 559.1 ha form productive forest land, while 45.2 ha are mainly water.

Horndal water protection area which has gone effective under the regulations since 1968. It is positioned within Dalarna's County (Municipality of Avesta) and has a water area of 12.4 ha (Total area: 73 ha).

Viggesnäs is a water protection area which has gone effective under the regulations since 2012. It is positioned within Dalarna's County (Municipality of Hedemora) and has a total area of 167.3 ha (18.5 ha water).

Nordansjö another water protection area which has gone effective under the regulations since 2012. It is positioned within Dalarna's County (Municipality of Hedemora) and has a total area of 22.1 ha (only 2.1 ha water).

Pettersburg, no information found

3.4. Biotope Protection Areas and Key Biotope

There are also a number of biotope areas and key biotope, but no specific information is provided on those

3.5. Nature Heritage

Klotgranen: No information found.

Flyttblock: No information found.

Vikhyttan: No information found.

A number of different types of trees: Lind, Ask and Tall

3.6. Natural Areas of National Interest

Hovran Flinesjön: No information found.

Hässlen: No information found.

4. RED LISTED SPECIES AND SPECIES OF INTEREST

4.1. Red Listed Species

Regarding red-listed species, a large proportion of the information in Garpenberg is received from ArtDatabanken, which is presented in Table 3 and 4. This information can be judged as old, hence some of these species might not be left in the vicinity of Garpenberg. A large part of the findings on the red-listed species is also scarce and does not exactly specify where the species have been last registered.

Table 3: EU species, signal species and indicator species known from the surroundings of Garpenberg's area are listed in the table below.

Name	Latin Terminology	Year	Location	EU species	Threat Category	Source
Birds						
Eurasian wryneck	<i>Jynx torquilla</i>	2005	Garpenberg	-	NT	ADB
Black-throated loon	<i>Gavia arctica</i>	2004	Spotted at Rylshyttesjön och Gruvsjön	x	-	EO
Common tern	<i>Sterna Hirundo</i>	2004	Several at Gruvsjön	x	-	EO
Common crane	<i>Grus Grus</i>	2004	Observed with youngsters at Högtjärn	x	-	Eo
Red-backed shrike	<i>Lanius collurio</i>	2004	At the clearcut by Rylshyttejön	x	-	Eo
Common swift	<i>Apus Apus</i>	2010	The church, Garpenberg	-	NT	ADB
Butterflies & Moths						
the scarce chocolate-tip (Moth)	<i>Clostera Anachoreta</i>	From 1930 and 1940	12G7e	-	NT	ADB
Scarce heath	<i>Coenonympha hero</i>		Around mansions	x	NT	ADB
Kovetenätfjäril	<i>Melitaea diamina</i>			-	NT	ADB
New Forest burnet	<i>Zygaena viciae</i>			-	NT	ADB
Allmän purpurmätare	<i>Lythria cruentaria</i>			-	NT	ADB
False heath fritillary	<i>Melitaea diamina</i>			-	VU	ADB
Marsh fritillary	<i>Euphydryas aurinia</i>			Garpenberg	-	NT
Narrow-bordered bee hawkmoth	<i>Euphydryas aurinia</i>	2007	Around mansions		NT	ADB
Shells / land snails						
land snail	<i>Clausilia dubia</i>		Lime quarry South Nygårdstjärn	-	NT	Lst and Eo
Vascular plants						
field gentian	<i>Gentianella campestris</i> ssp. <i>Campestris</i>	1990	Gruvsjöns S-side road edge O Långvik approx 70 ex 1989 and Fransbo 1990	-	VU	ADB

Common motherwort	Leonurus cardiaca	1990		-	NT	ADB
Moss						
Species of moss (family: Neckeraceae)	Neckera pennata	1937	Finnhytte, Dammsjön	-	NT	ADB
Fungus						
Skålkros	Femsjonia peziziformis	1974	12G7E	-	DD	S. Sundhed e via ADB
Woolly velvet polypore.	Inonotus tomentosus	1974	Garpenberg's Courtyard	-	NT	N. Sundhed e via ADB
Gränsticka	Hellinus nigrolimatatus	1974	Garpenberg's Courtyard	-	NT	N. Sundhed e via ADB
Coral tooth fungus	Ericium coralloides	1974	Garpenberg's Courtyard	-	NT	ADB
Hydnellum suaveolens	Ydnellum suaveolens	1991	Garpenberg's Courtyard	-	NT	ADB

Table 4: Red-Listed Species and EU Species Within the Surrounding Environment of Garpenberg

Name	Threat Category	Regional Occurrence	Comments
Birds			
Black-throated loon/ <i>Gavia arctica</i>	NT	Decreasing	biggest threat is again the growth of the cultural landscape.
Common tern/ <i>Sterna hirundo</i>	EU species	Stable population	Issues in breeding ground might be the biggest threat
Common Crane/ <i>Grus grus</i>	Eu Species	Pretty powerful Increasing	-
Red-backed shrike/ <i>Lanius collurio</i>	Eu species	Decreasing	-
Common swift/ <i>Apus apus</i>	NT	Decreasing	Decreasing quality of habitats
Butterflies			
Scarce chocolate-tip moth/ <i>Clostera anachoreta</i>	NT	Occurs in Dalarna. Possible premises may be available around Garpenberg	Bare felling of older aspen stands with continuity are most likely the biggest threat
Scarce heath/ <i>Coenonympha hero</i>	NT	Several populations in southern Dalarna. About 30 rooms after 1980.	The overgrowth of older small-scale agricultural landscape is biggest threat.
Ärenprisnätvinge	VU	Occurrences in Bergslagen and The Siljan area.	Tied to meadow weed and threatened by humid environments in forests and agricultural landscape ditches and grows again

Narrow-bordered bee hawkmoth/ <i>Hemaris tityus</i>	NT	8 premises in Dalarna until the 1940s. Now probably fewer mainly on Alderängarna i Österdalälven	Regrowth and rationalization of the cultural landscape is greatest threat.
Kovetenätfjäril	NT	In Dalarna 12 for income around 6 locations, however not Garpenberg	Forest ditches as to reduce the occurrence of the taproot is the primary threat
Purple Barred Yellow)/ <i>Lythria cruentaria</i>	NT	Decreasing	Decreasing quality of habitats
New Forest burnet/ <i>Zygaena viciae</i>	NT	Occurs in Dalarna. Suitable Environments around Garpenberg is settled in fast overgrowth.	Lives on pea plants in small-scale used cultural landscape
False heath fritillary/ <i>Melitaea diamina</i>	NT	Unknown but suspected to be decreasing	Reduced quality of habitat (overgrowth) and reduction of the number of reproductive individuals.
Marsh fritillary/ <i>Euphydryas aurinia</i>	VU	Decreasing	Decreasing quality of habitats
Shells			
land snail/ <i>Clausilia dubia</i>	NT	Occurrences within Dalarna	Stable on limestone quarries
Beetles			
Sexfläckig fallbagge	NT	Occurrences within Dalarna.	Unknown
Aspraktbagge	VU	Occurrences within Dalarna.	Lives on coarse free-standing asparagus, vars incidence decreases
Vascular plants			
Field gentian <i>Gentianella campestris</i>	EN	A number occurred in Dalarna, but sharply declining	Avoid overgrowth and pre-accumulation at the plant sites.
Common motherwort/ <i>Leonurus cardiaca</i>	VU	A few current premises in Dalarna, previously in many places in Garpenberg.	Not relevant within Garpenberg area
Moss			
Feather flat moss/ <i>Neckera pennata</i>	NT	Unknown, probably decreasing.	Decreasing quality of habitat due to overgrowth of spruce in aspen and the deciduous stands
Fungus			
Femsjonja <i>peziziformis</i>	DD	Even found in Dalarna	Lack of dead wood is the main threat
woolly velvet polypore/ <i>Onnia tomentosa</i>	NT	Occurrences in Dalarna	Forestry measures affecting the moss cover threatens the species
<i>Phelopilus nigrolimitatus</i>	NT	Occurrences in Dalarna	Modern forestry and shortage of dead wood constitutes threat

Coral-tooth fungus/ Hericium coralloides	NT	Occurrences in Dalarna	-
Hydnellum suaveolens	NT	Occurrences in Dalarna	Felling / decreasing area of meadow spruce forest, as well as elevated nitrogen levels

During field work, red-listed species and EU species have been searched in the surrounding environments. In the making of table, even more information on red-listed species from ArtDatabanken in Uppsala have been collected.

Figure 5 reports the findings of red-listed species and EU species that can be identified with slightly greater geographical accuracy (100 meters). On the following map (see figure 5), no species are listed within the area that was inventoried in 2010. Our assessment is that there are currently no known finds of red-listed species or EU species in the area that was inventoried back in 2010.

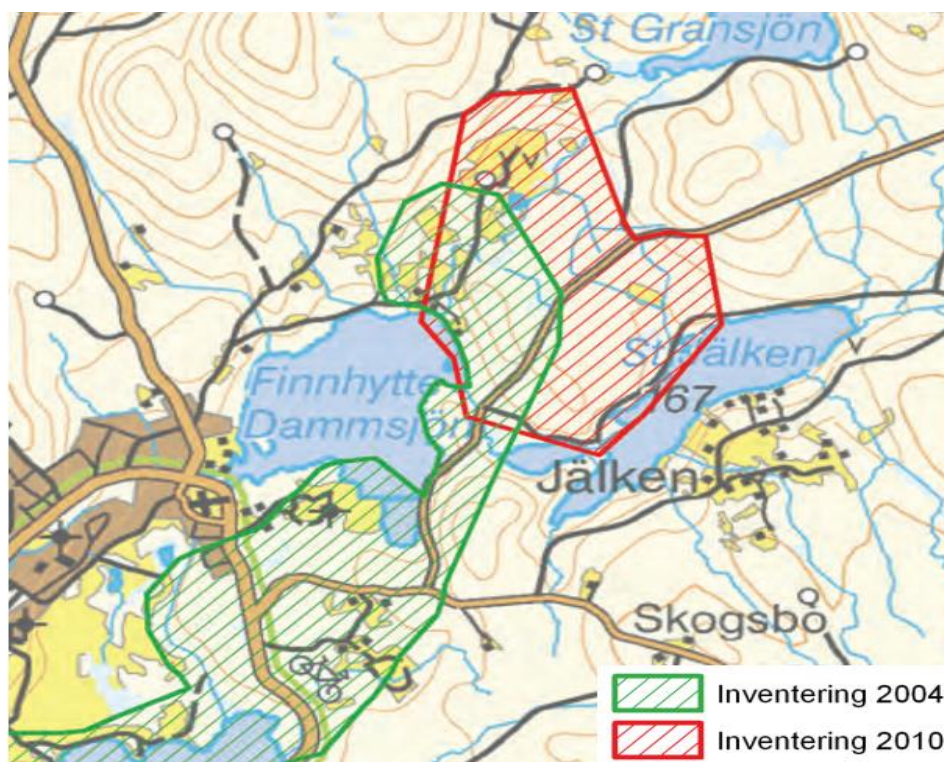


Figure 5. Map showing the area inventoried in 2010. Red section indicates the area inventoried in 2010, green marking indicates area inventoried in 2004.

4.2. Bird life

Overall, of the red-listed species and EU species mentioned in the table above, Eurasian wryneck, Common swift, Common tern, Common crane, Black-throated loon and Red-backed shrike are assessed as nesting or probable nesting in the area. During the investigation of species back in 2004, the Hovran area's ornithological association has been contacted and it has assessed that there are no particularly valuable nesting environments for birds within the inventory area.

4.3. Fishing

Most lakes are strongly affected by the mining operations. Despite this fact, fishing is conducted in most lakes. In Högtjärnen, valuable fish are fished and released by Hedemora sport fishing club. Release of fish (trout and rainbow trout (*Oncorhynchus mykiss*)) also takes place in Nygårdstjärn, under the wing of an association

consisting of about 10 members. Perch (genus *Perca*) and Pike (*Esox lucius*) are fished in Gruvsjön as well as Finnhytte-Dammsjön and Stora Jälken.

In Gruvsjön and more specifically Gruvsjön (s23), the test fishing in 2018 showed that Perch (genus *Perca*), Pike (*Esox lucius*), Eurasian ruffe (*Gymnocephalus cernua*), rutilus roach (*Rutilus rutilus*) and even a small European cisco (*Coregonus Albula*) were found in this lake. Every six years, sampling of mercury levels in Perch muscle and Gruvsjön's perch have relatively low levels. Zinc blocks or slows the absorption of mercury in fish, which is commonly seen in fish muscle from this type of recipients. Sampling of Perch liver takes place every six years and showed in 2018 high levels of lead, cadmium, and copper which increased over time. Elevated levels of zinc were also detected.

5. References

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