PRIORITISED ACTION FRAMEWORK (PAF) FOR NATURA 2000 in SWEDEN, final version

pursuant to Article 8 of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive)

for the *Multiannual Financial Framework* period 2021 – 2027

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A. Introduction

A.1 General introduction

Prioritised action frameworks (PAFs) are strategic multiannual planning tools, aimed at providing a comprehensive overview of the measures that are needed to implement the EU-wide Natura 2000 network and its associated green infrastructure, specifying the financing needs for these measures and linking them to the corresponding EU funding programmes. In line with the objectives of the EU Habitats Directive[1] on which the Natura 2000 network is based, the measures to be identified in the PAFs shall mainly be designed "*to maintain and restore, at a favourable conservation status, natural habitats and species of EU importance, whilst taking account of economic, social and cultural requirements and regional and local characteristics*".

The legal basis for the PAF is Article 8 (1) of the Habitats Directive[2], which requires Member States to send, as appropriate, to the Commission their estimates relating to the European Union co-financing which they consider necessary to meet their following obligations in relation to Natura 2000:

to establish the necessary conservation measures involving, if need be, appropriate management plans specifically designed for the sites or integrated into other development plans,

*to establish appropriate statutory, administrative or contractual meas*ures which correspond to the ecological requirements of the natural habitat types in Annex I and the species in Annex II present on the sites.

Prioritised action frameworks shall therefore focus on the identification of those financing needs and priorities that are directly linked to the specific conservation measures established for Natura 2000 sites, in view of achieving the site-level conservation objectives for those species and habitat types for which the sites have been designated (as required by Article 6(1) of the Habitats Directive). Given that the Natura 2000 network also includes the Special Protection Areas (SPAs) designated pursuant to the EU Birds Directive 2009/147/EEC[3], the financing needs and priority measures associated with bird species in SPAs are therefore also considered here.

Member States are invited to also present in their PAFs additional measures, and their financing needs related to wider green infrastructure (GI)[4]. Such green infrastructure measures are to be included in the PAF where they contribute to the ecological coherence of the Natura 2000 network, including in a cross-border context, and to the objective of maintaining or restoring favourable conservation status of the targeted species and habitats.

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[1] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01992L0043-20130701

[2] Article 8 (1): "In parallel with their proposals for sites eligible for designation as special areas of conservation, hosting priority natural habitat types and/or priority species, the Member States shall send, as appropriate, to the Commission their estimates relating to the Community co- financing which they consider necessary to allow them to meet their obligations pursuant to Article 6 (1)."

[3] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147

[4] Green infrastructure is defined as 'a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services'.

In its Special Report N° 1/2017 on Natura 2000[5] the European Court of Auditors concluded that the first completed PAFs (for the MFF period 2014-2020) did not present a reliable picture of the actual costs of the Natura 2000 network. The report therefore highlighted the need for updating the PAF format and providing further guidance for improving the quality of information that Member States provide in their PAFs. The recent EU Action plan for nature, people and the economy[6] commits to this process, with a view to ensuring that Member States provide more reliable and harmonised estimates of their financing needs for Natura 2000.

In its conclusions on this action plan[7], the Council of the European Union recognises the need for further improving the multiannual financial planning for investments in nature and agrees that there is a need to update and improve the PAFs. The importance of better forecasting the financing needs for Natura 2000 ahead of the next EU Multiannual Financial Framework is also recognised in a resolution by the European Parliament[8].

A.2 Structure of the current PAF format

The current PAF format is designed to provide reliable information about the priority Natura 2000-related financing needs, with a view to their incorporation in the relevant EU funding instruments under the next Multiannual Financial Framework (MFF) 2021-2027. To this aim, the PAF requires a level of breakdown of financing needs that would allow for an effective allocation of the Natura 2000 funding under the relevant EU funds for the MFF 2021-2027. With a view to that goal, the PAF also takes into consideration the experience that EU Member States and regions have gained so far with the MFF 2014-2020.

An essential component of the current PAF format is the required breakdown of the Natura 2000- and green infrastructure-related conservation and restoration measures per broad ecosystem category. The proposed ecosystem typology of 8 classes is very largely based on the MAES typology, which was established as a conceptual basis for an EU wide ecosystem assessment[9]. A comprehensive database allocating individual species and habitat types of EU importance to the MAES ecosystems is available for download from the European Environment Agency website[10]. It is recommended that the allocation of measures and costs to ecosystem types should largely follow this typology.

The presentation of priority measures and costs of the current PAF requires a distinction between running costs and one-off expenditure. Whereas running costs are typically associated with recurring measures that need to be continued in the long term (f. ex. staff costs for site management, annual payments to farmers for agri-environmental measures on grasslands, etc.), one-off expenditures are typically related to non-recurring actions such as habitat restoration projects, large infrastructural

[5] Special Report No 1/2017: More efforts needed to implement the Natura 2000 network to its full potential https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=40768

[6] COM(2017) 198 final: An Action Plan for nature, people and the economy http://ec.europa.eu/environment/nature/legislation/fitness_check/action_plan/communication_en.pdf

[7] http://www.consilium.europa.eu/en/press/press-releases/2017/06/19/conclusions-eu-action-plan-nature/

[8] European Parliament resolution of 15 November 2017 on an Action Plan for nature, people and the economy (2017/2819(RSP)) http://www.europarl.europa.eu/sides/getDoc.do?type=TA&language=EN&reference=P8-TA-2017-0441

[9] https://biodiversity.europa.eu/maes

[10] Linkages of species and habitat types to MAES ecosystems https://www.eea.europa.eu/data-and-maps/data/linkages-of-species-and-habitat#tab-european-data

investments, purchase of durable goods, etc. The correct allocation of costs to either category ("running" versus "one-off") will be highly relevant for a correct allocation of measures under different EU funds.

Finally, priority measures under this PAF will not only contribute to the specific objectives of the EU nature directives, but will also provide important socio-economic and ecosystem service benefits to the society. Examples of benefits may include climate mitigation and adaptation, or other ecosystem services such as those related to tourism and culture. The Commission has already provided an overview of ecosystem services benefits related to Natura 2000[11].

This aspect should be emphasized where possible, with a view to promote and communicate the wide societal benefits of funding nature and biodiversity.

A.3 Introduction to the specific PAF of Sweden

This PAF gives Sweden's estimate of prioritised financing needs for the period 2021–2027, based on the best available information at the time of writing. It does not constitute a formal decision on financing levels for Natura 2000 in Sweden during the 2021–2027 period. The priorities in this PAF can therefore be changed/adjusted when the results from the negotiations are ready.

The geographic area covered is the entire Sweden and our exclusive economic zone (EEZ). Of the habitats listed in Annex I of the Habitats Directive, 89 occur in Sweden, and 164 taxa listed in Annex II, IV and V. The network of Natura 2000 sites spans habitats important for nature conservation from the ocean floor up to mountain glaciers.

In short, the analysis conducted in preparation of this PAF shows a large need for conservation measures during this period, for most of the habitats and species concerned. For some habitats, species and measures, a lack of knowledge makes the estimates more uncertain. This has been a particular challenge in section E.2.1 on marine and coastal habitats and species. The need for EU co-financing is considered to be large. *Both EU and national funding need to target Natura 2000 conservation measures in the coming MFF period, inside as well as outside of the Natura 2000 sites, to reach our common nature conservation targets.*

Information related to species and habitats is based on the 2019 Habitats Directive article 17 reporting, and Birds Directive article 12 reporting. If existing or new environmentally harmful factors increase the pressures or threats, the need for conservation measures will also increase. Thus, the described "measures needed" is our current estimate and may have to be revised in the future. The sections in E.2 titled "Measures needed to maintain or restore favourable conservation status" (for each habitat group) describe the short- and long-term measures needed, without consideration of funding limitations or current capacity of labour, material or equipment.

In contrast, the measures listed in the sections for "Prioritization of measures to be implemented during the next MFF period" are based on the current level of national financing (2021). The listed *prioritized measures* have also been set at a level which is realistic concerning the capacity (of labour, material and equipment) that is either in place or possible to increase to the proposed level.

[11] http://ec.europa.eu/environment/nature/natura2000/financing/

In this PAF, all cost estimates are based on a systematic approach using the best available data, for example from recent projects. Most costs are based on known areas and a calculated cost per area unit. When site-specific data has not been possible to compile to a total sum, the figures are normally based on sampled data. This PAF should therefore give a significantly better estimate of the actual needs than Sweden's PAF for 2014–2020.

This PAF is not a decision on financing levels for Natura 2000 in Sweden until 2027. The figures given are instead based on a systematic approach made with best available data at the time of writing. The figures reflect the need for conservation measures, and builds upon mapping, monitoring and reporting information and actual costs for the same or similar measures taken recently. The volume of measures has, in cases when it takes time to expand the management capacity for nature conservation, been calculated moderately. For such measures, further experience will show if the figures will have to be adjusted.

The measures to be identified in this PAF are aimed to contribute to maintain and restore favourable conservation status for natural habitats and species of EU importance, whilst taking account of economic, social and cultural requirements and regional and local characteristics. Since this PAF gives a national overview, is has not been considered necessary or even desirable to try to describe the precise adaptations of each conservation measure to each site where it is to be applied. Actual figures for the costs of the same or similar measures taken previously have been used as these previous measures have been designed to reach the desired goal whilst taking account of the previously stated requirements and characteristics, and thus should give figures (averages) useful for the purpose of the PAF. When applying a conservation measure stated in this PAF, economic, social and cultural requirements will also be taken into account on a case-by-case basis. Thus, for example local characteristics might make a conservation measure cheaper or more expensive in a specific site or more or less suitable from a social or cultural aspect, and for example the precise technique or time of year to reach the desired outcome might have to be adapted.

When estimating the costs for 2021–2027, it has been assumed that 1 euro = 10 Swedish krona (SEK) throughout the whole period, and all costs are given in current monetary value (2021). All figures are rounded off to the nearest thousand euro. In the D section, on funding for the 2014–2020 period, figures are taken directly in euro from the financing agreements. Thus, there are differences in the currency rates used for different programs (as well as differences in monetary value due to inflation) which makes figures from D and E not fully comparable.

The Swedish PAF has been prepared by the Swedish Environmental Protection Agency – the national agency responsible for supporting, coordinating and overseeing environmental policy implementation in Sweden – in cooperation with the Swedish Agency for Marine and Water Management, the Swedish Forest Agency and the Swedish Board of Agriculture. The Swedish Species Information Center at the Swedish Agricultural University have assisted with data, calculations and fact-checking related to habitats and species. The County Administrative Boards, the Geological Survey of Sweden, the Swedish Agency for Economic and Regional Growth, as well as the Water District Authorities have been consulted.

For management measures in voluntary set-asides in the forest, representatives from the forestry sector also has contributed with data and estimates. The prioritised measures in lakes and rivers are partly based on assessments from the Water District Authorities.

Maintaining and restoring natural and semi-natural habitats and species in Natura 2000 and in associated green infrastructure is sometimes connected to cultural landscape and historic metods of maintenance.

B. Summary of priority financing needs for the period 2021-2027

		Priority financing needs 2021-2027	
1.	**Horizontal measures and administrative costs related to Natura 2000**	Annual running costs (Euros / year)	One-off / project costs (Euros / year)
1.1.	Site designation and management planning	2 980 000	207 342 000
1.2.	Site administration and communication with stakeholders	59 318 000	2 193 000
1.3.	Monitoring and reporting	23 471 000	500 000
1.4.	Remaining knowledge gaps and research needs	4 150 000	21 980 000
1.5.	Natura 2000-related communication and awareness raising measures, education and visitor access	26 947 000	13 219 000
	Sub-total	116 866 000	245 234 000

2.a	Natura 2000 site-related maintenance and restoration measures for species and habitats	Annual running costs	One-off / project costs (Euros / year)
2.1.a	Marine and coastal waters	1 140 000	4 549 000
2.2.a	Heathlands and shrubs	3 916 000	2 073 000
2.3.a	Bogs, mires, fens and other wetlands	850 000	9 799 000
2.4.a	Grasslands	28 775 000	4 904 000
2.5.a	Other agroecosystems (incl. croplands)	0	0
2.6.a	Woodlands and forests	850 000	6 448 000
2.7.a	Rocky habitats, dunes & sparsely vegetated lands	4 036 000	973 000
2.8.a	Freshwater habitats (rivers and lakes)	2 238 000	9 365 000
2.9.a	Others	0	0
	Sub-total	41 805 000	38 111 000

2.b	**Additional "Green infrastructure" measures beyond Natura 2000 (further improving coherence of the Natura 2000 network, including in a cross-border context)**	Annual running costs (Euros / year)	One-off / project costs (Euros / year)
2.1.b	Marine and coastal waters	0	1 130 000
2.2.b	Heathlands and shrubs	1 795 000	190 000
2.3.b	Bogs, mires, fens and other wetlands	5 936 000	1 542 000
2.4.b	Grasslands	29 915 000	1 332 000
2.5.b	Other agroecosystems (incl. croplands)	0	0
2.6.b	Woodlands and forests	624 000	2 134 000
2.7.b	Rocky habitats, dunes & sparsely vegetated lands	740 000	136 000
2.8.b	Freshwater habitats (rivers and lakes)	1 350 000	4 616 000
2.9.b	Others (caves, etc.)	0	0
	Sub-total	40 360 000	11 080 000

3.	**Additional species-specific measures not related to specific ecosystems or habitats**	Annual running costs (Euros / year)	One-off / project costs (Euros / year)
3.1	Species-specific measures and programmes not covered elsewhere	2 289 000	90 000
3.2.	Prevention, mitigation or compensation of damage caused by protected species	10 720 000	50 000
	Sub-total	13 009 000	140 000

	Annual total	212 040 000	294 565 000
	Total (2021-2027)		3 546 235 000

C. Current state of the Natura 2000 network

C.1. Area statistics of the Natura 2000 network

In Sweden, the Natura 2000 network is considered "largely complete" by the EU Commission[12]. The need for regular national evaluations, and additions if necessary, is acknowledged. For a few habitats and species additional Natura 2000 sites are under consideration. A national evaluation made in 2015 resulted in the proposal of new Natura 2000 sites as SPAs and SCIs [13] (see section E.1.1 for details).

The highest coverage of Natura 2000 sites in Sweden is found in the alpine biogeographic region, with 46 % of the area as Natura 2000. Outside this area the network covers 5-6 % of the terrestrial area, by mostly small and dispersed sites. In the marine Baltic region around 11 % of the sea area under Swedish jurisdiction (including the Exclusive Economic Zone) is Natura 2000. In the marine Atlantic region, the corresponding figure is 30 % of the area.

Sweden has a high number of sites, 4 087 at the time of writing, but the frequency of small sites is also high (2 753 sites are smaller than 1 km^2, 147 sites are smaller than 1 ha), particularly in the boreal and continental terrestrial regions. However, sites with very large areas occur in the northern boreal region, the alpine region, and in the marine regions (17 sites are larger than 100 000 ha each). For example, the entire Torne-Kalix river is designated.

There is a substantial overlap between the SPA sites and the SCI/SAC [14] sites. The total coverage of the network is around 13 % of the area under Swedish jurisdiction, see table below. 96 sites are SPA only (approx. 1 500 km^2), 452 sites are SPA and pSCI/SCI/SAC combined (approx. 39 000 km^2) and 3 539 sites are pSCI/SCI/SAC only (approx. 38 000 km^2).

	Natura 2000 area data per EU Member State (in km²)						**Proportion (in %) of the land *or sea* area covered by:**		
	Terrestrial			**Marine**					
Name of region	**SCI**	**SPA**	**N2K**	**SCI**	**SPA**	**N2K**	**SCI**	**SPA**	**N2K**
ALP	39 574	19 246	39 715				46	22	46
BOR	16 912	6 749	17 186				5	2	5
CON	906	589	997				6	4	6
MBAL				15 704	12 355	15 761	11	9	11
MATL				4 264	1 944	4 277	30	14	30
Total	57 392	26 584	57 898	19 969	14 299	20 038	13	7	13

Table above: Areas covered by Natura 2000 sites within Swedish jurisdiction (Swedish territory + Exclusive Economic Zone), and the proportion of each region covered by those. The calculation of area within Natura 2000 sites have been done for each biogeographic (Continental = CON, Boreal = BOR and Alpine = ALP) and marine region (marine Atlantic = MATL and marine Baltic = MBAL). The *marine regions* cover sea areas only. The *biogeographical regions* cover terrestrial area, lakes and rivers. Thus, there is no overlap between the different regions as defined in this calculation. A Natura 2000 site with sea area only is for example counted just once, adding to the total area in the correct marine region. The areas for "SCI" include pSCI, SCI and SAC areas, and there is no adjustment for SPA coverage in this figure. Likewise, the areas given for SPA have not been adjusted for "SCI" coverage within them. The figures for N2k = Natura 2000 area are on the other hand adjusted, so a square

[12] https://ec.europa.eu/environment/nature/natura2000/faq_en.htm

[13] SPA = Special Protection Area, designated for birds as stipulated by the Birds Directive. SCI = Site of Community Importance, designated for habitats and/or species as stipulated by the Habitats Directive.

[14] SAC = Special Area of Conservation. For a description of the designation procedure for all Natura 2000 sites, including SPA, SCI and SAC, see https://ec.europa.eu/environment/nature/natura2000/sites/index_en.htm

kilometer which is both SPA and SCI is only counted as one square kilometer. The figures for area percentage have been calculated as the ratio between area covered by “SCI”, SPA or N2k and the area of the region (see definition above).

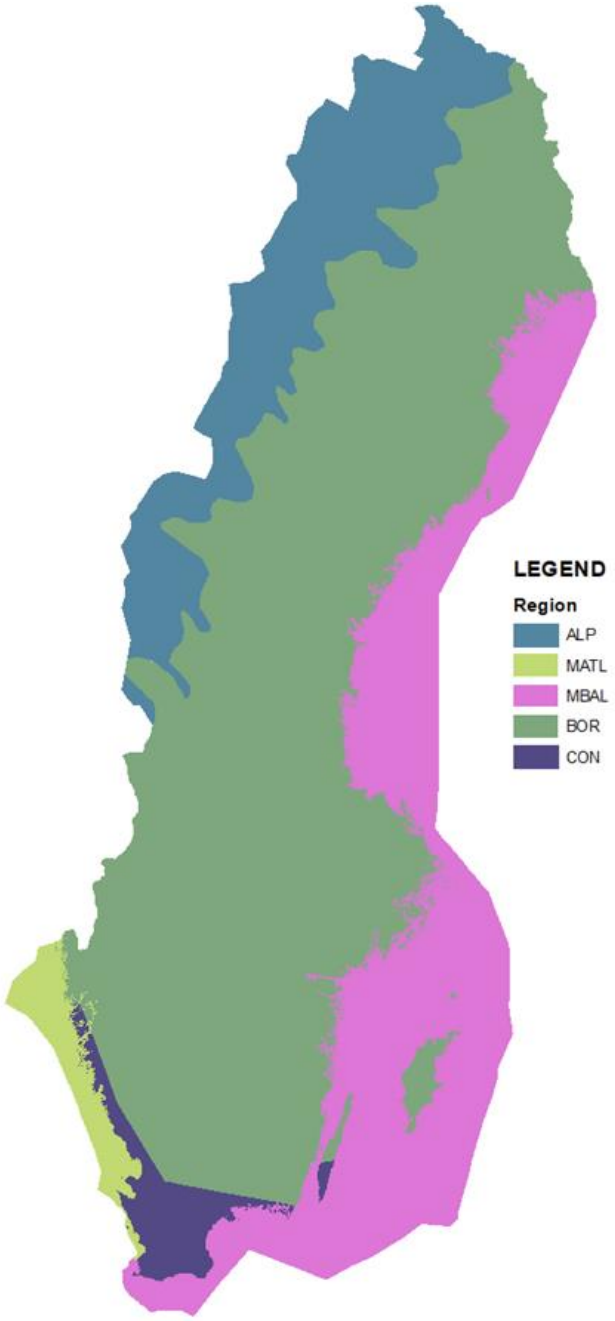

Figure 1. Map of the biogeographic and marine regions under Swedish jurisdiction.

C.2. Map of the Natura 2000 network in Sweden

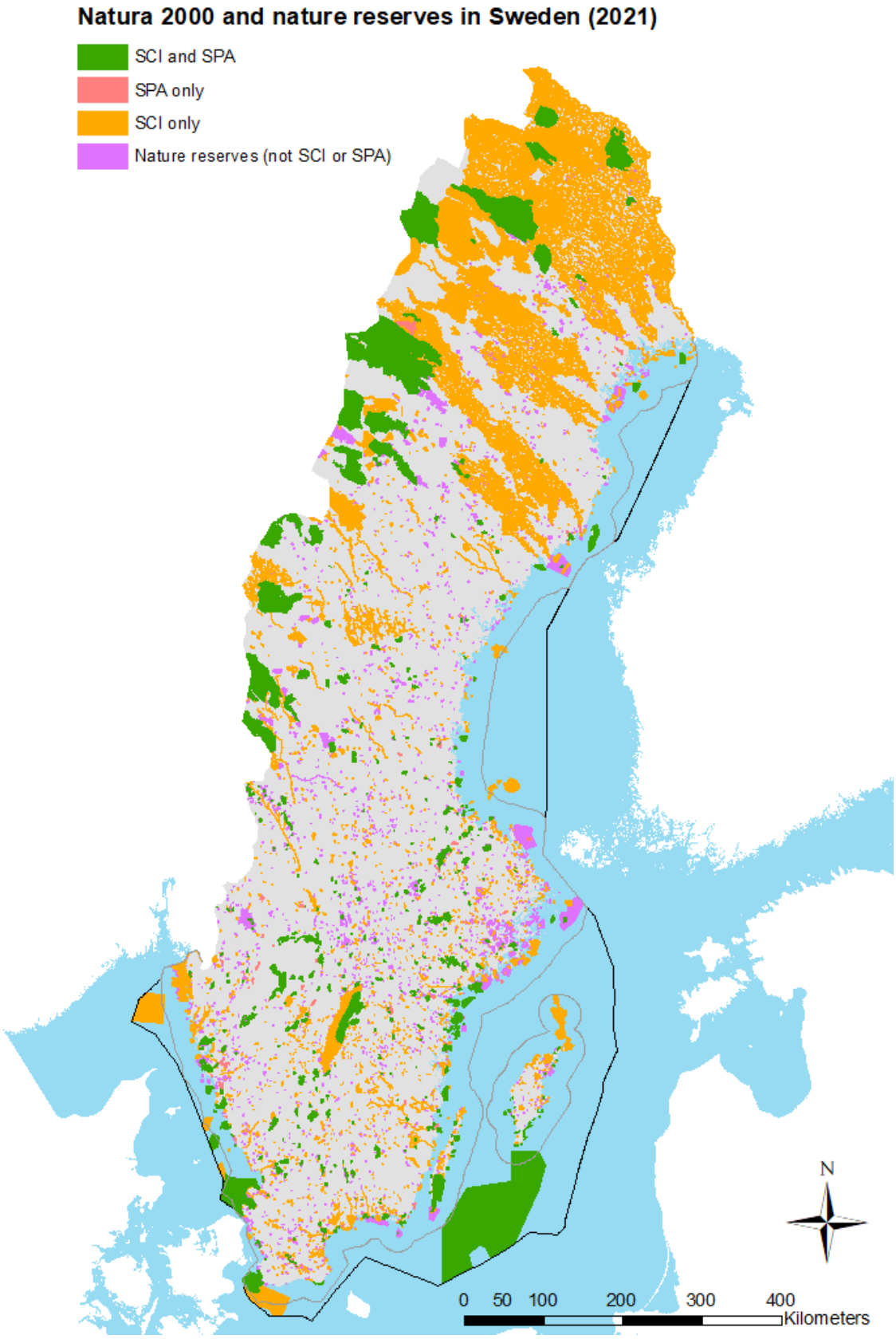

Figure 2. Map of Natura 2000 sites in Sweden, and nationally protected nature reserves which are not Natura 2000. All areas have been slightly exaggerated to be visible in this scale. The large rivers in the northern Sweden (orange = SCI) are the most obvious example of this (being 10-200 m wide, they would not be visible otherwise). Almost all SCI are also SAC, designated under the Habitats Directive. Most of the Natura 2000 sites are also designated as nature reserves or national parks, but this is not shown in this map.

D. EU and national financing of the Natura 2000 network during the period 2014–2020

This section provides a comprehensive overview of the funding allocated to Natura 2000, protection of species of EU interest and green infrastructure during the period 2014-2020. This data should help the Commission and national/regional authorities to assess to what extent the financial needs of Natura 2000 are currently met and what the funding gap is.

D.1 European Agricultural Fund for Rural Development (EAFRD)

Total allocation from the EAFRD to the Member State/region: 4 409 712 380 euro (for the entire 7-year period 2014-2020, including funding which is not relevant for Natura 2000)

Measure	**Total current allocation to the EAFRD measure**		**Current allocation to actions or sub-measures relevant for Natura 2000**		**Current spending on actions or sub-measures relevant for Natura 2000**		**Comments** (relevance, experience to-date, challenges for the next period)
	EU	**National**	**EU**	**National**	**EU**	**National**	
M4 Investments in physical assets	125 189 321	191 611 569	3 146 360 *	4 819 109 *	869 000 **	1 331 000 **	*Submeasures relevant are: non-productive investments, such as fencing to protect pastures from large carnivores. A project can receive higher grading in the selection process if placed inside a Natura 2000 area. **In Sweden, it is not possible to see how much of the allocation that is spent in Natura 2000 areas.
M7 Basic services & village renewal in rural areas	259 304 221	396 884 401	25 130 654*	38 491 255*	1 359 800*, **	2 082 7 00*, **	

*Submeasures with relevance for N2000 are: waterprojects, sami cultural heritages and restoration of landscape and cultural heritage.

**It is not possible to see how much of this that is spent in N2000 areas.							
M8 Investments in forest area	4 698 048	7 190 712	4 649 099 *	7 120 773 *	671 500 *	1 028 500 *	Main activities under this measure are prescribed burning, restoration of sites with cultural and biological values, and activities to increase the proportion of broad-leaved and other deciduous forests. *It is not possible to see how much of the allocation that is spent in Natura 2000 areas.

M10 Agri-environment and climate measures	390 077 572	597 042 741	317 358 396 *, **	486 080 581 *, **	178 572 200 *, **	273 511 000 *, **	More than half of the budget goes to maintenance of semi-natural pastures and meadows. * It is not possible to see how much of the allocation that is spent in Natura 2000 areas. **This figure includes semi-natural pastures and meadows, including restoration of pastures, maintenance of wetlands, and ley management. **Additional comments:** 1. The approximate total spending during the current program period (covering the five years 2014-2018 (until September 2018) on maintenance of semi-natural pastures in Natura 2000 areas is 79 948 559 Euro. (EU: €31 579 681, National: €48 368 878). 2. Analyses carried out by The Swedish Board of Agriculture show that the proportion of Natura 2000 habitat in Sweden covered by agri-environmental schemes (AES) for maintenance of semi-natural pastures varies between habitat types. In 2014, 32 percent of habitat type 6520 was covered by AES, while the same figure for habitats 6110, 6210, 6280 were approximately 85 %[1]. ***Experience to-date, challenges for the next period*** A great challenge is to deal with the lack of animals for grazing, which cannot be solved by changes within M10 or CAP alone. There is a need for simplification of CAP, for example through less detailed regulations and a new approach to audits. This is in line with the EU Commission's concept "the new delivery model" that shifts focus to a more result-oriented CAP. A detailed and complex system creates many challenges. It can be, for example, difficult to motivate beneficiaries to apply for funding since the administration is too heavy. This can be even more significant for small scale projects since there is less resources for administration.
M12 Natura 2000 payments							The measure is not used in Sweden 2014-2022.
M13 Payments to areas facing natural or other specific constraints	385 192 946	589 566 459	385 192 946 *	589 566 459 *	209 872 000 *	321 450 000	The measure is designed to support the use of agricultural land in parts of Sweden that face natural or other specific constraints. Constraints can e.g. be mountain or remote areas It aims to promote a varied agricultural landscape and to preserve and promote sustainable agricultural systems in these areas. But it is unclear to what extent the measure is relevant for Natura 2000. The measure does affect

							the agricultural area in parts of the country, but the purpose is far from preservation of species or habitats and it is not primarily paid to semi-natural grasslands. *It is not possible to see how much of this that is spent in Natura 2000 areas.
M15 Forest-environmental and climate services and forest conservation							The measure is not used in Sweden.
Other measures	599 103 142	863 851249	7 552 786 *, ***	11 568 191 *, ***	4 315 900 **, ***	6 610 400 **, ***	* "Other measures" with relevance for Natura 2000 areas are projects for cooperation with focus on environment (M16) and information and knowledge services (M1, M2) with focus on biodiversity and landscape ** It has not been possible to calculate exactly how much of M1, M2 and M16 that is spent on biodiversity and landscape. However, so far four out of seven years of the budget (i.e. approximately 60 % of the total budget) with relevance for N 2000 areas have been spent. *** It is not possible to see how much of this that is spent in Natura 2000 areas.
Subtotal	1 763 565 250	2 646 147 130	743 030 241	1 131 246 368	395 660 400	606 013 600	
TOTAL	4 409 712 380		1 874 276 609		1 001 674 000		In 2014, 16 million euro was used from EAFRD (including both EU and national funding) within Natura 2000 areas (see below for further details). If this is multiplied by 7 to represent the whole period, the sum would be around 112 million euro within Natura 2000. Program and budget adjustments since then makes it likely that the actual sum spent in Natura 2000 is at bit higher.

[1] Figures extracted from the Swedish survey of semi-natural pastures (TUVA):
http://www.jordbruksverket.se/etjanster/etjanster/etjansterformiljoochklimat/tuva.4.2b43ae8f11f6479737780001120.htmFurther clarifications to table D1

All amounts are in euros (€1 = SEK 8,39) and cover the whole program period (seven years), except for column 3, c*urrent spending,* which covers 2014-2018 (until September).

The amounts in column 1, *total current allocation to the … measure,* correspond to the allocated amounts as decided in the current program period, and cover the whole program period. Currently, the EU allocates 39,5 % and Sweden allocates 60,5% of the resources. This allocation of resources can change during the program period due to budgetary amendments.

The amounts in the second column, *current allocation to actions or sub-measures relevant for Natura 2000,* cover measures that are relevant for the Natura 2000 network. This does not imply that the full amounts have been used within Natura 2000. There is not enough information available to specify the amounts that are allocated specifically to measures within Natura 2000 areas.

The amounts in column 3, *current spending on actions or sub-measures relevant for Natura 2000,* represent what have been spent during the current program period until September 2018.

Sweden does not use M12 (Natura 2000 payments) or M15 (Forest-environmental and climate services and forest conservation) in the current Rural Development Programme (2014–2020).

M10 encompasses all agri-environmental payments. Payments are allocated both to land within Natura 2000 areas, and to other land that comply with the definitions used for agri-environmental payments and that are managed according to the regulations. At the same time, development activities that are carried out under other measures (M4, M7, M8) can be carried out within Natura 2000 areas, but the extent of such allocations is not known.

During 2014, 64 549 ha within Natura 2000 areas was managed with agri-environmental payments for semi-natural pastures and meadows. The payments to these lands from EAFRD that year amounted to about 16 million euro (including both EU and national funding). Note that the numbers under M10 and *Current spending* reflect the estimated amount of payments that has been paid out during 2014-2018, based on the areas within Natura 2000 that qualify for agri-environmental payments for semi-natural pastures.

In addition, the Single Payment Scheme offers financing for management of semi-natural pastures, however, not for management of Alvars, grazed forests, mountain pastures, or sward/rock mosaic grasslands. These amounts are *not* included here as they are not financed via the European Agricultural Guarantee Fund, EAGF (see D.5).

D.2 European Regional Development Fund (ERDF) / Cohesion Fund (CF)

Total allocation from ERDF to the Member State/region: 775 334 602 EUR

Total allocation from Cohesion Fund to the Member State/region: 0 EUR (the Cohesion Fund did not target Sweden for this period)

Category of intervention	**Allocation to measures relevant for Natura 2000**		**Current spending on measures relevant for Natura 2000**		**Comments** (relevance, experience to-date, challenges for the next period)
	EU	**National**	**EU**	**National**	
85 Protection and enhancement of biodiversity, nature protection and green infrastructure	-	-	-	-	None of the categories of intervention connected to Natura 2000 were selected for ERDF in Sweden for the 2014-2020 period (see the partnership agreement between Sweden and EU).
86 Protection, restoration and sustainable use of Natura 2000	-	-	-	-	Not used in Sweden 2014-2020, see above.
Other categories	-	-	-	-	
Subtotal	-	-	-	-	
TOTAL	-		-		

D.3 European Maritime and Fisheries Fund (EMFF)

Total allocation from the EMFF to the Member State: 120 156 004 euro (for the entire 2014-2020 period and all measures in the EMFF, not just for Natura 2000)

Measure	**Allocation to measures relevant for Natura 2000**		**Current spending on measures relevant for Natura 2000**		**Comments** (relevance, experience to-date, challenges for the next period)
	EU	**National**	**EU**	**National**	
Article 40. 1b-g. Measure I.18B	1 214 327	809 551	107 270	71 514	The use of these measures was small for the 2014-2020 period. One of the reasons can be that it is difficult to combine national co-finance and EU-finances for these types of projects since national co-financing might not correspond to the entire duration of projects. It is also difficult for national agencies to apply when terms and conditions differ between measures with similar purposes, i.e. salaries are only eligible in some measures.
Article 80.1.b Measure VIII.2	2 696 069	1 797 379	0	0	So far, this measure has not been used in Sweden.
Article 80.1c, Measure VIII.3	860 165	573 443	0	0	This measure was used 2014-2020, to enhance the work with national marine habitat mapping, including Natura 2000 habitats. This has been an important base for management and monitoring actions, which can justify continued funding under the next period.
Subtotal	4 770 561	3 180 373	107 270	71 514	
TOTAL (EU+SE)	7 950 934		178 784		

The European Maritime and Fisheries Fund had two measures directly connected to payments for area protection for the period: funds to increase the areas protected as Natura 2000 sites, and funds for other types of marine areas (e.g. marine protected areas, marine reserves, etc.). In addition, there were several measures that were connected to Natura 2000 indirectly. Such measures are not accounted for here, except that 80.1.c is included. Within 80.1.c only one project has been approved so far, a marine mapping project with high importance for future management, monitoring and complicance monitoring actions. *Current spending* is the payments that have been paid out during the current program period until September 2018. The EU share of the funding is 60 %, and 1 euro = 8,39 SEK.

D.4 LIFE Programme

Type of project or financing instrument	**Current allocation to measures relevant for Natura 2000**		**Comments** (number of projects, relevance, experience to-date, challenges for the next period)
	EU	**National**	
Traditional projects	51 380 030	40 419 676	In Sweden, 19 nature projects, all with high relevance for implementing and improving the Natura 2000 network, have been carried out during the 2014-2020 period. Measurable effects of high impact on favourable conservation status have been achieved. The Life programme is very important for Natura 2000 in Sweden. If the administration could be simplified, this would lower administrative costs and likely lead to even better results for the same amount of funding. Many actors in the conservation society have highlighted the need for similar projects outside of Natura 2000 sites. This is possible to achieve to some extent within the integrated projects. A suggestion is to enhance the possibility to fund actions outside Natura 2000 sites using LIFE, and to rank these projects by their contributions to improving the status in Natura 2000 network, to decide if they should be financed. Project owners have also experienced that it is very valuable to work in project form, since it gives a clear focus on what is to be achieved. Further simplification of the application procedure, and of the administrative requirements while started, has also been stressed by project owners. It is however important to retain strict requirements on measurable effects from project actions.
Integrated projects	10 008 312	13 393 333	The project "Grip On Life IP", with high relevance for implementing and improving the Natura 2000 network, is ongoing. The project started in 2017 and ends in 2025. It is therefore too early to see results. Another project, "IP Rich Waters" is also ongoing, and has high relevance for improvents to the coordination between the nature- and the water directives.
Others (NCFF etc.)	-	-	NCFF has not been used within nature and biodiversity in Sweden so far.
Subtotal	58 618 673	51 698 642	
TOTAL	110 317 315		

Notes on the D4 table, LIFE programme figures: Sums in euro are taken from the EU decisions (the database of LIFE-projects), for both EU and national funding. Thus, the exchange rate varies by month or year according to the rules. For projects that continue until 2020 the sums include the approved funding until 2020.

For projects that end outside of the program period 2014-2020, the total project funding in this table has been reduced using the ratio of years within the period. Projects included in these figures are (in abbreviated form): MIA, LIFE to admire, VINDEL river, MOTH, Foder och fägring, Grace, UC4LIFE, Remibar, Sandlife, reclaim, Elmias, Vänern, Coast Benefit, TripleLakes, BushLIFE, LIFETaiga,

SemiAquatic LIFE (the Swedish part), ReBorn, LIFE BTG, LIFE LOPHELIA, Rivers of LIFE, LIFE CONNECTS and GRIP On life IP Rich Waters. The figures do not include the Swedish parts of the Sambah and Marmoni projects, which were not led by Sweden.

Concerning projects that have not yet been decided as of this writing (November 2018), an assumption is that two new projects per year (2019 and 2020) are being funded (with numbers taken from actual concept notes) adding 5 665 638 euros in national funding and 8 498 144 euros in EU-funding.

Note: this table is different from D.1-D.3, since "current allocation" here is not a decided amount for the entire program period – programs can still be approved in 2019-2020 and if this happens the total allocation for the period 2014-2020 will increase (see previous paragraph). To get a sum for the entire program period, an estimate based on the previous paragraph and the figures from the table is approximately 57 364 280 euro in national funding and 67 116 817 euro in EU funding (to a total of 124 481 097 euro).

D.5 Other EU funds, including Interreg

Total EU funding/co-funding allocated from other EU programs for the implementation of EU nature policy and associated green infrastructure in the Member State/region: around 689 000 000 euro for the entire period (99 million euro yearly).

Total national/regional funding allocated for the co-funding of these measures: 5 476 457 euro (for Interreg projects decided at the time of writing).

In addition to EAFRD (see D.1)**,** approximately **95 358 000 euro per year** from the EAGF (European Agricultural Guarantee Fund) are used for maintenance of pastures and meadows (see table below, footnote #1).

Category of intervention	**Allocation to measures relevant for Natura 2000 #2**		**Current spending on measures relevant for Natura 2000**		**Comments** (relevance, experience to-date, challenges for the next period)
	EU	**National**	**EU**	**National**	
85 Protection and enhancement of biodiversity, nature protection and green infrastructure	10 755 046	4 113 442	3 640 571	1 471 384	Interreg Programs that have selected this category of intervention are Botnia Atlantica, North, Sweden-Norway and NPA
86 Protection, restoration and sustainable use of Natura 2000	678 715	678 715	15 792	15 793	Sweden- Norway
Other categories (87+88)	4 704 560	684 300	731 925	394 387	North, Sweden-Norway, NPA
EAGF #1	667 500 000	-	476 790 000	-	
Subtotal	683 638 321	5 476 457	481 178 288	1 881 564	

TOTAL (EU+nat)	689 114 778	483 059 852	

These figures are only indicative. It has not been possible within the timeframe for this PAF to analyse all EU funds and programs and their possible contributions to Natura 2000. For example, Horizon 2020 is not included here, even though research is one of the prioritsed actions in section E of this PAF.

#1 The sum for EAGF has been calculated from the average payment per hectare (includes the single-payment scheme and the green direct payments) to arable land in each of Sweden's 21 counties. This average payment is then multiplied by the area of semi-natural pastures and mown meadows in each county (with allocated payment entitlements) and all counties are summed to a grand total for the whole of Sweden. By doing so, any regional differences in the amount of single-payment as well as in the areas of semi-natural pastures and mown meadows are controlled for. In total, there are approximately 407 000 hectares of semi-natural pastures and mown meadows under the single-payment scheme. Numbers used are from 2017 (have been multiplied by 7 to get the sum for the whole period 2014-2020).

#2 Note: Here, in this table, allocation for Interreg projects include only those decided at the time of writing. For EAGF however, allocation represent an approximation for the entire program period (see explanation below). To get a sum for the entire program period for D.5, a projection for coming Interreg projects must be added. An estimate for D.5 for the entire period is around 693 198 855 euro. The figures for Interreg projects relevant for Natura 2000 are probably overestimated, since it has not been possible to validate how much of the projects that are relevant for this PAF.

For EU Interreg programs, numbers are only given for those that have managing authorities located in Sweden. The numbers presented are from 2018-10-17, with the NPA program as an exception with data from the end of 2017.

For Interreg programs, all *allocated* means will be used during the remaining period. If the allocation of means continues as to date, the projected additional sum of funding will be as presented in the table below. The sums have been calculated using the share of funds allocated to date to the different categories of intervention multiplied within the framework set for each thematic objective and program.

Category of intervention	Interreg programs, projected (additional) sum for the entire period 2014-2020 (euro)
85	3 021 091
86	225 618
87+88	837 368

D.6 Other (mainly national) funding for Natura 2000, green infrastructure, and species protection in 2014-2020

The total financing allocated to implementation of EU nature policy and associated green infrastructure during the 2014-2020 period, for measures or projects not benefiting from any EU co-funding, was approximately: **2 885 000 000 euro (~ 412 000 000 euro yearly).** All amounts are calculated using the rate 1 euro = 8,39 SEK. These figures do not include costs mentioned in D.1-D.5. The sum of D.1-D-5 is, for comparison, approximately 386 000 000 euro yearly (including both EU and national financing).

It is not easy to give an accurate figure of the average yearly funding for the whole Natura 2000 network, species protection and the green infrastructure necessary to maintain it, between 2014-2020 in Sweden. The costs for government funded measures aiming at preserving biodiversity have been estimated by the Swedish Board of Agriculture, the Swedish Environmental Protection Agency, the Swedish Forest Agency and the Swedish Agency for Marine and Water Management for 2017 (Naturvårdsverket 2018, "Sammanställning av medel för biologisk mångfald för år 2017"). The costs reflect the biodiversity measures by authorities as defined for reporting to the Convention on Biological Diversity, which is a wider perspective than used in this PAF. If the employee related costs for the County Administrative Boards are added, but EU funding and national co-funding of EU measures are subtracted, the estimated total spending is around 412 million euro yearly.

In addition to this, the public, farmers, land owners, private companies, organisations, and municipalities have spent money and large efforts on nature conservation in different ways. Also, spatial planning and handling of permits by authorities play an important role in reaching biodiversity targets. These costs, and opportunity costs, have not been estimated in this PAF.

The sum of D.1-D.6, based on figures given above, is around 798 million euro yearly.

E. Priority measures and financing needs for 2021–2027

E.1. Horizontal measures and administrative costs related to Natura 2000

E.1.1. Site designation and management planning

Current status and progress made so far in terms of site identification, designation and management planning (situation: 1/1/2021)

In the letter of formal notice from the European Commission (May 2020), the following deficiencies were found in the Swedish network: Correction of data for four habitats and the species *Phocoena phocoena*, Boreal region, insufficient moderate for the habitats 1650 (Boreal Baltic narrow inlets) 2330 (Inland dunes with open Corynephorus and Agrostis grasslands) and the species *Barbastella barbastellus* and also scientific reserve for the habitat 2330 , Continental region, insufficient major for the species *Myotis bechsteinii* and insufficient minor for the species *Lutra lutra*, Marine atlantic region, insufficient major for the habitat 8330 (Submerged or partially submerged sea caves), Marine Baltic region, insufficient minor for the species *Halichoeros grypus*.

In the evaluation the European Commission also noted a deficiency in the marine network of SPAs (Special Protection Areas), regarding number and size of designated SPAs in the areas most suitable for birds. Twenty IBA (International Bird Areas) were specifically mentioned in the evaluation.

Since May 2020, Sweden has in December 2020 proposed 11 new SCIs and 2 new SPAs to solve the deficiencies that could be done without further investigations by the authorities. Further the new list submitted to the EU in 2020 has corrected the erroneous data for four habitats and one species.

As indicated in the Swedish reply[1] to the Commission's letter of formal notice (2020/2207, C(2020) 2503 final), relevant government agencies are also currently preparing a proposal to add the species *Halichoeros grypus* to the site SDF of existing Natura 2000 sites in the Marine Baltic region. The Swedish Environmental Protection Agency is currently conducting a survey to remedy the scientific reserve for the habitat 2330 in the boreal region. Further, the County Administrative Boards are preparing proposals of new or increased marine SPAs.

Several different types of nature in the Swedish Natura 2000 areas are formed by and dependent on human intervention, often by traditional extensive methods now considered part of cultural heritage, such as meadows and pastures of various kinds, and a number of cultural reserves are wholly or partly included in the Natura 2000 network.

Responsible authorities are updating the specific conservation plans for Natura 2000 sites (in swedish "bevarandeplaner"). The conservation plans for Natura 2000 sites includes site level conservation objectives and conservation measures. In January 2021 there are 26 sites that lack conservation plans. There is also a need for continuous updating of old conservation plans with new knowledge, for example from new inventories of species or habitats, or to register increase in habitat area after restoration measures.

Overlap between regions occur in the figure below, for example all marine regions overlap with either the boreal or the continental region. Thus, the total number is lower than the sum of the regions.

		Number of sites with:		
Sites of Community Importance (SCIs) under the EU Habitats Directive	**Number of sites**	**legal site designation (SAC or equivalent)**	**specific site level conservation objectives**	**specific site-level conservation measures**
Alpine region	150	150	150	150
Boreal region	3495	3465	3480	3480
Continental region	427	419	419	419
Marine Baltic region	459	448	451	451
Marine Atlantic region	74	71	72	72
Total	**4002**	3965	3946	3946

		Number of sites with:		
Special Protection Areas (SPAs) under the EU Birds Directive	**Number of sites**	**legal site designation (SAC or equivalent)**	**specific site level conservation objectives**	**specific site-level conservation measures**
Alpine region	28	28	28	28
Boreal region	474	474	470	470
Continental region	65	65	63	63
Marine Baltic region	119	119	117	117
Marine Atlantic region	27	27	26	26
Total	550	713	542	542

Further measures needed

The relevance of the established network, as well as the green infrastructure, for the fulfillment of the objectives in the nature directives needs to be evaluated regularly. Such evaluations could point to further needs in protected areas (see also sections C1, E1.3 and E1.4). Further needs of measures should be included in relevant plans, for example river basin management plans according to the Water Framework Directive, and in the marine spatial plans under the Maritime Spatial Planning Directive.

There is a need to revise approximately 3 000 old, outdated regulations and management plans for legal site-based conservation forms. Some of these overlap Natura 2000 management plans for nationally protected areas, other contain forest habitats in need of measures. After this has been done, recurring revisions will continue to be needed, for nationally protected areas as well as for Natura 2000 sites. The recurring updates of conservation and management plans are handled by the County Administrative Boards.

To avoid deterioration of habitat status formal protection of threatened habitat areas is needed, and this demands compensation payments to landowners or land purchase. Although the compensation costs for forest habitats are dominating, formal protection is needed for all habitat groups, in all three biogeographical regions.

Sub-montane or montane forests[15] in the alpine area and adjacent forests of lower productivity in the upper boreal region often have high nature values since this is the only forest ecosystem in Sweden that has not been extensively affected by forestry. Formal protection of those areas is necessary to increase substantially to halt loss of this habitattype. Due to a recent change of legal praxis the financial requirements for formal protection has increased substantially. According to a governmental inquiry (see SOU 2020:83) there is a need to formally protect 525 000 ha sub-montane forest land.

Prioritization of measures to be implemented during the next MFF period

All measures connected to remaining deficiencies of the Commission evaluation (May 2020) will be prioritised during the period.

Development of Natura 2000 conservation plans for areas lacking such plans will be prioritized during the period, in accordance with the requirement to establish such plans as soon as possible and at least within six years of site designation. One example is the need to develop and implement management plans for four existing SCIs designated for the protection of Harbour Porpoise.

Sweden has initiated a process of reviewing hydropower plants' permits (see section E.2.8 for more details), starting in 2022. During the 2021–2027 financing period, this process will require the revision of conservation plans for 263 Natura 2000 sites impacted by the review.

Conservation plans for Natura 2000 sites are important when applications for permits or derogations for plans and projects are handled by the authorities or courts. They are also important for prioritization and planning of measures. Therefore regular updates are needed. A project has been started by the Regional Administration Boards and the Swedish EPA to create a national database for the most important data for the conservation plans. The database will facilitate future updating of the conservation plans, but some extra work will be needed for the first generation of updated plans. Revision and digitalisation of 2625 other conservation plans for Natura 2000 areas with new data will also be prioritised during the period.

Revision of old outdated management plans for 500 nationally protected areas will be prioritised during the period.

Name and short description of the measures	Type of measure*	Estimated cost in Euros (annualised)	Possible EU co-funding source
Inventory of inland sand dunes in the boreal region for designation purposes	O	145 000 €	
Inventory of 20 marine IBAs for designation purposes	O	140 000 €	
New Natura 2000 conservation plans ("bevarandeplaner") for 26 sites	O	15 000 €	

[15]Sub-montane or montane forests should here be understood as forests near or above the border for sub-montane forest (in Swedish: "gränsen för fjällnära skog"). In an article by Svensson et al (2020) these forests are called "the boreal to sub alpine forests and woodlands of the Scandinavian mountain range",

Revision of management plans for 263 Natura 2000 sites impacted by the review of hydropower plants' licenses (estimated average cost per management plan: EUR4 000)	O	151 000 €	
Revision and digitalisation of 2625 old Natura 2000 conservation plans	R	1 500 000 €	
Revision of management plans ("skötselplaner") for 500 nationally protected areas. #1	R	1 480 000 €	
Land purchase and compensation payments to landowners for legal protection in the boreal and continental biogeographic region. Mainly larger areas areas protected by the Regional Boards. Includes labour costs at the CAB etc. #2 (ca 120 000 ha/7 år)	O	136 891 000 €	
Land purchase and compensation payments to landowners for legal protection of sub-montane or montane forests (alpine region etc). Mainly larger areas areas protected by the Regional Boards. Includes labour costs at the CAB etc. #2	O	25 000 000 €	
Land purchase and compensation payment for legal protection of 1250 ha smaller forest habitat areas in the boreal and continental biogeographical zone by the Swedish Forest Agency (8750 ha /7 år)	O	15 000 000 €	
Compensation payment to forest owners for denied permission to harvest wood in natural sub-montane forests, mainly in the alpine biogeographical region (70 000 ha/7år)	O	30 000 000 €	

* indicate whether the measure is recurring or one-off.

#1 The measure also includes protection of non-productive forests, wetlands, grassland and aquatic areas, but the area of protected productive forest is most relevant to the cost.

#2 The sum is calculated from 2021 annual grant 1:14 (Swedish EPA) 168 070 000 euro. The difference between 168 070 000 and 136 891 000 euro is since the 1:14 grant is also used for related measures here in E.1.1 and E.1.2. For definition of sub-montane or montane forests in this context, see footnote on previous page.

Expected results

Natura 2000 sites and other protected areas are managed strategically at both national and County levels to achieve cost-efficient allocation of management resources. Natura 2000 habitats are managed, or restored, according to best knowledge and best practice. It is expected that the prioritised actions above will help ensure progress toward the objectives of the respective Natura 2000 site and thereby to the overall fulfillment of the objectives of the EU nature directives in Sweden. Updated conservation plans are also valuable documents for spatial planning in the municipalities.

E.1.2. Site administration and communication with stakeholders

Current status and progress made so far in terms of site administration and communication with stakeholders

When Natura 2000-sites are designated, the County Administrative Boards communicate the general and specific aims for the sites with landowners, relevant authorities, and other stakeholders. The same procedure applies for nationally protected areas such as Nature reserves. When new conservation and management plans are produced these are also communicated. Other examples of continuous cooperation in management of protected areas and green infrastructure include:

- councils including authorities, other stakeholders, and public organizations for management planning of certain protected areas,

- catchment partnerships which ensure effective stakeholder involvement when implementing river basin management plans,

- County Administrative Boards offering farm-advisory services, information material and arranging conferences and courses directed to farmers, landowners, local authorities, etc.

- The Forest Agency offer advisory services on how to manage biodiversity and cultural heritage in voluntary set-aside forests and in the wider green infrastructure.

- national authorities responsible for fisheries management in marine protected areas ensure early involvement of relevant stakeholders,

- authorities responsible for marine spatial planning involve relevant stakeholders in producing plans in an early stage to ensure that both green infrastructure and Natura 2000 network is considered in the planning.

Several LIFE-projects have included stakeholders. For example, The LIFE project GRIP on LIFE IP (2018 – 2025) has the main aim to contribute to, improve and increase this kind of cooperation. It aims to disseminate and get a wide acceptance for the Swedish PAF in order to achieve the goals of the EU Habitats Directive. The work within GRIP is inspired by the Natura 2000 Biogeographical Process and includes the exchange of experiences and best practices, stakeholder cooperation networks across regions and sectors, as well as international peer-to-peer learning, e.g. Nordic platforms.

GRIP on LIFE aims to improve the conservation status of watercourses and wetland habitats and their characteristic species, and thus the ecosystem services they provide, in selected sites within the Boreal and Continental biogeographical regions. The project will also increase available funding by strengthening the coordination of existing funds to improve the conservation status of habitats and species in the Natura 2000 network while enhancing sustainable use of watercourses and wetlands to help improve their conservation status.

Several Natura 2000 sites are protected as nature reserves and in 2015 the Swedish Environmental Protection Agency and the National Heritage Board was given a government assignment to improve co-operation between nature- and cultural heritage conservation management. Several measures to be improved was identified, e.g. education and knowledge of biological heritage, research and development of instruments and synergies.

Further measures needed

An increased effort is needed for management and monitoring of protected areas and species according to the needs presented in this PAF and some efforts are still needed with relevance to lacks in the Swedish part of the Natura 2000 network in accordance to the Commissions latest status review.

Cooperation in management could be improved and increased. The immediate benefits of these kinds of activities are more cost-effective management, coordination of local and national objectives, coordination of the objectives of local interests, such as landowners, companies and authorities, and coordination of the objectives of different sectors. LIFE Projects and LIFE IP projects such as GRIP on LIFE IP are good examples of this kind of cooperation.

More measures directed to farmers could be needed because the grassland habitats are generally in far from favourable conservation status and their status is deteriorating. In this habitat group, most of the management is done by farmers having agri-environmental subsidies for maintenance of semi-natural pastures. More information directed to farmers about management methods and expected results for biodiversity could be helpful.

In 2019, a new law entered into force, stipulating for instance that all hydropower plants must apply for new permits to ensure compliance with modern environmental requirements and EU directives. A national plan for issuing of new permits was adopted by the Swedish government in June 2020 (SE: ”Nationell plan för omprövning av vattenkraft”). The plan will facilitate contact between decision-makers, stakeholders, and various kinds of experts. The implementation of the law will require collaborative projects, promotion of best practices, and implementation of those best practices in hydropower plants. It will also require a review and possible revision of 450 Natura 2000 management plans.

Experience and lessons learned from earlier periods show that support for measures to preserve and develop the ecological values in forests in voluntary set-asides (green infrastructure outside Natura 2000 sites) is dependent on targeted counselling and education. To improve the ecological status in the green infrastructure set-asides of forests on private land, it is estimated that roughly 4 000 landowners can benefit counselling annually.

Continued advisory and training focusing on alternative forest management methods as an alternative to traditional clear-cutting forestry practices would help foresters to improve the biological values. Natura 2000 sites and associated green infrastructure can benefit if forests nearby are managed with alternative methods. In the same way, targeted information and advisory may help increasing the area of broadleaved forests in southern Sweden. Expansion or re-creation of broadleaved forests is one way to restore a favourable conservation status to habitats with oak, hornbeam, beech, and other broadleaved tree species. To improve the ecological status of forests in a wider perspective, to increase the amount of continuous tree cover forestry and regeneration with broad leaved trees, further counselling of landowners might be needed.

In the marine environment, counselling of fishermen and coastal tourism operators should also increase. Continued efforts are also needed to increase the public’s understanding of aquatic invasive alien species (IAS), in order to help mitigate the impacts of IAS on annex I habitats and annex II species.

Prioritization of measures to be implemented during the next MFF period

All the measures mentioned above should, to some extent, be prioritized during 2021-2027, se table below.

Stopping further deterioration in habitat area by formal protection.has top priority. The target area prioritised for formal protection is set at the same level as for the year 2021.

List of prioritized measures to be carried out, and estimated costs for these measures

Name and short description of the measures	Type of measure*	Estimated cost in Euros (annualised)	Possible EU co-funding source
Counselling in the forest set-asides outside Natura 2000 with the aim to restore habitats	R	750 000 €	
Counselling in a wider perspective in the forest green infrastructure concerning continuous tree cover forestry and regeneration of broadleaved forests	R	1 100 000 €	
The LIFE project GRIP on LIFE (2021 – 2025)	O	1 893 000 €	LIFE
Information and communication strategy directed to farmers, including development of new digital based information	O	100 000 €	EAFRD
Production and communication of printed and digital information material directed to farmers	R	22 000 €	EAFRD
Farm advisory services	R	1 200 000 €	EAFRD
Conferences and courses directed to farmers, landowners and other stakeholders	R	1 000 000 €	EAFRD
Information and communication with sector operators about Natura 2000 prior to re-examination of hydropower	R	100 000 €	
Administration of liming of lakes and rivers at the County Administrative Boards and the Swedish Agency for Marine and Water Management #0	R	85 000 €	
Management and monitoring of protected areas and species at the County Administrative Boards #1	R	38 000 000 €	
Management and monitoring of protected areas and species at the Swedish Forest Agency #1	R	5 000 000 €	
Designation, management and monitoring of protected areas and species at the Swedish Environmental Protection Agency #1	R	3 000 000 €	
Designation, management and monitoring of protected areas and species at the Swedish Agency for Marine and Water Management #1	R	1 200 000 €	
Monitoring of compliance with existing rules related to physical constructions and operations in aquatic Natura 2000 sites, and improved permitting processes #2	R	2 800 000 €	LIFE/ EMFAF
Continuing ongoing information campaigns to alert the public about invasive alien species in the aquatic environment	R	40 000 €	LIFE
Monitoring of compliance with fisheries regulations in marine Natura 2000 sites	R	1 600 000 €	EMFAF
Improvements of IT systems for management of Natura 2000 sites #3	O	200 000 €	
IT systems for designation and management of protected areas including Natura 2000 sites #3	R	3 421 000 €	

* indicate whether the measure is recurring or one-off.

#0: Figure includes 20% of management at the County Administrative Boards and the Swedish Agency for Marine and Water Management.

#1: For CABs the current situation and priority for 2021-2027 is estimated to 20 annual manpowers per CAB, equalling 420 persons, for handling designation, management and monitoring of protected areas and species**.** 55 of those work only with designation funded by SEPA 1:14 grants, and is included in E.1.1, not here in E.1.2. Another 75 are estimated as funded by CAB ("förvaltningsanslag") for designation work, leaving 290 annual manpower for management and monitoring, and half of this is estimated as funded by SEPA 1:3, half CAB ("förvaltningsanslag"). NV 1:3 also finances coordination of action programs for threatened species with 3 million euro annually. For SEPA the need is estimated to 30 annual manpowers and for SWAM and SFA the need is estimated to 12 and 50 annual manpowers, respectively.

#2: Figure based on two annual salaries at each of the 14 coastal CABs, and one annual salary for each of the remaining seven CABs. One annual salary estimated to cost 80 000 euro / year.

#3: VIC Natur IT system (including IT operation, development, support and depreciation) had an annual budget of around 3.5 million euro in 2021. Here, the entire system is considered necessary for the purpose of this PAF, since designation and management of protected areas can hardly be separated from Natura 2000 work.

Expected results

Counselling of forest owners annually resulting in restored Natura 2000 forest habitats in the green infrastructure set-asides outside Natura 2000 sites.

The counselling concerning maintenance of continuous tree cover forestry are expected to lead to an increased use of such silvicultural methods in the green infrastructure outside Natura 2000 sites.

The courses and information material produced for farmers are expected to reach around 13 000 farmers, and thereby contribute to reach the conservation status of grasslands and other habitats in need of grazing or mowing.

Good information and understanding of Nature 2000 in the catchment areas where hydropower will be re-examined during the period will optimize the measures to achieve the goals in the areas

Increased monitoring of compliance during the period is expected to help reduce and mitigate the impacts of, for instance, physical constructions, water operations and fisheries in the marine environment, as well as different types of disturbance of protected species, including marine mammals and birds.

The other measures prioritised during this period are expected to help maintain and increase the conservation status for many habitats and species, by supporting more result-oriented and cost-effective management. This kind of cooperative measures are also expected to help raise the general awareness and contribute to other benefits. These results are not possible to quantify.

[1] Promemoria 15 september 2020 (M2020/00754/R).

E.1.3. Monitoring and reporting

Current status and progress made so far in terms of monitoring and reporting

Sweden has a system for monitoring of biodiversity that is based on different programs which can be grouped as follows:

1) national and regional environmental monitoring of for example forests, lakes and landscapes,

2) national biogeographical monitoring of selected habitats and species,

3) site-focused monitoring of protected areas (including Natura 2000 sites).

However, the extent to which monitoring has been implemented varies between different habitats, species and regions. For marine habitats and species in particular, more efforts are needed to develop relevant methods and implement monitoring programs. During the last years, several improvements of the monitoring system have been made. An example is the LIFE+ project "MOTH" (Monitoring Of Terrestrial Habitats), which ended in 2014 and demonstrated sample-based monitoring of several terrestrial less common but widespread habitats. Another example is the MARMONI LIFE+ project, dealing with marine monitoring. Both the site-based and biogeographical monitoring is currently under revision, after having been in use for 5-10 years. The monitoring of large carnivores is handled with higher ambition than other species, due to the high political interest (Naturvårdsverket report 6830, 2018, gives a report on this monitoring system, in Swedish: http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6830-1.pdf?pid=22578).

Inventories, research projects and public observations have also contributed with important new knowledge for several species and habitats, which are used for reporting. One example is the "Sambah" research project (Static Acoustic Monitoring of the Baltic Harbour Porpoise, see www.sambah.org). In this, the eight EU Member States around the Baltic Sea cooperated to survey the distribution and abundance of harbour porpoises in the Baltic Sea. The results have been used to suggest new Natura 2000 areas, as a basis for the 2019 Article 17 reporting under the Habitats Directive, and as a basis for a new monitoring program for this species. For some species and habitats, especially in the marine environment, the knowledge is still too limited to be able to direct monitoring efforts effectively. Currently, the reporting of these species is based on expert judgements.

Further measures needed

Existing monitoring programs need to be upheld, and in some cases the sampling should be increased to get better data. A few details in the current monitoring would benefit from being adjusted to better correspond to the latest reporting formats for the Habitats and Birds directives. One example is that the Article 17 format in the 2019 reporting asks for a figure on how much of a habitat that is in a "good" vs "not good" condition (new for this reporting). In most of Sweden's monitoring programs, this can only be inferred from other data which are not collected with the primary purpose of answering that question, which is not optimal.

To cover the requirements from the Habitats Directive and the Marine Strategy Framework Directive (Commission Decision for MSFD EU COM 848/2017), a coordinated monitoring for marine benthic habitats and species needs to be developed.

The monitoring of species and habitats is, as stated above, partly based on insufficient knowledge. Funding for further inventories, especially in the marine environment but also for some poorly known terrestrial habitats and species, is needed to help build a knowledge base. This can then be used, inter alia, to direct monitoring efforts, improve the quality of reporting, and direct conservation measures better.

For the reporting, there is a need to develop methods and IT systems to simplify the reporting and make the assessments easier and of higher quality. Sweden proposes more effort into data standardization and data harvesting at the EU level (by EEA, working groups and the EU Commission in cooperation with Member States), with the ambition of reducing the reporting burden for Member States while maintaining the desired data quality for EU-level analysis.

For monitoring of protected areas, better IT support systems are needed to simplify the analysis of data to make best use of the results for management and other decisions on prioritization. There is also ongoing work to improve the access to online information of monitoring and reporting data. For aquatic Natura 2000 especially, there is also a need to improve the national follow-up and overview of what conservation measures have been adopted at site-level and where, and any information on their effects.

Prioritization of measures to be implemented during the next MFF period

Regarding the monitoring of habitats and species covered by the Nature directives, maintaining established sampling programs is important. Of the "further measures needed" mentioned above, all should be started 2021-2027, if funding allows.

There are significant needs for improved monitoring and baseline mapping for marine habitats and species, as well as for some terrestrial habitats and species (mostly the lower flora and fauna). Inland dunes is an example of a habitat prioritized for mapping in the beginning of the period. An analysis of this is ongoing, and priorities are not clear as of this writing. If the political interest in the large carnivores should happen to decrease, and a favourable conservation status for those species is well secured, the monitoring of these could be decreased, thus freeing funding for other purposes. At present, however, none of those points are true.

List of prioritized measures to be carried out, and estimated costs for these measures

Name and short description of the measures	Type of measure*	Estimated cost in Euros (annualised)	Possible EU co-funding source
Monitoring of the outcome of the management of Natura 2000 sites and other protected areas #2	R	2 100 000 €	Horizon
Terrestrial environmental monitoring and reporting related to Natura 2000, IT systems for this etc #1	R	5 010 000 €	Horizon
Terrestrial biogeographic monitoring of habitats and species #3	R	2 200 000 €	Horizon
Reporting for article 17, terrestrial and aquatic, Habitats Directive #4	R	171 000 €	
Reporting for article 12, Birds Directive	R	30 000 €	
Monitoring of large terrestrial carnivores (wolves, brown bear, lynx, wolverine, golden eagle) including DNA analysis, IT systems ("Rovbase") and costs for personell. The largest part is staff at the County Administrative Boards, financed by the 1:3 grant through the Swedish EPA (50 annual manpower). # 8	R	6 400 000 €	Horizon
Wildlife management information #9	R	1 560 000 €	ERDF, Horizon
Coordination and administration of monitoring and reporting related to the Birds and Habitat Directives #5	R	See #5	
The Swedish Species Portal (IT system for species registrations from volunteers and some governmental monitoring and inventories)	R	1 000 000 €	
Aquatic environmental monitoring related to Natura 2000, IT-systems for this etc #6	R	5 000 000 €	
Method development and pilot studies, mostly for marine biogeographic monitoring of habitats and species	O	500 000 €	

* indicate whether the measure is recurring or one-off.

#1: The figure is calculated as 80 % of the amount stated as funding for biodiversity within the grant "1:2 miljöövervakning m.m." in the Swedish EPA report to the government in June 2016 (NV-08874-17, annex 1 and 2). Of the 5 million euro for biodiversity environmental monitoring, 80 % is estimated to be of relevance for the Natura 2000 network (the remaining 20 % is nationally and/or internationally relevant biodiversity monitoring costs, but not relevant for the Habitats or Birds Directives).

#2: In accordance with the national recommendations to the County Administrative Boards (CABs), this is calculated as 5 % of the budget for management of protected areas. The cost for administration at the CABs is not included here, but in the figure in E1.2 for general administrative costs related to Natura 2000 management at the CABs.

#3: Naeslund et al, 2018

#4: Reporting costs for article 17 reporting according to project plan, excluding specific costs for aquatic habitats and species, annualized (reporting once every sixth year)

#5: No figure given here, since this work is included in the general figure for administration in E1.2 (desk officers at Swedish EPA, Swedish Agency for Marine and Water Management, and others)

#6: Figure based on the Swedish Agency for Marine and Water Management's 2021 budget for aquatic environmental monitoring; whereof 25% is estimated to relate to Nature Directive habitats and species.

#7: Estimated from the proportion of aquatic vs terrestrial habitats and the known costs for the terrestrial reporting.

#8: See Naturvårdsverket report 6830 (2018), "Beskrivning av det skandinaviska inventeringssystemet för stora rovdjur". This is funded using the 1:3 grant handled by the Swedish EPA, except for a small part which goes directly to Sametinget. The sum includes all costs related to the measure, for example manpower at the Swedish EPA and the County Administrative Boards. Working groups and carnivore coordinators at the Sami Villages are also included.

9: Figure taken from Naturvårdsverket 2021 annual budget, code 1311 for 1:3 grants, knowledge base.

Expected results

The measures prioritised during the period with regards to monitoring, analysis and reporting are expected to provide an improved base for reporting in accordance with, foremost, the EU nature directives but will also be important for other reporting obligations (e.g. under the MSFD).

The improved knowledge gained from the measures listed is also expected to support decisions on for example prioritization of funding conservation measures and to allow the public, media and politicians to more easily take part in discussions about what future measures to prioritize, where and when.

E.1.4. Remaining knowledge gaps and research needs

Current status

The knowledge about the status of the habitats and species covered by the Nature directives is relatively good for some habitats and species, but weaker for others and in certain regions. This is especially the case for the green infrastructure outside protected areas. There have been comprehensive nationwide surveys of wetlands, meadows and pastures, woodland key habitats and of some watercourses, but a relatively large knowledge gap remains also for these habitats. The largest knowledge gaps are connected to forest habitats outside protected areas, for certain grassland habitats, fresh water and marine habitats, and for many species. The strategic work with green infrastructure started relatively recently in Sweden and is not yet fully developed.

Management strategies and guidelines are rarely comprehensive and the evidence-base for conservation measures and the priority between them is varied, both on national and regional levels.

In general, the adaptive management of protected areas is not very well developed. Management is mostly carried out based on the professional skills gained in the management organizations in the counties. Monitoring is carried out, but the monitoring results are generally not used systematically. In the case of marine protected areas, the Swedish Agency for Marine and Water Management has, together with concerned County Administrative Boards, developed a “Swedish approach to MPA Network Design & Management: framework and step-by-step guidance”. The ambition with the framework, together with regional plans for marine protected areas, is to further implement adaptive management of marine protected areas, both at site- and network level.

Although there is a growing consensus on the value of interplay between nature conservation and cultural heritage conservation there is a need to further develop knowledge on traditional methods and synergies that arise, guidelines, methods and best practices.

For several marine Natura 2000 habitat types, the lack of knowledge on their distribution is significant, particularly in off-shore areas. Habitat maps exist to some extent in the coastal area, but their quality is varying and patchy (the geographic scope is often limited, and the methods used vary). Habitat maps of high resolution primarily exist for areas that already enjoy formal protection. However, these maps are often based on modelling and/or desk work and have not been verified in the field. Knowledge gaps remain also for some coastal habitat. The ongoing shore inventory section of the THUF environmental monitoring (Terrester Habitat Uppföljning, SLU) project will give useful data (only for shores, not marine habitats), but should be complemented with mapping and further monitoring.

In 2016, a national project for marine habitat mapping was initiated at the Swedish Agency for Marine and Water Management. The purpose of the project is to produce seamless maps of benthic habitats, including Natura 2000 habitat types, to cover different management needs and to establish a long-term cooperation on mapping activities between relevant national authorities. The budget is approximately 1 million euros annually, including co-funding from EMFF. The project will run until 2023, but significant knowledge gaps will remain beyond that date, with continued need for EU funding aimed at mapping and/or inventory work in 2023–2027. More efforts are also needed to develop relevant monitoring methods for benthic habitats.

Research relevant for Natura 2000 and directive species and habitats more broadly has been financed through Swedish EPA research grants and a few other sources. Highly relevant research has been funded recently (for example by decisions by the Swedish EPA in the end of 2018 on funding i.e. for forest and grassland biodiversity) and several topics remain to be investigated. Examples include a lack of knowledge about the ecological needs of many species, especially for the lower flora, lower

fauna and fungi, when it comes to quantitative and qualitative habitat demands, dispersal abilities, genetic diversity and population viability analysis. At present, research on large carnivores is financed with approximately a few hundred thousand euros annually. Projects under Horizon 2020 will also be able to contribute. ”SUPERB” is an example, Systemic solutions for upscaling of urgent ecosystem restoration for forest-related biodiversity and ecosystem services.

Further measures needed

There is a need for better mapping of the restoration need of habitats and species – in the Natura 2000 network and other protected areas, but also for annex 1 habitats in the wider landscape. Such mapping will be necessary to make a national restoration plan in accordance with upcoming EU nature restoration policy in line with the EU Biodiversity Strategy to 2030. The cost needs suggested below are very preliminary, since they will depend on how the precise requirement for any such plans will be formulated.

The Article 17 report shows the need to increase the area, and improve the connectivity, of many habitat types of forests, semi-natural grasslands, wetlands, freshwater and marine habitats. Extensive surveys of several habitat types outside Natura 2000 areas are therefore needed.

The Article 17 report also shows that structures and functions need to be improved for many habitat types to reach favourable conservation status. Surveys of management needs in Natura 2000 areas and other protected areas are required and old management plans should be revised according to the needs. Strategies to prioritize between habitat types, management methods, measures and regions need to be developed. Monitoring of the effects of management is required to adapt management and achieve as favourable outcomes as possible, for instance monitoring the effects of fisheries management measures in marine Natura 2000 areas. A stronger emphasis on other gains from Natura 2000 management needs to be incorporated in new management plans, for example their contribution to ecosystem services, climate mitigation and adaptation, rural development, nature tourism, and small and medium enterprises.

The following specific measures are needed to develop better knowledge about the distribution and status of Natura 2000 habitats and species and their management needs:

- Surveys of habitats and species outside Natura 2000 sites and other protected areas to gain better knowledge of their distribution, status, and management needs of habitats with high value for nature conservation, to increase the possibilities to achieve an improved and more cost-efficient green infrastructure in both terrestrial and marine systems.

- Surveys of habitats and species, structures and functions, and management needs in approximately 3 000 Natura 2000 sites and other protected areas to gain knowledge of the required management needs of the actual sites.

- Improved methods and participatory processes for adaptive management and interplay with stakeholders.

- The development and administration of a GIS-based site-related database, including site information on conservation status and site-based management and monitoring needs for all Natura 2000 sites and other protected areas.

- Surveys of invasive alien species that can worsen the conservation status of habitats or species and development of control programs of such invasive alien species.

- The development of national and regional management strategies to manage areas in the most cost-efficient way. A compilation and analysis of site-related geographical information of management needs is required to prioritize resources and make strategic planning of the management of protected areas including Natura 2000 sites.

- Develop management guidelines, based on research, monitoring and best practice for some habitats, including aquatic systems and the interdependence between water and the terrestrial habitats, semi-natural grasslands, wet forests in need of hydrological restoration, marine and coastal habitats, and many typical species.

- Carry out management courses and other support to ensure that principles of adaptive management are incorporated in management strategies and guidelines for management of protected areas at both national and county levels.

- Research to increase the ecological knowledge, e.g. distribution traits, habitat needs, and critical habitat thresholds of many species, especially in the lower flora, lower fauna, fungi and in marine ecosystems. Such knowledge would enable the achievement of connectivity and long-term favourable conservation status for species.

Other research needs with relevance for annex I habitats and annex II species include:

- Evaluating and further developing methods for restoring important habitats in the marine environment, such as corals and blue mussel beds which are important structures in reefs (1170) and coastal wetlands.

- Developing and evaluating methods to improve conditions and restore areas for large carnivorous fish to reproduce successfully (to benefit habitats such as 1110 MBAL, 1130 MBAL, 1150, 1160).

- Research to improve the knowledge base to support the conservation of Harbour Porpoise, for instance the impacts of underwater noise pollution (both continuous and impulsive noise), developing improved bycatch risk maps in the Baltic Sea and continuing the development of alternative fishing gear that do not bycatch Harbour Porpoise.

- Research to improve the knowledge about the Swedish seal species, including satellite tagging and complementary monitoring of the Baltic Ringed Seal (6307), genetic studies and satellite tagging of the Harbour Seal (1365), especially in the MBAL, and satellite tagging of the Grey Seal (1364).

Prioritization of measures to be implemented during the next MFF period

All the measures mentioned above should be prioritized during the next MFF period when funding allows, see table below.

List of prioritized measures to be carried out, and estimated costs for these measures

Name and short description of the measures	Type of measure*	Estimated cost in Euros (annualised)	Possible EU co-funding source
Nationwide compilation of the conditions for biological diversity in forests outside Natura 2000 sites and other protected areas. #1	O	100 000 €	
Surveys of other habitats than forests and species outside Natura 2000 sites and other protected areas. #2	O	2 100 000 €	LIFE
Surveys of habitats and species, structures and functions and management needs in approximately 3000 Natura 2000 sites and other protected areas. #3	O	2 140 000 €	LIFE
Improving methods and processes for adaptive management.	O	100 000 €	LIFE, Horizon
Surveys of alien invasive species in areas included in PAF. #4	R	1 050 000 €	LIFE
Developing national management strategies for protected areas	O	100 000 €	LIFE

Mapping of restoration needs	O	50 000 €	LIFE
Developing 21 regional management strategies for protected areas (on County level)	O	600 000 €	LIFE
Develop management guidelines	O	200 000 €	LIFE
Consultant support to carry out management courses	R	200 000 €	LIFE
Mapping of marine benthic habitats	O	1 000 000 €	EMFAF, Horizon
Research to increase the ecological knowledge about species and habitats #5	O	14 400 000 €	Horizon
Other Research measures, for example on thresholds for connectivity #6	O	700 000 €	Horizon
Develop management of aquatic systems and their relationship to other terrestrial habitats in the concept of free-flowing rivers #XX	O	100 000 €	LIFE/ EMFAF
Research to improve the knowledge to support the conservation of Harbour Porpoise #7	R	1 300 000 €	LIFE/ EMFAF / Horizon
Research to improve the knowledge about the Swedish seal populations	R	700 000 €	LIFE, Horizon
Evaluating the effects of fisheries management measures in Natura 2000 areas (including evaluation of cold-water coral reefs (Lophelia pertusa) (1170 MATL) in 2027) #8	R	400 000 €	LIFE/ EMFAF
Developing and evaluating methods for restoring mussel- and oyster beds in order to identify the most cost-effective approach to benefit habitat type 1170 #9	O	145 000 €	LIFE/ EMFAF
Evaluating coastal wetland restoration projects carried out to date in order to identify the most cost-effective approach #10	O	100 000 €	LIFE/ EMFAF
Developing and following up methods to manage Stickleback populations in MBAL, to benefit populations of carnivorous fish and thereby habitats 1110, 1150, 1160 and 1130 #11	O	145 000 €	LIFE/ EMFAF
New or improved genetic monitoring of selected species other than large carnivores (mammals, birds, amphibians, pollinators)	R	500 000	Horizon

* indicate whether the measure is recurring or one-off.

#1: Forest mapping done as a part of the work with designation of new protected areas is included in the figures in E.1.1. This figure currently only includes research funded by the Swedish EPA.

#2: The figure is calculated as 1 annual manpower per County. Example of habitats to survey are springs and springfens (code 7160) and dune habitats (21xx, 23xx).

#3: The figure is calculated from the estimation that 20 sites could be surveyed per annual manpower.

#4: The figure is calculated as half annual manpower per County.

#5: The figure is taken from the current spending on research related issues at the Swedish Species Information Centre and the Swedish Biodiversity Centre at the Swedish Agricultural University. Other universities also do research relevant for Natura 2000 species and habitats. Funding of relevant research also come from MISTRA and FORMAS, but except for the new Formas program for sea and lakes they are outside the scope of this PAF due to a lack of time to delimit the actual amounts. The number given here should thus be read as being an underestimation.

#6: Swedish EPA research funding in end of 2018 for biodiversity in fragmented landscapes and protected areas 2-3 years ahead is used to estimate this figure.

#7: The figure is based on the cost estimates developed as part of the Swedish action programme for Harbour Porpoise, to be published in 2021, and the estimated budget for prospective Life-projects on this topic during this period (total estimation EUR10 000 000).

#8: The figure is based on the evaluation costs in the project Marine protected areas, subproject Assessing effects of fisheries regulations in marine protected areas (SLU Aqua).

#9: The figure is based on the cost of developing and evaluating methods for restoring eelgrass beds over a 7-year period (EUR1 000 000 in total).

#10: The figure is an estimate from the Swedish Agricultural University and includes evaluation of 100 restoration projects carried out in the past 10 years.

#11: The figure is an estimate from the Swedish Agricultural University and based on previous similar studies. The estimate includes three potential methods deemed most relevant to explore, including targeted pelagic fishing, targeted local coastal fishing and measures to support the population of large carnivorous fish through natural means (total cost EUR1 000 000).

Expected results

An improvement in the knowledge of the distribution, status, and management needs of Natura 2000 habitats both in Natura 2000 sites and in the green infrastructure outside Natura 2000 sites.

Natura 2000 sites and other protected areas are managed strategically at both national and county level and management resources are prioritized in a cost-efficient way. Natura 2000 habitats are managed, or restored, according to best knowledge and best practice.

Principles of adaptive management are overarching the management of protected areas at national and county levels and are reflected in management strategies and guidelines. Monitoring of management activities are carried out systematically and management of protected areas is adapted according to the results.

A first generation of green infrastructure is developed at national and county levels. Meadows and pastures outside protected areas, forest voluntarily set-asides in the forestry plans, and other valuable, or potentially valuable habitats, in the green infrastructure are managed in a cost-efficient way. Furthermore, marine spatial plans are based on green infrastructure and ensure connectivity between sites.

Restoration of marine annex I habitats is significantly advanced, as well as effective protection of the most vulnerable annex II species in the marine environment.

E.1.5. Natura 2000-related communication and awareness raising measures, education and visitor access

Current status

Most of the Swedish Natura-2000 sites are also protected nationally, either as national parks or as nature reserves. Some sites are protected as habitat protection areas or nature conservation agreements. Many awareness raising measures, including visitor access activities, are only carried out in national parks or nature reserves, whereas Natura 2000 sites which do not overlap with national parks or nature reserves are less developed in this respect. Habitat protection areas and nature conservation agreements are small areas that are strictly set aside for their high conservation values and are therefore only occasionally managed with visitor access in mind. In total there are 30 national parks and around 5 000 nature reserves which cover about 11% of Sweden's total area.

Awareness raising activities such as information, education, and demonstration of visit values represent a ground pillar in the public communication. The visitor centers (Naturum) play an important role in this work and offer a “gate” to nature. There are 32 visitor centers (23 state owned and 9 owned by municipalities). Information and communication are also carried out at websites of the national parks and the County Administrative Boards.

Accessibility measures to facilitate nature tourism for all, such as information and interpretation as well as means to improve physical accessibility, constitute an important part of the work. Priority is given to national parks and nature reserves important for the general public. During the previous funding period, the work with measures such as guidelines for accessibility (Naturvårdsverket et.al, 2013), guidelines for planning and organizing entrance points in national parks and other much visited areas (Naturvårdsverket, 2015), guidelines for interpretation and web-based education for managers to make nature and cultural areas accessible for all visitors have improved.

The costs of awareness-raising and accessibility measures are divided between one-off investments and recurrent costs. Bigger one-off investments include visitor centers, the national park websites, and entrance point to the sites. Smaller one-off investments include accessible toilets, information signs, improvement or construction of new paths, and bird observation platforms. In the alpine

region, recurring maintenance cost of security huts along winter paths and small-scale bridges over water courses are prioritized. Due to an increasing number of facilities and other investments, the recurrent costs for maintenance of facilities, buildings, web sites, information signs, etc. are increasing annually. Against this background, the financial means to keep up with maintenance work are not always enough.

Like many other countries around Europe, Sweden has had an outdoor recreation boom during the Covid-19 pandemic but the trend with increasing visitor numbers in protected areas has been observed during a longer period. The increasing visitor numbers provides a possibility for reaching out with information and hence establish higher awareness of the importance of nature conservation. At the same time, it is challenging to maintain a sustainable recreational use that aligns with the conservation objectives. Therefore, continuous and extended measures for visitor access and education is essential. To manage the increased number of visitors, Sweden needs to invest in capacity building and peer-to-peer learning about adaptive management tools, e.g. zonation, strategies to cope with litter, etc.

To achieve and sustain good conservation status, increased visitor rates also require improved communication between managers, nature tourism companies, the local community, and municipalities. Several national parks are working strategically with stakeholders for sustainable tourist destination development with the aim to create sustainable tourism in the whole area. One example is Åsnen National Park within Destination Åsnen. The possibilities for commercial activities for companies working with nature tourism are in some respects restricted in protected areas. Developments such as Destination Åsnen, provide an interesting example of how protected areas can be included in wider strategies that contribute to local development and green jobs. Since the Åsnen national park was established in 2018, it has played an important role in the development of nature tourism around lake Åsnen – thus far, without causing significant damage to natural values. Municipalities, the County Administrative Board and local companies have a well-developed cooperation and are working close together to promote sustainable tourism and preserve the natural values that it is dependent on.

All Swedish LIFE projects include communication activities to raise awareness of habitats, species and the Natura 2000 network as such. Many projects also facilitate access to Natura 2000 sites by the construction of footbridges, observation towers, etc.

In 2017 an integrated LIFE project, GRIP on LIFE, was launched with the goal to implement the Swedish PAF in a set of habitats connected to watercourses and wetlands in forested landscapes. The success of the project depends crucially on cooperation and dialogue between different authorities as well as the private sector and the public involved. The project is intended to contribute to developing and improving the communication around Natura 2000 and PAF in an important way.

LIFE IP Rich Waters is another collaborative project that was launched in 2017. This project tackles some of the most serious environmental problems affecting the Northern Baltic Sea River Basin and it aims at developing new and better methods to combat the problems in a cost-effective way. In 2021, the Project LIFE RestoRED has started, and it also has many important communication and dissemination activities, including information about restoration methods to students at schools for young farmers.

There are also important contributions from municipalities and foundations regarding visitor access and awareness raising about environment and nature conservation. Their measures are sometimes funded by The Local Nature Conservation Programme (LONA) that aims to strengthen local support and engagement for nature protection.

Further measures needed

It is important to continue prioritizing work within Natura 2000 sites that are also protected as a national park or nature reserve. This is because the areas are well spread over the country and provide a diversity of nature experiences that can appeal to a broad target group. Many of the areas have high accessibility and several services with high potential to enlighten visitors of the importance of protected areas. In areas that are only protected as Natura 2000, agreements with the land-owners about these types of measures need to be improved.

Visitor access (physical and information/interpretation)

The work with maintenance and investment in facilities needs to continue, both to improve physical access and for awareness raising. Each year new protected areas are established, bringing about increasing visitor numbers. Due to the high number of protected areas, maintenance work and investments needs to be prioritized carefully according to where they have the highest effects, since finances are limited.

The increasing nature tourism in protected areas accentuates the need for responsible planning and management. Such management needs to be able to handle sudden and sometimes unpredictable increases in numbers of visitors in protected areas. Measures include zonation (for which guidelines are needed), peer-to-peer learning and adoption of best practice from other countries such as Iceland and Norway.

Monitoring, evaluation and adaptive management needs to be improved. The gap between the need of maintenance and the actual measures in protected areas needs to be estimated and acted upon.

Entrance points to national parks and other nature sites of high visitor interest, as well as for example cottages and trails, need recurrent management.

Both climate mitigation and adaptation require amplified attention and investment. It is necessary to strengthen climate responsibility in visitor management and to take climate change into account while planning for new facilities and other investments for visitor access.

Education and awareness

To tailor awareness-raising activities, people's knowledge of the aim of protected areas as well as visitor behavior needs to be assessed. Currently, the work with surveys and monitoring is limited. Some questions are surveyed yearly but the assessments need to be further developed.

- Continue, and expand on, the yearly survey about awareness of protected areas in Sweden.
- Develop the website sverigesnationalparker.se
- Communicate and create awareness through visitor centers.
- Visitor monitoring – to be able to measure effects and goals, e.g. awareness, accessibility, etc.

Prioritization of measures to be implemented during the next MFF period

The measures listed are prioritized. With our current level of knowledge, it is not possible to quantify the relation between measures in this section and the conservation status of habitats and species in the Natura 2000 network. Decisions will have to be taken by those who manage the sites, on a case by case basis. The ambition is based on current (2021) national funding level.

List of prioritized measures to be carried out, and estimated costs for these measures

Name and short description of the measures	Type of measure*	Estimated cost in Euros (annualised)	Possible EU co-funding source
Buildings and recreation facilities; e.g. toilets, waste sorting facilities, information boards and buildings, bird-watching towers, shelter, areas for fireplaces, benches, tables, etc.	O	5 610 000 €	ERUF, LEADER
Buildings and recreation facilities; e.g. toilets, waste sorting facilities, information boards and buildings, bird-watching towers, shelter, areas for fireplaces, benches, tables, etc.	R	8 415 000 €	ERUF
Parking areas; foundation, hard/flattened areas with gravel, car front-railings, etc.	O	736 000 €	ERUF
Parking areas; foundation, hard/flattened areas with gravel, car front-railings, etc.	R	1 104 000 €	ERUF
Path/track; gravel paths, footbridges, wooden paths, ramps, railings, fence, etc.	O	3 222 000 €	ERUF
Path/track; gravel paths, footbridges, wooden paths, ramps, railings, fence, etc.	R	6 363 000 €	ERUF
Information and interpretation; information signs, direction signs, web-information, folders/brochures, guiding, etc.	O	3 651 000 €	ERUF
Information and interpretation; information signs, direction signs, web-information, folders/brochures, guiding, etc.	R	5 369 000 €	ERUF
Visitor centers (naturum); visitor information in visitor centres, guiding, exhibitions, technical information, etc.	R	5 696 000 €	ERUF
	TOTAL	**40 166 000**	

* indicate whether the measure is recurring or one-off.

Expected results

We believe that the effect of the work will result in:

- an increased number of visitors and therefore *more visitors who learn about protected areas* and who enjoy protected areas and therefore acknowledge their importance. From 2017 – 2020, the annual number of visitors in Swedish national parks has increased from about 2,5 million to about 3,1 million. The nature reserves also show increasing numbers of visitors. The same trend was seen in the visitor centers where the annual number increased from 1,4 million in 2014 to 1,8 million in 2017 but due to the Covid-19 pandemic, many visitor centers have had to close temporarily or relocated their activities to the surroundings outside of the buildings, resulting in decreasing visitor numbers inside the visitor centers. The number of visitors will probably start to increase again as soon as the visitor centers are able to open up and return to normal activity.
- an increased number of people *who will consider protected areas as important for their outdoor recreation and nature experiences, w*hich is important for the general awareness. In a survey from 2018, 98% of the respondents agree totally or partly that it is important to protect nature. Compared to results in 2017, the share has increased from 94% to 98%. In the same survey (2018), 56% of the respondents agree that nature reserves and national parks are important for their outdoor recreation (Kantar Sifo, 2018).
- an increased number of visitors *that have higher needs, difficulties, and perhaps also resistance to visit protected areas*, such as people with disabilities, older people, immigrants, and families with small children. In an unpublished survey from 2016 (170 people), with respondents with disabilities, it was shown that 9 out of 10 wants to spend more time in nature. The three most important factors identified to hinder outdoor access were; 1) difficulties to find information of accessible areas, 2) the information presented not being accessible, and 3) the areas not being physical accessible. These factors are no different in protected areas (Naturvårdsverket, 2016).

- *a sustainable recreation and nature tourism* in the national parks and nature reserves (through adaptive management, guidelines, zoning, awareness, accessibility, channeling, etc.). This should also contribute to reaching the biodiversity targets for the sites.

E.1.6. References (for horizontal measures and administrative costs related to Natura 2000)

See footnotes.

E.2 Site-related maintenance and restoration measures, within and beyond Natura 2000

E.2.1. Marine and coastal waters

Current status of habitats and species, conservation measures taken until now and their impact so far, remaining pressures and threats

Current status of habitats and species

The following table lists the marine and coastal habitats and species on Annex I and Annex II of the Habitats Directive that are present in Sweden and their national conservation status as reported in the most recent Swedish article 17 report (2019).

Code	Name	Status BOR	Status CON	Status MATL	Status MBAL
Habitats					
1110	Sandbanks			Bad =	Bad ↓
1130	Estuaries			Bad =	Bad =
1140	Mudflats and sandflats			Bad =	Inadequate =
1150	Coastal lagoons	Bad =	Bad =		
1160	Large shallow inlets and bays			Bad =	Inadequate =
1170	Reefs			Bad ↓	Bad ↓
1180	Submarine structures made by leaking gases			Bad ↓	
1650	Boreal Baltic narrow inlets				Bad =
8330	Sea caves			Inadequate =	Inadequate =
Species					
1364	*Halichoerus grypus*			Favourable	Favourable
6307 (1938)	*Pusa hispida botnica*				Bad ↑
1365	*Phoca vitulina*			Favourable	Bad ↑
1351	*Phocoena phocoena*			Favourable	Bad
1940	*Alisma wahlenbergii*	Bad			
1960	*Hippuris tetraphylla*	Bad ↓			
1922	*Macroplea pubipennis**	Unknown			

* Macroplea pubipennis is an aquatic leef beetle, recently found in Swedish waters in a few locations.

Considerable gaps in knowledge remain on the occurrence and distribution of several marine habitat types in Sweden, as well as their conservation status (see section E.1.4). The 2019 article 17 reporting assessments presented above were primarily based on extrapolation or expert opinion from a limited amount of data.

Common for all Annex I marine and coastal habitats present in Sweden, according to the article 17 report, is that their future prospects in terms of structure and functions are deemed as poor or bad, and their quality inadequate or bad.

Conservation measures taken until now and their impact so far

All Swedish marine and coastal habitat types listed in Annex I of the Habitats Directive require management within the habitats and/or in adjacent terrestrial and freshwater habitats to reach or maintain a favourable conservation status.

Measures aimed at reducing eutrophication in the marine environment is one example, which is primarily addressed within the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD) programmes of measures and coordinated regionally in the Regional Sea Conventions, including reducing marine pollution from agricultural activities. As part of the implementation of the MSFD programme of measures, for instance, several measures have been taken to limit the discharge of contaminants to the marine environment, including stricter

regulations of sewage water and tributylin discharge from leisure boats, decontamination of shipwrecks, etc.

Another relevant measure from the Swedish MSFD programme of measures is the ongoing development of a digital toolbox for restoration and ecological compensation of marine habitats. The experience with marine ecological restoration has so far been limited in Sweden. Many methods have only been applied at a very limited scale and their efficiency, cost and success rate are often poorly known. The toolbox is intended to enable more cost-efficient restoration measures at scale, thereby helping to improve the status of targeted habitats and the species that rely on them.

A range of site-specific measures have been carried out over the years to reduce the pressure and threat to protected habitats and species caused by physical modifications of the coastline. Examples include, among many others, removal of embankments and relocation of jetties. In recent years, Sweden has invested time and effort in developing and compiling a more comprehensive knowledge base on the impacts of physical modification of the coastline. These results are now being used to support, for instance, impact assessments, spatial planning and control and enforcement. Based on this improved understanding, a coordinated strategy against physical damages, and for biological restoration, is being developed and will be launched in late 2022. The strategy is another action within the Swedish MSFD programme of measures.

There is ongoing work to implement necessary fisheries conservation measures, both nationally and in offshore Natura 2000 areas, in accordance with the Nature Directives, the MSFD and the Common Fisheries Policy (CFP). Fisheries regulations have been implemented in Bratten (SE0520189) as a delegated regulation according to the CFP articles 11 and 18, in Kosterfjorden – Väderöfjorden (SE0520170) through national fisheries legislation. A joint recommendation has been sent to the European Commission for further process into a delegated regulation concerning another four sites. Proposed measures include, for example, zones with restricted gear types to prevent damage to habitats from bottom contacting gear or by-catch of Harbour Porpoise (1351) and sea birds. The MBAL population of Harbour Porpoise has been classified as Critically Endangered on the national Swedish red list (last update 2020) as well as on the red lists published by Helcom and by the IUCN. Fisheries regulations are aimed at both commercial and recreational fisheries, depending on the site. The intention is to implement fisheries conservation measures in marine protected areas where necessary as soon as possible.

Work is also underway to restrict the harvesting of wild populations of blue mussels for commercial purposes in MATL region, and a species action plan for blue mussel is being developed to collate best available knowledge and identify necessary measures to improve the status and range of mussel banks. The assessment of reefs (1170) in the 2019 article 17 report was largely influenced by the status of cold-water coral reefs and the decline in biogenic reefs in shallow waters, including blue mussel banks. Measures taken so far with regard to the blue mussel will hopefully help improve the status of habitat 1170, although much remains unknown about the causes of the decline of blue mussel and what the most effective measures to reverse it might be.

Several measures are ongoing to protect marine Annex II species, including managing hunting, limiting bycatch and reducing pollution. In the case of the MATL populations of Grey Seal and Harbour Seal and the MBAL populations of Harbour Seal and Baltic Ringed Seal, these measures have had a positive effect on the population. However, the overall status of the MBAL populations of Harbour Seal and Baltic Ringed Seal remain unfavourable. The Grey Seal is now in a favourable status in all its Swedish range. Efforts are ongoing to implement regulations to protect the Harbour Porpoise in Natura 2000 sites SE0330308 and SE0430187 both through BALTFISH and through articles

11 and 18 of the CFP with Sweden as initiating Member State. A joint recommendation according to the CFP is under development for the parts of site SE0420360 where other Member States have fishing access. For the parts of the site where only Swedish fishermen have access, national regulation is expected to come into force 1 January 2022. A joint recommendation according to the CFP is under development also for site SE0430183.

Lastly, a national species action plan for the Harbour Porpoise is soon to be published by the Swedish Agency for Marine and Water Management.

Remaining pressures and threats

The primary anthropogenic pressures on marine and coastal habitats include discharge of nutrients and contaminants, fishing and other exploitation along the coastline, including dredging and bottom trawling. The combination of different pressures may also lead to **cascade effects**. For instance, the absence of large predatory fish, caused by intensive fishing and other pressures, may reinforce the effects of eutrophication and lead to a decreased distribution of vegetation, e.g., eelgrass meadows. The area covered by eelgrass meadows has decreased in Swedish waters, particularly in MATL. Eelgrass meadows are a component of several marine habitats and a prioritized subtype of sandbanks (1110), which have an unfavourable status throughout their range.

Accumulated effects of **ongoing small-scale exploitation** of the Swedish coastline have severe impacts, including fragmentation and decreased connectivity between habitats. The decline in eelgrass meadows is primarily due to coastal exploitation and resulting increased turbidity. Small scale dredging is a diffuse but significant pressure from which negative effects on habitats and species can accumulate and generate a larger total than single large-scale projects. In the case of lagoons (1150), exploitation such as dredging has led to a decreased area over time, in particular in the MBAL and BOR regions. 1150 is a prioritized habitat in the Habitats Directive. Physical modification of the coastline is a remaining high impact pressure, as well as future threat, also to habitats 1130, 1140 and 1160 in all regions where they occur. Notably, the rate of destruction of these habitats currently far outweighs the rate at which remaining areas are protected or can be restored.

Marine fish and shellfish harvesting (including recreational fishing) causing a reduction of species/prey populations is identified in the 2019 article 17 reporting as a high impact pressure during the reporting period for several marine habitats (including 1110, 1130, 1150, 1160, 1170 and 1650). Loss of physical structures and disturbance of the seafloor from the same activities (trawling in particular) are identified as a remaining high impact pressure for habitats 1110 and 1170. Habitat 1180 (which only occurs in MATL) is unfavourable-declining, also partly due to indirect effects of bottom trawling (part of the habitat is located outside areas where trawling is restricted) as well as impacts of climate change (acidification). Marine fish and shellfish harvesting limiting the recovery of large predatory fish populations is also identified as a future threat of high importance to many of these habitats (including 1130, 1160, 1170 and 1650).

The nutrient pollution in water from agricultural land remains a considerable concern for the Swedish marine environment and is identified as a high impact pressure for habitats 1130, 1150, 1160, 1650 in the 2019 article 17 reporting. Natural processes of eutrophication (internal nutrient load) and acidification are identified as a high impact pressure and future threat for habitat 1170. Marine pollution caused by residential or recreational activities is exerting a high pressure and continues to be a threat to, in particular, habitats 1130 and 1650.

Wind, wave and tidal power (including infrastructure) and **bycatch and incidental killing** (due to fishingare identified in the 2019 article 17 report as high impact pressures to the MBAL population of Harbour Porpoise and continue to threaten the population in the near future.

The spread of and impacts caused by **invasive alien species (IAS)** exert pressure on several of the Annex I habitats and Annex II species in Swedish waters and is a potentially significant future threat to their conservation status. However, we still have limited knowledge of the extent and nature of these pressures and what measures might be effective to mitigate them.

Lastly, ongoing **climate change** is putting additional pressure on marine environments. It is identified as a pressure and threat to especially the Baltic Ringed Seal (6307), a species that is dependent on sea ice for successful reproduction.

Measures needed to maintain or restore favourable conservation status

Despite some measures having been carried out, as mentioned above, a majority of the measures identified as necessary in the 2019 article 17 report have not yet been taken. Notably, a coordinated approach including large-scale (also on land; often in collaboration with other countries) and site-specific measures, both inside and outside Natura 2000 areas, is necessary in order to restore and then maintain Swedish marine habitats and species to a favourable conservation status. Often measures aimed at addressing major pressures and threats are more likely to have long-lasting positive effects, than individual restoration measures. In order for restoration measures to have the intended effect, the environment needs to be in a good enough condition to support the habitats and species over time.

For instance, additional measures are needed on land to **reduce eutrophication and discharge of excess nutrients and contaminants** to the marine environment. Such measures are also needed locally to reduce the discharge to sensitive shallow bays in the Natura 2000 network and help improve the status of BOR and CON lagoons (1150), as well as habitats 1130, 1140, 1160 and 1650, and several species. Measures to reduce or eliminate marine pollution from agricultural activities, for instance, are identified in the 2019 Swedish article 17 report as important for improving the status of habitats 1110 and 1130 in the MATL region, 1150 in the CON region, and 1160 in the MBAL region. Some of these measures and their anticipated costs during the 2021–2027 period are presented in further detail in section E.2.4 (Grasslands) of this PAF. Others are listed under prioritized measures below.

Reducing or eliminating marine **contamination with litter** will also be important to improving the status of several marine Annex I habitats and Annex II species. Such measures might be needed locally, but also nationally and in collaboration with other countries. Habitats that could particularly benefit include 1110, 1140 in MATL, 1150 in CON, and species 1364 in MBAL.

There is a significant need in Sweden for in-situ **restoration of marine habitats**, for instance in order to help mitigate the effects of eutrophication. However, marine restoration is often very costly, slow and the outcome is uncertain. The ongoing work to improve the knowledge base and develop a practical toolbox for marine restoration (see above) will be important in this regard, as well as international cooperation on the development of cost-effective methods. In parallel, active restoration of habitats needs to continue, applying and evaluating methods that are already known. For instance, additional measures are needed to stabilize sediments along the west coast, to support eelgrass growth and thereby help improve the status of sandbanks (1110). Approximately 12,000 ha of eelgrass have been lost to date and it is estimated that about 75% of what was lost needs to be restored in order to reach favourable conservation status of related habitats. About 75% of this need

is estimated to be located within Natura 2000 sites. Replanting eelgrass is only feasible in areas where the conditions are suitable, for instance not too turbid. Such areas can be difficult to identify and they will need to be protected once measures have been carried out.

On the east coast, further measures are needed to support lagoons (1150), including restoring thresholds that have been dredged.

Restoration of coastal wetlands can help address issues related to trophic cascades by improving the status of reproductive areas for large carnivorous fish species, improving the status of several MBAL habitats, including 1110, that is unfavourable-declining, as well as for 1130, 1150 and 1160. Managing the increasing population of Stickleback (*Gasterosteus aculeatus*) could also support populations of large carnivorous fish (whose egg and larvae are eaten by the Stickleback), in particular in the MBAL region, with cascade effects benefitting protected habitats.

Management of commercial fishing has been identified as an important measure to improve the status of habitats such as 1170 in the MATL region, and to address the high pressure and threat that some of these activities still exert on habitats such as 1110, 1130, 1150, 1160 and 1650, as well as several marine species and birds. Applying an adaptive management scheme for Natura 2000 areas may entail adopting additional fisheries conservation measures, based on ongoing evaluations of the effects of implemented measures and reflecting the remaining pressures and threats listed above. Management of recreational fishing in the MBAL region is identified as important to improve the status of habitats such as 1110, 1140, and 1170. The measures in the MATL could be particularly beneficial for habitat 1160, according to the latest Swedish article 17 report.

The ongoing **small-scale exploitation of the coastline** needs to be reduced – both within and outside protected areas. Measures initiated through the implementation of the coordinated strategy for measures against physical damage and for biological recovery of coastal environments (see above) will be important to help improve the status of, for instance, habitats 1110, 1140, 1130 and 1160 in both MATL and MBAL. In practice, measures are needed both to significantly improve the monitoring of compliance with existing permitting rules, and to ensure due consideration of protected habitats and species (as well as key ecosystems functions and processes) in the permitting of new constructions and water operations. So long as the existing high pressure is not reduced, costly measures to restore habitats will not be able to deliver net status improvements of these habitats, and remaining good status habitats will be at risk of deteriorating and disappearing.

Sandbanks (1110), which are in an unfavourable status throughout their range, would benefit from reduced impact of **transport operation and infrastructure**, as would several marine species, including Harbour Porpoise and different seabirds. The need for further regulation of shipping in and/or close to some Natura 2000 areas therefore needs to be evaluated in more detail.

Measures to reduce the impacts of **outdoor sports, leisure and recreational activities** in MATL, in particular physical damage caused by anchoring, have been identified as important to improve the status of habitat 1170. Reducing the physical impacts of anchoring would also benefit habitats 1110, 1150 and 1160.

Measures are needed to try to manage certain **invasive alien species (IAS)** along the Swedish coastline, such as Pacific Oyster (*Crassostrea gigas*). Management, control or eradication of IAS is listed as an important measure in the article 17 report for habitat 1110 and 1150 CON. Notably, in the marine environment especially, measures to control or try to eradicate IAS are extremely challenging.

Conservation measures to address the pressures and threats caused by certain **power production installations** and **bycatch and incidental killing** in fishing are still not being applied in several Natura 2000 areas designated for the protection of Harbour Porpoise, neither in the MATL nor MBAL regions (note, however, the ongoing efforts described above). General measures to reduce bycatch are needed also outside Natura 2000 areas to protect the species, as well as measures to ensure the species' protection in areas that have been identified as particularly important for its survival but that are without formal protection today. Other measures that would be important to improve the status of the species, according to the article 17 report, include reducing/eliminating noise, light, heat or other forms pollution from industrial, commercial, residential and recreational areas and activities, and from transport. Lastly, four of the nine Sites of Community Interest (SCIs) that Sweden has designated for the protection of Harbour Porpoise still lack a management plan (designation is less than six years ago); these need to be developed and implemented.

Baltic Ringed Seal (6307) and Harbour Seal (1365) in the MBAL are in unfavourable status and could benefit from measures such as reducing risks of bycatch and incidental killing in fishing activities and measures to reduce the impacts of pollutants and physical disturbance. There are meanwhile significant knowledge gaps for these two populations. The MATL Harbour Seal population is in favourable status, as is the Grey Seal (1364) in all its range. A continued attention to these populations is needed in order to maintain their favourable status over time.

More work is needed to improve our knowledge about biogenic reefs (1170) and what measures are most important to improve the habitat's status (see section E.1.4). Relevant restoration methods are being developed to some extent (see above), but this work needs to continue and measures implemented and followed up, for instance the ongoing restoration of cold-water coral reefs (*Lophelia pertusa*).

For some habitats and species additional areas and/for improve connectivity between sitesmay need to be reviewed. This could be one suitable measure to strengthen the protection of reefs (1170) and Boreal Baltic narrow inlets (1650).

Prioritization of measures to be implemented during the next MFF period

As described above, based on the status assessment in the latest Swedish article 17 report, the need for measures in marine and coastal habitats is very large. Measures are needed at different scales, both inside and outside the Natura 2000 network, in order to improve the conservation status of the Swedish marine annex I habitats and annex II species. The measures prioritized for the 2021–2027 financing period below are primarily those that have been identified as central for the Annex I habitats and Annex II species that have an unfavourable conservation status and are declining. Some complementary measures aimed at addressing the most important pressures and threats are also prioritized. The prioritized measures below are those deemed to be feasible to carry out in the 2021–2027 period, based on, for instance, available capacity.

Due to remaining knowledge gaps, it is very difficult to estimate how much of a habitat area that is in need of a specific measure to improve its status. Significant efforts through research, mapping and inventories are needed to improve the knowledge about marine habitats (see E.1.4). Habitat 1180 MBAL, for instance, was reported as unfavourable-declining in 2019. However, the knowledge base is particularly poor for this habitat type and the prioritized measure for the period is therefore to improve the understanding of its distribution, status and most important pressures and threats. Work will also continue during the period to improve the knowledge about habitats 1170 and 1650. These knowledge-building measures are covered in section E.1.4.

The negative impacts of physical constructions and water operations in coastal areas and exiting watercourses need to be reduced during the period, as clearly identified in the extensive work done to date on physical impacts along the Swedish coastline (see above). Prioritized measures for the period include supporting an increased monitoring of compliance with existing permitting rules in order to identify constructions or operations that should be removed. This is part of the County Administrative Boards' and municipalities' ongoing work, costs for which are included in section E.1.2.

Resources for compliance monitoring will also be prioritized when it comes to species protection and other protection measures adopted inside and outside protected areas (see section E.1.2).

Measures to manage marine IAS impacting annex I habitats or annex II species this period will focus on continuing the already ongoing information campaign to alert the public about these species. These measures are listed in section E.1.2 of this PAF. Local management of IAS might also be required within marine Natura 2000 sites; costs for which are listed below.

Management of commercial and recreational fishing inside Natura 2000 areas will continue during the period. In the near future, approximately 30 marine protected areas (different designations) will be prioritized for fisheries regulation.

General measures to further improve water quality, for instance reducing eutrophication, are essential and will continue throughout the period as part of the Swedish river basin management plans. Measures to reduce and mitigate local input of nutrients and organic matter to the marine environment, such as mitigating internal loading of phosphorus, restoring natural hydrology and installing ditches, are prioritized during this period.

Continuing the work of restoring coastal wetlands to improve the status of reproductive areas for large carnivorous fish is also prioritized in 2021–2027. In order to calibrate and ensure cost-effective methods going forward, resources will also be prioritized to evaluate coastal wetland restoration projects that have already been carried out (about 100 projects during the last 10-year period) (see section E.1.4).

Developing and following up effective methods to manage Stickleback populations in MBAL, including active removal, will also be prioritized during the period (see section E.1.4). Further, the 2027 evaluation of ongoing restoration of *Lophelia pertusa* is prioritised; the costs of which are included in the costs for monitoring fisheries management measures in Natura 2000; see section E.1.4.

In parallel to method development, improved knowledge and intensified monitoring of compliance, active restoration is prioritized during this period as it may help mitigate further pressure and thereby reduce further harm. The following restoration measures related to specific Annex I habitats are examples of those prioritized for the 2021–2027 funding period:

Restoring meadows of eelgrass and other submerged aquatic plants (a prioritized subtype of sandbanks (1110).

Restoring lagoons (1150), including thresholds that have been damaged/destroyed by dredging.

Restoring and developing and following up methods to restore, where appropriate, mussel- and oyster beds, to benefit habitat type 1170 (see also section E.1.4).

Restoring macro algae vegetation in MBAL and MATL, to benefit habitat types 1150, 1160, 1170 and 1650 (as well as 1610 and 1620 to some extent).

As mentioned, restoration of habitats in the marine environment is still at an early stage in Sweden. Existing methods are expensive and results are uncertain and might only materialize far into the future. The foremost priority is to protect remaining sites of intact and well-functioning habitats and habitats of species. To further investigate if there are suitable additional areas to protect will therefore also be prioritized during the period to help improve the status of, for instance, habitat 1650 (see section E.1.1).

With regard to Annex II species, measures to improve the status of the critically endangered MBAL population of Harbour Porpoise (1351) are prioritized during the 2021–2027 period. Formal designation of unprotected areas that are known to be of high importance to the population is prioritized (see section E.1.1). Management plans need to be developed and implemented for the existing four SCIs designated for the species that currently lack such a plan (see section E1.1). Other measures include to further develop alternative fishing gear to reduce bycatch of Harbour Porpoise, develop improved bycatch risk maps in the Baltic and improve the knowledge about the impacts of underwater noise pollution, including continuous and impulsive noise. Cost estimates of these measures are provided in section E.1.4 of this PAF. Section E.1.4 also includes knowledge-building measures prioritised this period related to the Swedish seal species, especially the Baltic Ringed Seal (6307) and the Baltic population of the Harbour Seal (1365).

List of prioritized measures to be carried out, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Managing the nutrient load in shallow bays, to benefit habitats 1130, 1140, 1150, 1160, 1650 (CA13, CF07, CJ01) (average cost per bay: EUR140 000) #1	O	8 bays/ 7y	160 000	LIFE
Restoring coastal wetlands and flooded zones, to benefit habitats 1110 MBAL, 1130 MBAL, 1150, 1160 (CF02) (average cost per ha: EUR11 000) #2	O	432 ha/ 7y	679 000	LIFE/ EMFAF
Restoring eelgrass and other submerged aquatic plants in MBAL and MATL, including preparatory and supporting measures, to benefit habitats 1110 MATL, 1130 and 1160 (CF02) (average cost per ha: EUR500 000) #3	O	35 ha/ 7y	2 500 000	LIFE/ EMFAF
Restoring mussel- and oyster beds, to benefit habitat type 1170 (CF02) #4	O	20 ha/ y	400 000	LIFE/ EMFAF
Restoring macro algae vegetation in MATL and MBAL, to benefit habitats 1150, 1160, 1170 and 1650 (and 1610 and 1620 to some extent) (CF02) (average cost per ha: EUR70 000) #5	O	1 ha/ 7y	10 000	LIFE
Restoring lagoons (1150), including dredged thresholds (CF02) (estimated average cost per lagoon: EUR25 000) #6	O	32 lagoons/ y	800 000	LIFE
Managing, controlling and eradicating IAS in marine Natura 2000 (CI02, CI03) (average cost per project: EUR200 000) #7	R	3 projects/ y	600 000	LIFE
Managing commercial and recreational fishing in Natura 2000 (CG01 and CG02) (average one weeks work per site) #8	R	350 Natura 2000 sites/ y	540 000	EMFAF

* indicate whether the measure is recurring or one-off.

#1: Cost estimated based on the five-year demonstration project "Living Coast"[16] and the budget for a planned follow-up project. Target estimated based on capacity for the period and where measures will be prioritised.

#2: Cost estimated based on average cost of wetlands restored in the past 10-year period. Target estimated based on their number and size, and where additional measures might be prioritised.[17]

#3: Cost based on experience to date. Target estimated based on restoration need and nation-wide capacity.

#4: Cost based on existing interest at CABs to restore mussel- and oyster beds and known costs for mussels. Target estimated based on existing interest, assuming all measures will be prioritised inside Natura 2000.

#5: Cost based on the Green gravel method (USD7/ m^2)[18]. Target estimated based on existing capacity, assuming all measures will be prioritised inside Natura 2000.

#6: Cost based on average cost of lagoons restored to date. Target based on estimated need, available capacity at relevant CABs 2021-2027 and where additional measures might be prioritised.

#7: Cost based on projects carried out to date. Target based on estimated need and resources available.

#8: Cost based on estimated work required per Natura 2000 site and an annual salary rate of EUR80,000. Target based on estimated number of relevant Natura 2000 sites.

16 https://balticsea2020.org/images/Bilagor/White_paper-Bjornofjarden-201908.pdf.

17 https://www.su.se/polopoly_fs/1.500696.1589978079!/menu/standard/file/Va%CC%8Atmarksrapport%20O%CC%88stersjo%CC%88centrum.pdf and https://balticsea2020.org/images/Bilagor/rapport2012_3_lowres.pdf.

18 Fredriksen, S., Filbee-Dexter, K., Norderhaug, K.M. et al. Green gravel: a novel restoration tool to combat kelp forest decline. Sci Rep 10, 3983 (2020). https://doi.org/10.1038/s41598-020-60553-x.

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Managing the nutrient load in shallow bays, to benefit habitats 1130, 1140, 1150, 1160, 1650 (CA13, CF07, CJ01) (average cost per bay: EUR140 000) #1	O	2 bays /7y	40 000	LIFE
Restoring coastal wetlands and flooded zones, to benefit habitats 1110 MBAL, 1130 MBAL, 1150, 1160 (CF02) (average cost per ha: EUR11 000) #2	O	108 ha /7y	170 000	LIFE/ EMFAF
Restoring eelgrass and other submerged aquatic plants in MBAL and MATL, including preparatory and supporting measures, to benefit habitats 1110 MATL, 1130 and 1160 (CF02) (average cost per ha: EUR500 000) #3	O	10 ha /7y	720 000	LIFE/ EMFAF
Restoring lagoons (1150), including dredged thresholds (CF02) (estimated average cost per lagoon: EUR25 000) #4	O	8 lagoons/ y	200 000	LIFE

* indicate whether the measure is recurring or one-off.

#1: Cost estimated based on the five-year demonstration project "Living Coast"[19] and the budget for a planned follow-up project. Target estimated based on capacity for the period and where measures will be prioritised.

#2: Cost estimated based on average cost of wetlands restored in the past 10-year period. Target estimated based on their number and size, and where additional measures might be prioritised.[20]

#3: Cost based on experience to date. Target estimated based on restoration need and nation-wide capacity.

#4: Cost based on average cost of lagoons restored to date. Target based on estimated need, available capacity at relevant CABs 2021-2027 and where additional measures might be prioritised.

Expected results for targeted species and habitat types

Implementing all measures listed above is expected to lead to an improvement in the condition of the marine and coastal Annex I habitats and habitats of Annex II species, as indicated in this chapter. However, due to the remaining knowledge gaps concerning their conservation status it is difficult to predict to which degree the condition of different habitats will improve during the period, and by which measures. Considering the magnitude and complexity of the challenges facing these habitats and species in Swedish waters, we do not expect these measures to be enough to result in an improved status in the next assessment. In several cases, notably restoration measures, the results of measures will take a long time to materialize, even well beyond 2027.

Several of the relevant habitat types are currently being lost at a higher rate than they are being effectively protected or restored, in particular outside Natura 2000 sites. Therefore, the prioritised measures above will only deliver the intended improvements in condition if combined with broader measures to improve the status of the wider marine environment, for instance reducing eutrophication. They also have to be combined with the measures listed in section E.1, especially the improved monitoring of compliance with existing rules in E.1.2. The knowledge building and method development measures listed in E.1.4 are also essential, not least to ensure that future measures are effective and well directed.

Species listed on Annex I of the Birds Directive, or migratory birds, that are currently not in favourable status but are expected to be positively affected by conservation measures in the marine habitats include Clangula hyemalis (wintering) (Long-tailed Duck / alfågel), Haliaetus albicilla (White-tailed Eagle / havsörn), Hydroprogne caspia (Caspian Tern / skräntärna), Somateria mollissima (Eider

[19] https://balticsea2020.org/images/Bilagor/White_paper-Bjornofjarden-201908.pdf.

[20] https://www.su.se/polopoly_fs/1.500696.1589978079!/menu/standard/file/Va%CC%8Atmarksrapport%20O%CC%88stersjo%CC%88centrum.pdf and https://balticsea2020.org/images/Bilagor/rapport2012_3_lowres.pdf.

/ ejder), Sterna sandviciensis (Sandwich Tern / kentsk tärna), Sternula albifrons (Little Tern / småtärna).

Expected results: other benefits

Improving the status for large carnivorous fish is expected to not only have positive cascade effects on habitats such as 1110, but also on supporting ecosystem services such as water quality and provisioning services like benefiting the small-scale commercial and recreational fisheries.

Continued protection and restoration of eelgrass beds could have positive effects in the longer run on small-scale and recreational fishing. It can also, if successful, contribute to carbon sequestration and storage as well as improved water quality locally.

See section F, section on marine and coastal waters, for additional reasoning.

E.2.2. Heathlands and shrubs

Current status of habitats and species, conservation measures taken until now and their impact so far, remaining pressures and threats

The following table lists the heathland and shrub Annex II habitats of the Habitats Directive that are present in Sweden and their national conservation status as reported in the most recent Swedish article 17 report (2019). (No annex 2 species are listed under this section.)

Code	Name	Status ALP	Status BOR	Status CON
Habitats				
2130	Fixed dunes (grey dunes)		Unfavourable	Unfavourable ↑
2140	Empetrum dunes		Unfavourable	Unfavourable
2170	Dunes with creeping willow		Unfavourable	Unfavourable
2180	Wooded dunes		Unfavourable	Unfavourable
2190	Humid dune slacks		Unfavourable	Unfavourable
2320	Dry sand heaths		Unfavourable	Unfavourable =
4010	Wet heaths		Unfavourable↓	Unfavourable↓
4030	Dry heaths		Unfavourable↓	Unfavourable ↓
4060	Alpine heaths	Favourable		
4080	Sub-arctic scrub	Favourable		
5130	Juniper scrub		Unfavourable	Unfavourable

Heathlands are in general threatened by the abandonment of agricultural land and by changes in land use. Exceptions are the alpine heathlands (4060, 4080) which are in favourable conservation status and thus not covered in the text below. Although they are extensively grazed by reindeer herding in the summer, and this practice contributes to the favourable status there. The habitat types and species associated with the agricultural landscape have poor conservation status. Both area coverage and the “Structures and functions” criterion are in general assessed as unfavourable/bad in the article 17 report, meaning that the management regime needs to be improved in these habitat types and that additional restoration actions will be required in areas that have been abandoned or are subjected to land use change.

The management of boreal and continental heathland and shrub habitat types is similar to the management of many grassland habitat types, e.g. traditional grazing and in some cases mowing or heathland burning. They are mainly maintained by current agricultural production holdings, enabled with subsidies for management of lands with biological values, but significant areas are also restored and maintained by County Administrative Boards, municipalities, and non-profit organizations. Just

as for the grassland habitat types, major efforts, both in terms of restorations and annual management measures, need to be implemented also in heathland and shrub habitat types to improve their conservation status.

The conservation status among coastal dunes is unfavourable in many areas as a result of the plantation of sand-binding vegetation, reduced soil disturbance from grazing livestock, absence of fire, nitrogen deposition, and the spread of invasive species. Significant areas have been restored in recent years in parts of southern Sweden within the SandLife project. Additional restoration actions are however still necessary, particularly in the boreal zone.

Surface areas reported in this document are mainly based on the areas in the article 17 report, with addition information about current management status gathered from national databases (TUVA and NNK), statistics from the Swedish Board of Agriculture and sometimes from expert judgements.

The most important associated species listed under Annex IV in the Habitats directive or under Annex I in the Birds directive, that are currently in unfavourable conservation status but will be positively affected by conservation measures in the heathland habitats, are *Lacerta agilis* and *Anthus campestris*.

Measures needed to maintain or restore favourable conservation status

A total of 23 600 ha of management-dependent heathland and shrub area are currently recorded (2130, 2140, 2170, 2180, 2190, 2320, 4010, 4030, and 5130), 58% of this area is located within the Natura 2000 network. Active annual or regularly recurring management measures are required to ensure maintenance, avoid deterioration and/or progressively lead to an improvement of ecological condition in all these habitat types.

Among the heathland and shrub habitat types listed in Annex I of the Habitats Directive occurring in Sweden, seven require active management through agricultural practices (2140, 2170, 2320, 4010, 4030, and 5130). In total, 13 390 ha require grazing, 6 880 ha of this area is located within Natura 2000.

Other active annual management measures include recurring prescribed burning (2130, 2140, 2320, 4010, and 4030) and/or soil disturbance (e.g. tillaging; 2130, 2140, 2170, 2180, 2190, and 2320). Burning and soil disturbance are not appropriate every year but rather with 3-10-year intervals. Active clearing of bush and understory vegetation is also necessary to avoid overgrowth in 2170, 2180, and 2190.

In addition to the traditional management measures, decimation of problematic alien and native species is required to maintain good ecological status in some habitat types.

One-off restoration measures are also needed to increase the area in good conservation status in all habitat types. For wooded dunes, 2180, prescribed woodland burning will be an important part of the restoration measures.

In addition to the active management actions presented here, several other actions necessary to halt habitat deterioration can be listed. These include the reduction of atmospheric nitrogen deposition, the reduction of negative impacts from some types of recreational activities, culling of wild boar, and the adaptation and maintenance of military activities in a few specific areas.

List of measures needed to maintain or improve habitat status

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)
Grazing	R	6 880 ha/y
Prescribed burning	R	7 073 ha/y
Tillaging	R	7 234 ha/y
Clearing of bush and understory vegetation	R	5 211 ha/y
Removal of Campylopus introflexus and/or Rosa rugosa	R	2 254 ha/y
Culling of wild boar	R	6550 ha/y
Restoration of pastures	O	2 408 ha/7y
Restoration of sand dunes	O	3 452 ha/7y

** indicate whether the measure is recurring or one-off.

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)
Grazing	R	6 510 ha/y
Prescribed burning	R	5 077 ha/y
Tillaging	R	3 737 ha/y
Clearing of bush and understory vegetation	R	1 840 ha/y
Removal of Campylopus introflexus and/or Rosa rugosa	R	1 687 ha/y
Culling of wild boar	R	6 080 ha/y
Restoration of pastures	O	2 279 ha/7y
Restoration of sand dunes	O	979 ha/7y

* indicate whether the measure is recurring or one-off.

Prioritization of measures to be implemented during the next MFF period

The active maintenance measures presented above are all essential to avoid further deterioration of the conservation status of the nine non-alpine heathland habitat types. But based on practical feasibility and the currently (2021) available annual budget, it is not possible to prioritise all actions.

Maintenance of the current management of heathland and shrub habitats that is covered by schemes in the rural development program 2014-2022 (EAFRD) is prioritized, together with maintenance of recurring management actions carried out in protected areas by the site managers. Consideration of the possibilities to finance other recurrent management actions in the larger GI has led to their exclusion from the prioritized measures, although they are important for maintaining habitat quality.

Based on monitoring as well as statistics on subsidies for habitat management of lands with biological values, it is estimated that the area of grazed pastures (2320, 4010, 4030, 5130) that have been abandoned relatively recently and that are practically/economically possible to restore during 2021-27 is 2 408 ha in Natura 2000, and 500 ha in the surrounding green infrastructure. Corresponding figures for the dune habitats (2130, 2140, 2170, 2180, 2190) are 3 452 ha located inside Natura 2000 sites.

Assumptions regarding measures carried out by private voluntary actions: Figures for the hunting of wild boar have not been included among the prioritized measures in the tables below, except for a limited activity within the Natura 2000 network. The true cost exceeds on average the figures below, since the farmer is not compensated for all incurred cost and income forgone.

List of prioritized measures to be carried out, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source

Grazing	R	4884 ha/y	2 250 000 €	EAGF, EAFRD
Prescribed burning	R	7234 ha/y	1 415 000 €	EAFRD
Tillaging	R	5211 ha/y	72 000 €	
Clearing of bush and understory vegetation	R	5189 ha/y	115 000 €	LIFE, EAFRD
Removal of Campylopus introflexus and/or Rosa rugosa	R	2 254 ha/y	50 000 €	LIFE
Culling of wild boar	R	655 ha/y	14 000 €	
Restoration of pastures	O	2408 ha/7y	917 000 €	EAFRD, LIFE
Restoration of sand dunes	O	3452 ha/7y	1 156 000 €	LIFE

** indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Grazing	R	3 903 ha/y	1 795 000 €	EAGF, EAFRD
Prescribed burning	R	0 ha/y	0 €	EAFRD
Tillaging	R	0 ha/y	0 €	
Clearing of bush and understory vegetation	R	0 ha/y	0 €	LIFE, EAFRD
Removal of Campylopus introflexus and/or Rosa rugosa	R	0 ha/y	0 €	LIFE
Culling of wild boar	R	0 ha/y	0 €	
Restoration of pastures	O	500 ha/7y	190 000 €	EAFRD, LIFE
Restoration of sand dunes	O	0 ha/7y	0 €	LIFE

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

Estimated costs for maintenance and restoration measures are based on information from authentic management projects conducted in many different sites with very different local conditions and in different parts of the country. The variation in costs is therefore substantial but the standard costs suggested here are based on relevant figures and are near the median of those in the assembled background information. The only exception are the grazing costs, where the estimated costs are based on the current amount spent on EAGF and EAFRD payments, as well as some of the national costs for management of Natura 2000. These costs are thus below the estimated real costs of grazing these areas, since the contribution of these funds is below the calculated cost and income forgone.

Expected results for targeted species and habitat types

The suggested actions for dune habitats within Natura 2000 are expected to be able to improve the dune habitat status there.

The implementation of the above recurring maintenance measures targeting heathland and shrub habitat types will be important for maintaining current habitat types during 2021-2027, but since it only covers a part of the estimated total grazing needs, and only includes other important recurring actions in Natura 2000, not in the GI, they are not expected to be sufficient for maintaining current habitat areas, or to stop the decline in species or habitat status.

Expected results: other benefits

The suggested measures contribute to an open and varied landscape, valuable for recreation and tourism. See also section F.

E.2.3. Bogs, mires, fens and other wetlands

Current status of habitats and species, conservation measures taken until now and their impact so far, remaining pressures and threats

Sweden has 11 of the wetland habitat types listed in the Annex I of the Habitats directive (7110, 7120, 7130, 7140, 7160, 7210, 7220, 7230, 7240, 7310, 7320). The habitats 2170 and 2190 are handled under E.2.2 Heathlands and shrubs and 91D0 is handled under E.2.6 Woodlands and forests.

Current status of habitats and species

Of the wetland habitats in this section, all in the alpine region are reported to have a favourable conservation status due to quite low pressures as compared to the continental and boreal regions, especially the southern part of the boreal region. The following table lists the habitats and species in Annex I and Annex II of the Habitats Directive that are present in Sweden and their conservation status within Sweden for each biogeographic region, as reported in the most recent Swedish article 17 report (2019).

Code	Name	Status ALP	Status BOR	Status CON
Habitats				
7110	Active raised bogs		Inadequate =	Bad ↓
7120	Degraded raised bogs		Bad ↓	Bad ↓
7130	Blanket bogs	Favourable		
7140	Transition mires and quaking bogs	Favourable	Inadequate ↓	Inadequate ↓
7160	Springs and springfens	Favourable	Bad ↓	Bad ↓
7210	Calcareous fens		Favourable	Favourable
7220	Petrifying springs		Inadequate =	Inadequate ↓
7230	Alkaline fens	Favourable	Inadequate ↓	Bad ↓
7240	Alpine pioneer formations	Favourable		
7310	Aapa mires	Favourable	Inadequate =	
7320	Palsa mires	Bad ↓		
Species				
1013	*Vertigo geyeri*	Favourable	Bad ↓	Bad ↓
1014	*Vertigo angustior*		Inadequate	Inadequate
1015	*Vertigo genesii*	Favourable	Bad =	
1389	*Meesia longiseta*	Favourable	Bad ↓	
6216 (1393)	*Hamatocaulis vernicosus*	Favourable	Inadequate ↓	Bad ↓
1528	*Saxifraga hirculus*	Favourable	Inadequate =	
1903	*Liparis loeselii*		Inadequate ↓	Bad ↓
1983	*Hamatocaulis lapponicus*		Bad =	
4115	*Rhinanthus oesilensis*		Favourable	

Conservation measures taken until now and their impact so far

Measures taken to restore, recreate and protect wetland have had a large positive influence, and contribute to biodiversity targets and ecosystem services. Many of these measures also contribute towards reaching the Agenda 2030 goals. Yet, deterioration such as bush and tree encroachment of wetlands continue due to effects from earlier drainage works and other hydrology changes, land use, cessation of grazing or mowing, nitrogen deposition, and climate change. Out of 4,3 million hectares of wetland in our boreal and continental regions (wetlands in a broader sense than in this PAF section, as defined by the Swedish wetland survey), around 0,5 million hectars have formal

protection, and around 0,2 million hectars is listed as in need of protection[21]. Only one or a few percent of the total area in need of restoration have been restored so far. The need for further measures to protect, restore and recreate thriving wetlands is thus still large. Regarding hydrology of wetlands, it should be mentioned that land drainage is subject to a strict permit procedure since several decades, and this has hindered further damage to wetlands.

Mowing of wetlands has received funding through the CAP and cover more than 8 000 hectares. These are mainly located in northern Sweden, and the mowing has been important to maintain biodiversity and cultural values. At the same time, grazing or mowing of wetlands overall, especially in southern Sweden, is often insufficient to maintain or restore the habitats concerned.

A government priority to restore and recreate wetlands, with increased funding, was introduced in 2018, paused in 2019-2020 and re-established in 2021. This has been important to step up the efforts and improve the trends for wetlands.

Remaining pressures and threats

In the boreal and continental regions, the pressures and threats are high. Many wetlands are hydrologically modified by e.g. drainage for improving the forest and food production or to increase the area of land. Around 80 % of the mapped wetlands (outside the alpine area) have been affected in the last centuries. Since several decades, new drainage of wetlands is subject to strict regulation, but negative effects from previous modifications normally remain. Road construction in or close to wetlands often impact the hydrology negatively and increases the habitat fragmentation. Peat extraction affect a small fraction of the area, but where it occurs it destroys the habitat and the hydrology nearby is also negatively affected.

Drier conditions from affected hydrology in open mire types result in encroachment with higher vegetation such as shrubs and trees, and oxidation and compaction of the surface peat layer. This of course also leads to negative effects for lower vegetation such as mosses and for animals using the wetland, including for example small snails such as *Vertigo* species (some of which are listed in annex 2 of the Habitats Directive). Decreased traditional management, such as grazing or mowing, also contribute to bush or tree encroachment. Drier conditions in combination with less management make the situation even more severe. In addition, climate change and nitrogen deposition from air pollution contribute to increased overgrowth. Nitrogen deposition is particularly relevant in the south and southwest of Sweden and less of a concern in the north. Historically, many of the habitats have been more used for e.g. hay production (e.g., 7230 and 7140) or as sources for water (7160). Habitat types which are rarer (e.g., 7160, 7220) have often not received enough attention, and thus threats from for example forestry or road constructions can risk a negative impact of a larger proportion of such habitats.

Measures needed to maintain or restore favourable conservation status

All wetland habitat types are dependent on, or favoured by, natural or close to natural hydrological conditions. Hydrological restoration by blocking and/or filling old ditches and drainage systems can be useful andare of great importance for the large portion of wetland habitats that are negatively hydrologically affected. Adjusting or improving road culverts, or other culverts, if they act as fauna

[21] Myrskyddsplanen (Translation: The plan for protection of mires)

barriers and/or water dams, is also important. Hydrological damage has occurred in about 80 % of the wetlands in the boreal and continental regions, and the need for restoration is thus large.

To recreate open bogs, first the hydrology needs to be restored, then higher vegetation that has thrived during drier conditions need to be removed. Raising the water table often drowns the higher vegetation, but the organic matter also often needs to be removed to establish more nutrient poor conditions, which is natural for bogs. Recurrent removal of vegetation may be needed to maintain the open habitats, with a frequency depending on the growth rate.

Rich fens, and some other habitats, often need a more active, and recurring, management, either mowing or grazing or a combination of both to achieve favourable conservation status. Many of the fens have not been mowed or grazed for quite a long time and need first to be restored (similar to the description for bogs above) and then management should be reinstated. In the boreal and continental regions, large areas of the habitat need to be restored. Active management can also be needed in some wetlands important for birds, for example to maintain a mosaic of open water and vegetation despite nutrient load and land upheaval. Generally, such recurring management or restoration is currently more often needed in the contintental and lower boreal region, less often in the upper boreal region, and very rarely in the alpine region.

Palsa mires (7320) are decreasing due to climate change and there are currently no feasible measures available, other than to limit the climate change. Limiting climate change would also be preferable for most other habitats and species in wetlands. Apart from the obvious, that a smaller change in climate would lead to smaller changes in the habitats concerned, the climate change is probably too quick for species to be able to spread to new sites as fast as the climate changes (see for example a thesis on mosses [22]). Enhancing species dispersal, for example by transplantation, will likely thus be needed soon.

Where wetlands meet aquatic habitats, grasslands and forests, the gradient is often abrupt today due to hydrological alterations and should be enhanced to create more of a mosaic landscape for species dependent on several habitat types or gradients. This can for example include recreating meandering watercourses with areas which flood during high water. Such measures are generally listed in section E.2.8 (Freshwater).

Recreation of wetlands in the form of fish-free ponds, for amphibians, is also needed, within the range of those species.

Invasive alien species (IAS) is a problem that is increasing. At present it is considered a managable issue for wetlands in Sweden, but the development needs to be monitored, and measures should continue against known IAS, such as the raccoon dog *(Nyctereutes procyonoides),* Egyptian goose *(Alopochen aegyptiaca)* and others. Such measures are listed in section E.3 since they are a concern for several habitats and species. The Spanish slug *(Arion vulgaris)* is an example that perhaps can spread further into some wetlands.

Prioritization of measures to be implemented during the next MFF period

[22] Predicting the dynamics of range shifts under climate change: assumptions and applications to the European bryophyte flora. June 2021. Thesis for: PhD, Flavien Collart, University of Liege, Belgium. https://www.researchgate.net/publication/352439935_Predicting_the_dynamics_of_range_shifts_under_climate_change_assumptions_and_applications_to_the_European_bryophyte_flora

Hydrological restoration and improved green infrastructure are crucial for all the wetland habitat types and before performing any other measures the hydrological functioning needs to be considered. This applies basically independent of cause (roads, culverts, ditches in forests or agricultural land, etc). The habitats 7110, 7140, 7230, 7160 and 7220 are highly prioritised for management and restoration. For example, alkaline fens (7230) often need hydrological restoration and clearance of higher vegetation, and where funding allows, recurrent grazing and/or mowing should then be put in place to reach and maintain a favourable conservation status. Generally, such recurring management is currently more often needed in the contintental and lower boreal region, less often in the upper boreal region, and very rarely in the alpine region. Continuation of management by grazing or mowing is important to maintain the status for the habitats concerned, in particular within Natura 2000 sites.

The landscape perspective and the impact of measures on nearby land is important to consider when restoring wetland habitats, to find appropriate solutions for prioritized habitats and species while taking account of economic, social and cultural requirements and regional and local characteristics. The prioritized measures therefore include planning and analysis, often at the scale of catchment areas. Such overall planning and analysis is not included in the figures here, but instead in E.1.2 (mainly work at the County Administrative Boards).

Monitoring of status and trends should continue (see section E.1.3), and we should be ready to consider further measures for example in the alpine region if climate change makes it necessary.

Habitat 7120 (degraded raised bogs) is not prioritized for measures outside the Natura 2000 sites since there are still many other bogs (7110) that can be restored, and it is more efficient to prioritize them.

List of prioritized measures to be carried out, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Grazing (CA03, CA05)	R	1440 ha/y	637 000 €	EAFRD, EAGF
Mowing (CA03, CA05)	R	300 ha/y	213 000 €	EAFRD, EAGF
Recreate Annex 1 agricultural habitats, mainly by clearance of higher vegetation in rich fens, in the boreal and continental regions (CA07)	O	723 ha/7y	244 000 €	LIFE
Adaption or reconstruction of culverts that act both as a barrier and or alter the hydrological function	O	37 units/7y (culverts)	55 000 €	LIFE
Hydrological restoration, mainly by filling and blocking ditches. Includes hydrological investigations. (CJ03, CA15, CB14, CC04, CE06, CC13, CF10...) #1	O	32 000 ha/7y	6 000 000 €	LIFE
Clearance of higher vegetation (shrubs, bushes and/or trees.) (CJ03 = Restore habitats impacted by multi-purpose hydrological changes)	O	8 000 ha/7y	3 000 000 €	LIFE
Recreate ponds for amphibians etc. (CS03 = Improvement of habitat of species from the directives)	O	70 ponds/7y	500 000 €	LIFE, EAFRD

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

1: Recurring grazing or mowing. In some cases, this includes to reinstate grazing or mowing (after a restoration, see other measures)

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Grazing (CA03, CA05)	R	840 ha/y	370 000 €	EAFRD, EAGF
Mowing (CA03, CA05)	R	7840 ha/y	5 566 000 €	EAFRD, EAGF
Recreate Annex 1 agricultural habitats, mainly by clearance of higher vegetation in rich fens, in the boreal and continental regions (CA07)	O	723 ha/7y	244 000 €	EAFRD, LIFE
Adaption or reconstruction of culverts that act both as a barrier and or alter the hydrological function	O	37 units/7y (culverts)	55 000 €	LIFE
Hydrological restoration, mainly by filling and blocking ditches. Includes hydrological investigations. (CJ03, CA15, CB14, CC04, CE06, CC13, CF10...) #1	O	4300 ha/7y	800 000 €	LIFE
Clearance of higher vegetation (shrubs, bushes and/or trees.) (CJ03 = Restore habitats impacted by multi-purpose hydrological changes)	O	800 ha/7y	300 000 €	LIFE
Recreate ponds for amphibians etc. (CS03 = Improvement of habitat of species from the directives)	O	20 ponds/7y	143 000 €	LIFE
Management, control or eradication of invasive species – by eradication or reduction (CI01-07)	O	see E.3.1	see E.3.1	

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

#1 The cost for hydrological investigation is estimated to 200 euro/ha based on experiences from the LIFE AdMire project

Expected results for targeted species and habitat types

The listed restoration measures should improve the hydrological status of the *targeted* areas of wetland. For Natura 2000 sites this is an ambitious program for hydrological restoration, but realistic according to current knowledge and funding levels. Even though it is ambitious, it is unlikely to be enough to reverse the negative trend for most habitats, since large areas are outside the scope of our measures in this PAF period.

For areas dependent on recurring management, the prioritized measures this period are not enough to make the wetlands in all sites within Natura 2000 reach a favourable conservation status at site level, and only a minor portion of the ones outside of Natura 2000 will be possible to manage. This will lead to further deterioration of conservation status for habitats which depend on grazing or mowing. This includes many rich fens (code 7230) and some transition mires and quaking bogs (code 7140) in the continental and boreal regions. An important exception ca be the wetlands with funded mowing, mostly in northern Sweden, which contribute to maintaining the prioritized biodiversity (and cultural) values in those sites.

For amphibians depending on ponds, increasing the number of suitable ponds should improve their conservation status and/or trend, all other factors being equal.

Species listed under Annex IV in the Habitats directive or under Annex I in the Birds directive, that are currently not in favourable conservation status but will be positively affected by conservation measures in the wetland habitats listed above:

Vertebrates: *Lutra lutra*, *Myotis dasycneme*

Amphibians: *Bufotes variabilis*, *Epidalea calamita*, *Pelobates fuscus*, *Pelophylax lessonae*, *Rana dalmatina*, *Triturus cristatus*

Plants: *Arctophila fulva*, *Liparis loeselii*, *Persicaria foliosa*

Birds: *Alcedo atthis*, *Anser erythropus*, *Botaurus stellaris*, *Chlidonias niger*, *Ciconia Ciconia*, *Circus cyaneus*, *Circus pygargus*, *Falco peregrinus*, *Gallinago media*, *Gavia stellate*, *Haliaeetus albicilla*, *Limosa lapponica*, *Porzana porzana*

Expected results: other benefits

Mires provide a series of ecosystem services and climate change adaptation e.g. sequestration of carbon, purification of water e.g. by absorbing nutrients into vegetation, reduced leakage of metals and acids from drained acid sulfate soils, increase the retention time of the water, flood prevention and increased biodiversity and habitats. Restoration and management of wetlands will increase the services mentioned above.

E.2.4. Grasslands

Current status of habitats and species, conservation measures taken until now and their impact so far, remaining pressures and threats

The following table lists the grassland habitats and species in Annex I and Annex II of the Habitats Directive that are present in Sweden and their national conservation status as reported in the most recent Swedish article 17 report (2019).

Code	Name	Status ALP	Status BOR	Status CON
Habitats				
1310	Salicornia mud and sand		Bad ↓	Bad ↓
1330	Atlantic salt meadows		Bad =	Bad =
1630	Baltic coastal meadows		Bad =	Bad =
2330	Inland dunes		Bad	Bad
6150	Siliceous alpine grasslands	Favourable	Favourable	
6170	Alpine and subalpine calcareous grasslands	Favourable		
6210	Orchid-rich calcareous grasslands	Bad ↓	Bad ↓	Bad ↓
6230	Species-rich *Nardus* grasslands	Bad ↓	Bad ↓	Bad ↓
6270	Fennoscandian lowland species-rich grasslands	Bad ↓	Bad ↓	Bad ↓
6410	Molinia meadows	Bad ↓	Bad ↓	Bad ↓
6430	Hydrophilous tall herb	Favourable	Bad	Bad
6450	Northern Boreal alluvial meadows	Bad	Bad ↓	
6510	Lowland hay meadows		Bad ↓	Bad ↓
6520	Mountain hay meadows	Bad ↓	Bad ↓	
6530	Fennoscandian wooded meadows		Bad ↓	Bad ↓
9070	Fennoscandian wooded pastures	Bad =	Bad =	Bad ↑
Mammals				
1911	Alopex lagopus	Bad ↑		
Amphibians				
1188	Bombina bombina			Bad =
Woodliving evertebrates				
1083	Lucanus cervus		Favourable	Favourable
1088	Cerambyx cerdo		Bad =	
Butterflies				
1065	*Euphydryas aurinia*		Bad ↓	
4038	*Lycaena helle*	Bad	Bad ↓	
1931	*Clossiana improba*	Bad ↓		
1933	*Hesperia comma catena*	Bad =		
Plants				
1419	*Botrychium simplex*		Bad ↓	Bad ↓
1477	*Pulsatilla patens*		Inadequate =	
1493	*Sisymbrium supinum*		Favourable	Favourable
1496	*Artemisia oelandica*		Bad =	Favourable
1952	*Corydalis gotlandica*		Favourable	
1954	*Dianthus arenarius subsp. Arenarius*			Inadequate =
1968	*Primula nutans*		Favourable	
1970	*Pulsatilla vulgaris subsp. Gotlandica*		Favourable	
6288 (1974)	*Jacobea vulgaris subsp. Gotlandicus*		Favourable	Favourable
1976	*Sorbus teodorii*		Favourable	
1969	*Primula scandinavica*	Favourable		
Mosses				
1387	Orthotrichum rogeri		Bad =	
1982	Encalypta mutica	Bad ↓	Inadequate ↓	Favourable

Semi-natural grasslands are in general threatened by the abandonment of agricultural land or by changes in land use most prominently from the peak distribution in 1890s until around 1970. The only grassland habitat types that are in favourable status are 6150, 6170 and 6430 in the alpine region, and since they are in favourable status, they are not covered in the following text. 6430 is assumed to not require any management in the alpine region (but it does in the boreal and continental regions). 6150 and 6170 are extensively grazed by reindeer herding in the summer, and this practice contributes to the favourable status there.

The habitat types and species associated to the agricultural landscape all have poor conservation status, and most of them also have a negative trend. In most cases, both area coverage and the "Structures and functions" criterion are assessed as inadequate in the article 17 report, meaning that the management regime needs to be improved in these habitat types and that additional restoration actions will be required in areas that have been abandoned or are subjected to land use change.

The major areas of semi-natural grasslands are maintained by current agricultural holdings, but significant areas are also restored and maintained by County Administrative Boards responsible for the management of protected areas, municipalities, and non-profit organizations. The main financial support for the management practices comes from the agrienvironmental payments for management of lands with biological values.

Due to the huge loss of semi-natural habitats between 1890 and 1970, the remaining semi-natural grasslands are usually small and their distribution fragmented compared with the historical state, and habitat quality is easily lost and hard to regain after periods of abandonment or disadvantageous management. The risk for abandonment is substantial in several regions. Even though the total area of managed semi-natural grasslands on a national level has been relatively constant over the last decade with financing from EU funds, the number of farms with cattle (especially dairy farms) is decreasing, increasing the risk of abandonment of grasslands rich in biodiversity. Several indicators of grassland biodiversity indicate an unsatisfactory conservation status and a negative trend. To reverse the negative trends, efforts - both continued and increased annual management, and restoration measures need to be implemented for semi-natural grasslands in the whole landscape.

Surface areas reported in this document are based on data from the last article 17 report, and available data concerning management status from the Swedish Board of Agriculture together with some expert judgements from the Swedish Species Information Centre. In total, 217 830 ha of semi-natural grasslands are currently documented in these databases. Of this area, 13 298 ha are estimated to be suitable for meadow management.

Associated species (listed under Annex II in the Habitats directive or under Annex I in the Birds directive) that are currently not in favourable conservation status but will be positively affected by conservation measures in the grassland habitats, are listed in the table with article 17 data.

Measures needed to maintain or restore favourable conservation status

Among the grassland habitat types listed in Annex I of the Habitats directive occurring in Sweden, fifteen, of the habitats in non-favorable status require active management through agricultural practices (1310, 1330, 1630, 2330, 6120, 6210, 6230, 6270, 6410, 6430, 6450, 6510, 6520, 6530, and 9070). Extensive grazing by reindeer herding contributes to the currently favourable conservation status for 6150 and 6170 in the alpine region. Restoration measures are also needed to increase the area in good conservation status in all habitat types.

Active annual management measures are required to ensure maintenance, avoid deterioration and/or progressively lead to an improvement of ecological condition in all Annex I grassland habitat types. Active and recurring management measures include grazing and mowing in pastures and meadows, respectively. Traditional management of meadows also includes spring litter raking and, in Fennoscandian wooded meadows (6530), pollarding of trees. A few habitat types are also characterized by recurring burning (2330) and/or soil disturbance (e.g. tillaging; 2330, 6120), with a 3-10-year interval.

In addition to the traditional management measures, recurring decimation of problematic alien and native species is required to maintain good ecological status in most habitat types. Beach cleaning from plastics, Styrofoam, and other waste is needed in the coastal habitat types 1310, 1330, and 1630.

Large areas that currently are closed forests were historically used as forage land by grazing livestock, and as a result, they were relatively open pastures but with a rich and complex vegetation structure in which the tree layer varied from sparse forest with open patches to small copses of trees and shrubs in open grassland. Many of those forests, that today still have a large amount of such structures, need to be restored to Scandinavian wooded pastures (9070) to reach the set goal. They are therefore included in these measures for grasslands. Restoration measures specific for the wooded pastures also include the recreation of veteran tree structures and dead-wood substrates as well as restoration of forest edges and stand heterogeneity. There is also a need for increased animal husbandry in these areas for their maintenance.

In addition to the active management actions presented here, several other actions necessary to halt habitat deterioration can be listed for some habitat types. These include culling of wild boar, the general reduction of atmospheric nitrogen deposition, the eradication of Dutch elm disease and *Hymenoscyphus fraxineus* (causing ash dieback), the reduction of negative impacts from some types of recreational activities, and the reduction of negative impact from hydropower operation and infrastructure.

List of measures needed to maintain or improve habitat status

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)
Grazing	R	50 033 ha/y
Mowing	R	7 397 ha/y
Pollarding	R	2 009 ha/y
Prescribed burning	R	240 ha/y
Tillaging	R	300 ha/y
Removal of Cotula coronopifolia and/or Rosa rugosa	R	5 235 ha/y
Management of expansive plant species and culling of wild boar	R	49 809 ha/y
Creating old (veteran) tree structures, tree and dead-wood substrates, and managing forest edges and heterogeneity	R	170 ha/y
Beach cleaning	R	5 510 ha/y
Restoration of pastures	O	16 010 ha/7y
Restoration of meadows	O	2 911 ha/7y
Restoration of forests to Fennoscandian wooded pastures (9070)	O	6 494 ha/7y

* indicate whether the measure is recurring or one-off.

Additional measures needed beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)
Grazing	R	229 299 ha/y
Mowing	R	5 902 ha/y
Pollarding	R	704 ha/y
Prescribed burning	R	490 ha/y
Tillaging	R	507 ha/y
Removal of Cotula coronopifolia and/or Rosa rugosa	R	9 111 ha/y
Management of expansive plant species and culling of wild boar	R	223 311 ha/y
Creating old (veteran) tree structures, tree and dead-wood substrates, and managing forest edges and heterogeneity	R	578 ha/y
Beach cleaning	R	9 590 ha/y
Restoration of pastures	O	36 688 ha/7y
Restoration of meadows	O	1 256 ha/7y
Restoration of forests to Fennoscandian wooded pastures (9070)	O	8 205 ha/7y

* indicate whether the measure is recurring or one-off.

Prioritization of measures to be implemented during the next MFF period

The active maintenance measures listed above are all essential to avoid further deterioration of the conservation status of these seventeen grassland habitat types. Any reduction in the extent of the area actively managed for these habitat types would lead to a further deterioration of their conservation status. But based on practical feasibility and the currently (2021) available annual budget, it is not possible to prioritise all actions.

Maintenance of the current management of grassland habitats under EAFRD schemes is prioritized, together with maintenance of recurring management actions carried out in protected areas by the site managers.

Based on monitoring as well as statistics on subsidies for habitat management of lands with biological values, and with regard to practical feasibility as well as available annual financing (based on the level in 2021) it is estimated that the area of grazed pastures that have been abandoned relatively recently and can be prioritized for restoration during 2021-2027 is 11 005 ha. 8 005 ha of this total area is located inside Natura 2000 sites, and 3 000 ha in the wider green infrastructure.

Corresponding figures for restoration of meadows is 1 956 ha, of which 1 456 ha is located inside Natura 2000 sites, and 500 ha in the wider landscape.

Finally, it is also suggested that 3 247 ha of suitable current woodland areas in Natura 2000 sites are prioritized to be restored to Fennoscandian wooded pastures (9070) during 2021-2027.

Assumptions regarding measures carried out by private voluntary actions: Figures for the hunting of wild boar have not been included among the prioritized measures in the tables below, except for a limited activity within the Natura 2000 network. The prioritized areas for grazing also depend on continued voluntary contributions from farmers and landowners, Since the EAFRD payments cover part of the calculated actual cost and income forgone, the estimated grazing costs presented below are thus on average lower than the true cost.

List of prioritized measures to be carried out, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Grazing	R	38 062 ha/y	21 669 000 €	EAGF, EAFRD
Mowing	R	4 173 ha/y	3 926 000 €	EAGF, EAFRD
Pollarding	R	2 009 ha/y	1 507 000 €	EAFRD
Creating old (veteran) tree structures, tree and dead-wood substrates, and managing forest edges and heterogeneity	R	170 ha/y	564 000 €	EAFRD
Prescribed burning	R	240 ha/y	48 000 €	EAFRD
Tillaging	R	300 ha/y	3 000 €	
Removal of Cotula coronopifolia and/or Rosa rugosa	R	5 235 ha/y	121 000 €	
Management of expansive plant species and culling of wild boar	R	4 981 ha/y	110 000 €	
Beach cleaning	R	5 510 ha/y	827 000 €	
Restoration of pastures	O	8 005 ha/7y	3 048 000 €	EAFRD, LIFE
Restoration of forests to Fennoscandian wooded pastures (9070)	O	3 247 ha/7y	1 236 000 €	EAFRD, LIFE
Restoration of meadows	O	1 456 ha/7y	620 000 €	EAFRD, LIFE

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Grazing	R	57 489 ha/y	26 748 000 €	EAGF, EAFRD
Mowing	R	2173 ha/y	1 728 000 €	EAGF, EAFRD
Pollarding	R	0 ha/y	0 €	EAFRD
Creating old (veteran) tree structures, tree and dead-wood substrates, and managing forest edges and heterogeneity	R	0 ha/y	0 €	EAFRD
Prescribed burning	R	0 ha/y	0 €	EAFRD
Tillaging	R	0 ha/y	0 €	
Removal of Cotula coronopifolia and/or Rosa rugosa	R	0 ha/y	0 €	
Management of expansive plant species and culling of wild boar	R	0 ha/y	0 €	
Beach cleaning	R	9 590 ha/y	1 439 000 €	
Restoration of pastures	O	3 000 ha/7y	1 142 000 €	EAFRD, LIFE
Restoration of forests to Fennoscandian wooded pastures (9070)	O	0 ha/7y	0 €	EAFRD, LIFE
Restoration of meadows	O	500 ha/7y	190 000 €	EAFRD, LIFE

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

Estimated costs for maintenance and restoration measures are based on information from authentic management projects conducted in many different sites with very different local conditions and in different parts of the country. The variation in costs is therefore substantial but the standard costs suggested here are based on relevant figures and are near the median of those in the assembled background information.

The only exceptions are the grazing and mowing costs, where the estimated costs are based on the current amount spent on EAGF and EAFRD payments, as well as some of the national costs for management of Natura 2000. These costs are thus below the estimated real costs of grazing or mowing these areas, since the contribution of these funds is below the calculated cost and income forgone.

In future management projects, the realized costs may therefore be lower or higher than those presented here.

Expected results for targeted species and habitat types

The implementation of the above recurring maintenance measures targeting grassland habitat types will be important for maintaining current habitat types during 2021-2027, but since it only covers a part of the estimated total grazing/mowing needs, and only includes other important recurring actions in Natura 2000, not in the GI, they are not expected to be sufficient for maintaining current habitat areas, or to stop the decline in species or habitat status.

Expected results: other benefits

The suggested measures contribute to an open and varied cultural landscape, valuable for recreation and tourism. See also section F.

E.2.5. Other agroecosystems (incl. croplands)

Current status of habitats and species, conservation measures taken until now and their impact so far, remaining pressures and threats

No habitats, species or measures.

Measures needed to maintain or restore favourable conservation status

No measures

Prioritization of measures to be implemented during the next MFF period

No measures

List of prioritized measures to be carried out, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source

* indicate whether the measure is recurring or one-off.

Expected results for targeted species and habitat types

n.a.

Expected results: other benefits

n.a.

E.2.6. Woodlands and forests

Current status of habitats and species

The following table lists the forest habitats (9070 is listed in section E.2.4.) and species on Annex I and Annex II of the Habitats Directive that are present in Sweden and their national conservation status as reported in the most recent Swedish article 17 report (2019).

Code	Name	Status ALP	Status BOR	Status CON
Habitats				
9010	Western Taïga	Inadequate ↓	Bad↓	Bad
9020	Broad-leaved deciduous forests		Bad =	Bad =
9030	Primary succession forest of landupheaval coast		Inadequate	
9040	Subalpine forests	Favourable		
9050	Herb-rich forests with Picea abies	Inadequate	Bad	
9060	Coniferous forests on glaciofluvial eskers		Bad ↓	
9080	Deciduous swamp woods		Bad	Bad
9110	Luzulo-Fagetum beech forests		Inadequate =	Bad =
9130	Asperulo-Fagetum beech forests		Bad =	Bad =
9160	Sub-Atlantic and medio-European oak forests		Bad	Bad
9180	Tilio-Acerion forests of slopes, screes and ravines		Bad	Bad
9190	Old acidophilous oak woods with Quercus robur on sandy plains		Inadequate	Bad
91D0	Bog woodland	Favourable	Inadequate =	Inadequate =
91E0	Alluvial forests	Inadequate =	Bad	Bad
91F0	Riparian mixed forests along the great rivers		Inadequate	Bad
Bats				
	Barbastella barbastellus		Favourable	Favourable
Woodliving evertebrates				
6966 (1084)	Osmoderma eremita		Bad↓	Bad↓
1919	Agathidium pulchellum		Bad↓	
1920	Boros schneideri		Bad↓	
1925	Pytho kolwensis		Bad↓	
1926	Stephanopachys linearis		Inadequate =	
1927	Stephanopachys substriatus		Bad↓	
1086	Cucujus cinnaberinus		Bad↓	
1928	Xyletinus tremulicola		Bad↓	
1929	Aradus angularis		Bad↓	
1936	*Anthrenochernes stellae*		Bad↓	Bad↓
4021	Phryganophilus ruficollis		Bad↓	
Butterflies				
6169 (1052)	Euphydryas maturna		Bad↓	
1934	Xestia borealis	Bad↓	Bad↓	
Molluscs				
1016	Vertigo moulinsiana			Inadequate =
Plants				
1948	Calamagrostis chalybaea	Favourable	Favourable	
1949	Calypso bulbosa	Favourable	Inadequate ↓	
1951	Cinna latifolia		Inadequate =	
1955	Diplazium sibiricum	Favourable	Favourable	
1962	Moehringia lateriflora		Inadequate ↓	
1972	Ranunculus lapponicus	Favourable	Favourable	
1902	Cypripedium calceolus	Favourable	Favourable	
1959	Gymnigritella runei	Favourable		
Mosses				
1979	Bryhnia novae-angliae		Inadequate =	Favourable
1980	Cephalozia macounii		Bad ↓	
1981	Cynodontium suecicum	Favourable	Favourable	

1984	Herzogiella turfacea		Inadequate ↓	
1381	Dicranum viride		Bad ↓	
1386	Buxbaumia viridis		Favourable	
6166 (1394)	Scapania carinthiaca		Bad ↓	
Mammals				
1352	Canis lupus	Occasional	Favourable	Marginal occurrence
1361	Lynx lynx	Favourable	Favourable	Marginal occurrence
1912	Gulo gulo	Inadequate ↑	Inadequate ↑	

Six forest habitat types occurring on dry to mesic site types (9010, 9020, 9060, 9160, 9180, 9190), and five habitat types occurring on moist to wet (9010, 9080, 91D0) or alluvial (91E0, 91F0) site types, require future conservation measures to achive favourable conservation status.

Measures needed to maintain or restore favourable conservation status

Necessary conservation measures are needed during 2021-2027 in terms of:

- further protection of areas (both formal protection and voluntary set-asides) to prevent further loss of forest habitat types;
- recurrent conservation measures to avoid deterioration of habitat quality; and,
- restoration measures to improve conditions in terms of typical structures, functions, and species are.

Further protection is needed in all three regions, and recurrent actions and restoration are particularly needed in the boreal and continental regions. In boreal and continental region, all of the habitat types listed, 14 in the boreal region and 11 in the continental, have unfavourable-bad or unfavourable-inadequate conservation status. Improvement of the conservation status also requires that the area of the habitat types is increased by restoration.

The area of forest land in Sweden cover ca 27,9 million ha (279,000 km^2). Here, priority of measures is given primarily to the areas of the habitat types that have been identified as high conservation value forests (HCVFs); the core areas and main dispersal sources of many rare and threatened forest-living species. The HCVFs include not only the Natura 2000 sites, nature reserves, national parks, habitat protection areas and nature conservation agreements protected by the state or municipalities, but also woodland key habitats and forest areas voluntarily set aside from forestry by landowners (individual persons, organizations and companies). Most of the HCVFs have until recent decades been managed passively, with a strategy of minimum intervention. Only a minority of them have been actively managed with the aim to improve or maintain the local conditions although the area of habitat types in need of such actions is significant.

To avoid deterioration of habitat status both formal and voluntary protection is needed in all three biogeographical. Furthermore, four main conservation measures are necessary in boreal and continental region to meet corresponding and wide-ranging pressures on the habitat types and related species.

First, prescribed burning is needed to restore areas and maintain local conditions of particularly boreal coniferous and deciduous forests on dry to mesic site types (mainly 9010, but also 9060). Fire is a vital natural disturbance factor in the boreal region. However, efficient fire suppression due to the increase of the human population and the expansion of the forestry industry during the past 150 – 200 years have led to a lack of fire dynamics and thus negatively affecting the dynamic, composition, occurrence of ecological structures and typical species in fire dependent forest habitats.

Second, restoration of hydrological regimes is needed to increase areas and maintain local conditions of boreal and continental swamp forests (9010, 9080, 91D0), but also alluvial and riparian forests (91E0, 91F0). In swamp forests (9010, 9080, 91D0), hydrology mainly needs to be restored by blocking and/or filling old ditches and drainage systems that formerly were established to improve forest production comprise important pressures on these forest habitat types. Also road related constructions and other negative effects by exploitation needs to be restored. In alluvial forests (91E0, 91F0) hydrological regimes in rivers and streams affected by dams and modification of river flow needs to be restored as the hydrological regime are a vital ecological function in these forest habitats. 4 000 ha of alluvial forests are negatively affected by altered hydrological regimes. Measures to restore hydrological regimes in rivers and streams need to be planned and implemented in accordance with conservation strategies for freshwater habitats, therefore necessary measures to change hydrological regimes as a necessary complement to restoration by reducing competing tree vegetation (see below) are listed in section E.2.8. (Freshwaters).

Third, opening up closed forests and then reintroducing continuous, low intensive conservation grazing is needed to restore areas and maintain local conditions of particularly continental broad-leaved deciduous forests (9020, 9160, 9180, 9190), but also some boreal coniferous forests (9050 and 9060). The successive decrease of traditional agriculture and forest treatments have led to loss and adverse natural succession that comprise important pressures to these forest habitat types. Grazing in above mentioned habitats are complementary to grazing in Fennoscandian wooded pastures (9070), see E.2.4.

Fourth, opening of closed woodlands is also a necessary measure to reduce competition from unwanted tree species that can threaten the survival of deciduous trees in alluvial forests (91E0, 91F0), continental broad-leaved deciduous forests (9020, 9160, 9180, 9190) and also in boreal broad-leaved deciduous forest (9010).

Besides the four main measures, five additional actions are needed to restore the typical structures and functions and favour species that are currently inadequate or lacking in some areas due to previous, historical land-use:

1) Veteranisation of younger trees to bridge generation gaps and speed up tree habitat production in mainly broad-leaved deciduous forests;

2) Restoration actions to recreate forest structures (e.g. canopy gaps) and substrates (e.g. coarse woody debris) in coniferous and deciduous forests;

3) Restoration of natural vegetation structures and stand heterogeneity to improve local conditions in forest edges and some deciduous forests;

4) Fencing to support regeneration and survival of key tree species by hindering losses and damages due to deer browsing; and,

5) Planting of trees to support regeneration of key deciduous tree species

The four main conservation measures; prescribed burning, hydrological restoration, conservation grazing and removal of competing tress in closed woodlands should primarily occur in the HCVFs. The annual need of prescribed burning in boreal coniferous and deciduous forests (mainly 9010 but also 9060) is estimated to be around 9 000 ha/year. The annual need of conservation grazing in broad-leaved deciduous forests (9020, 9160, 9180, 9190) along with boreal coniferous forests (9050 and 9060) is estimated to be around 9 400 ha. The annual need of grazing in forests after removal of competing trees is estimated to 9 600 ha and reduction of competing trees to favour survival of

deciduous trees is estimated to be around 7 000 ha. The annual need of hydrological restoration in swamp forests (9010, 9080, 91D0) to be around 1 700 ha.

The estimated annual needs of the additional actions are as follows; 1) creating veteran tree structures (ca 2 800 ha) and 2) dead-wood substrates (ca 3 300 ha); 3) restoration of forest edges and stand heterogeneity (800 ha); 4) fencing out deer (200 ha); and 5) planting trees (40 ha).

List of measures needed to be carried out

Name and short description of the measures	Type of measure*	Target (Unit & quantity)
Prescribed burning	O	21 855 ha/7y
Grazing after removal of competing trees in closed forests	R	4 029 ha/y
Favour the opening of closed woodlands by reduction of competing trees	O	10 747 ha/7y
Restore natural hydrology by filling and blocking ditches. Includes hydrological investigations	O	3 680 ha/7y
Creating old (veteran) tree structures	O	6 061 ha/7y
Creating tree and dead-wood substrates	O	9 450 ha/7y
Creating and managing forest edges and heterogeneity	O	794 ha/7y
Fencing out deer	O	201 ha/7y
Planting trees	O	40 ha/7y

* indicate whether the measure is recurring or one-off.

Additional measures needed beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)
Prescribed burning	O	44 283 ha/7y
Grazing after removal of competing trees in closed forests	R	5 615 ha/y
Favour the opening of closed woodlands by reduction of competing trees	O	37 981 ha/7y
Restore natural hydrology by filling and blocking ditches. Includes hydrological investigations	O	8 113 ha/7y
Creating old (veteran) tree structures	O	13 470 ha/7y
Creating tree and dead-wood substrates	O	13 346 ha/7y
Creating and managing forest edges and heterogeneity	O	5 012 ha/7y
Fencing out deer	O	1 253 ha/7y
Planting trees	O	251 ha/7y

* indicate whether the measure is recurring or one-off.

Prioritisation of measures to be implemented during the next MFF period

Formal protection is needed to stop further deterioration in habitat area and is therefore of highest priority. The target area and financial needs for formal protection are listed in section *E.1.1. Site designation and management planning*. The four main conservation measures are also of highest priority and should be implemented to as high extent as possible to reduce the effects of wide-ranging pressures to the habitat types and associated species. Complementary actions should especially be prioritized when of great importance for occurrence of species associated with the habitats concerned.

Prioritized measures within Natura 2000 areas

Restoration of hydrology and opening of closed woodland by reducing competing trees are considered to be possible to implement at the level of measures needed within Natura 2000. For prescribed burning there is a need to gradually improve capacity for implementation within Natura 2000 areas during 2021-2027. A capacity equal to 1 000 ha/y on average is considered possible to be reached at the end of the period. Such improvement of capacity is essential to be able to reach the

level of measures needed in the future. An increase in burnt area will have considerable positive effects on habitats and species even though it does not fully reach the level of measures needed. The reintroduction of grazing in forests are hampered by the lack of grazing animals. Also, this resource is crucial for implementation of necessary measures in grassland habitats (see section E4) of high priority. Complementary actions are also prioritized to be implemented, especially where it has particular importance for species. See table below for summary and financing sources.

List of prioritised measures to be carried out, and estimated costs for these measures within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Prescribed burning	O	5 600 ha/7y	1 760 000 €	LIFE
Grazing after removal of competing trees in closed forests	R	1000 ha/y	850 000 €	LIFE
Favour the opening of closed woodlands by logging/opening of competing trees	O	10 747 ha/7y	2 326 000 €	LIFE
Restore natural hydrology by filling and blocking ditches. Includes hydrological investigations	O	3 680 ha/7y	683 000 €	
Creating old (veteran) tree structures	O	6 061 ha/7y	714 000 €	LIFE
Creating tree and dead-wood substrates	O	9 450 ha/7y	548 000 €	LIFE
Creating and managing forest edges and heterogeneity	O	794 ha/7y	237 000 €	LIFE
Fencing out deer	O	201 ha/7y	149 000 €	LIFE
Planting trees	O	40 ha/7y	31 000 €	LIFE

Prioritised measures beyond Natura 2000

Same conservation measures as for Natura 2000 areas are prioritised in HCVF areas beyond Natura 2000. However, possibilities for implementation are different.

Swedish forest agency is responsible for conservation measures in habitat protection areas and nature conservation agreements. The capacity to implement conservation measures has recently improved and is planned to improve further until 2022. The limited size of the areas provides challenges to implement some measure (e.g. prescribed burning). Prioritized measures to be carried out in these areas 2021-2027 are summarized in table below.

List of prioritised measures to be carried out, and estimated costs for these measures, within habitat protection areas and nature conservation agreements.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding Source
Prescribed burning	O	490 ha/7y	329 000	LIFE
Grazing after removal of competing trees in closed forests	R	166 ha/y	624 000	
Favour the opening of closed woodlands by reduction of competing trees	O	6 587ha/7y	1 421 000	LIFE
Restore natural hydrology by filling and blocking ditches. Includes hydrological investigations	O	100 ha/7 y	34 000	LIFE
Creating old (veteran) tree structures	O	700 ha/7 y	83 000	LIFE
Creating tree and dead-wood substrates	O	1632 ha/7 y	96 000	LIFE
Creating and managing forest edges and heterogeneity	O	81 ha/7 y	24 000	LIFE
Fencing out deer	O	369 ha/7 y	131 000	LIFE
Planting trees	O	155 ha/7 y	16 000	LIFE

Substantial contributions are made by private initiatives regarding implementation of prioritized actions within voluntary set aside areas. Measures are financed both by private funding and government subsidies (public funding to an extent of at least 3 000 000 € annually). Implementation of measures are considered to continue to at least the same extent during the period 2021-2027. Prescribed burning is carried out by forest companies as a part of certification schemes and is contributing to a similar or even higher degree as with in Natura 2000 areas. However, prescribed burning is rarely implemented among individual forest owners. Restoration of hydrology has until now been implemented at small scale, but this measure can possibly increase among forest companies and individual forest owners as there will be more funding available during coming years. Grazing is strongly limited by the supply of grazing animals. The forestry sector is considered to have a rather high capacity to implement measures to reduce competing trees, creating veteran trees and dead wood. Fencing and planting can possibly be implemented. Measures to create forest edges occur, but at an unknown extent.

Expected results for targeted species and habitat types

The full implementation of the prioritized measures will reduce the deterioration of the habitats, increase the amount of habitat area in good condition. It will also and induce positive trends in restored areas. However, the prioritized measures are not sufficient to fully stop deterioration for all habitats. Species listed under Annex IV in the Habitats directive or under Annex I in the Birds directive, that are currently not in favourable conservation status but will be positively affected by conservation measures in the forest habitats. Positive effects on specific species requires careful spatiotemporal planning and prioritization of measures. For conservation measures with a gap between conservation measures needed and measures prioritized during 2021-2027 in terms of quantity (e.g. prescribed burning) it is of great importance that actions are taken to improve the capacity to implement these conservation measures.

Expected results: other benefits

Forests provide a series of ecosystem services, e.g., climate regulation and carbon sequestration, nutrient cycling, berry and fungi production, game production, water regulation and supply, flood prevention, biodiversity protection and human recreation. Restoration and recurrent measures of forests will increase these ecosystem services. See also section F.

E.2.7. Rocky habitats, dunes & sparsely vegetated lands

Current status of habitats and species, conservation measures taken until now and their impact so far, remaining pressures and threats

The following table lists the rocky, dune and sparsely vegetated land habitats and species on Annex I and Annex II of the Habitats Directive that are present in Sweden and their national conservation status as reported in the most recent Swedish article 17 report (2019).

Code	Name	Status ALP	Status BOR	Status CON
Habitats				
1210	Drift lines		Inadequate =	Inadequate =
1220	Shingle		Inadequate =	Inadequate =
1230	Sea cliffs		Favourable	Favourable
1610	Esker islands		Bad ↓	
1620	Baltic islets and small islands		Inadequate ↓	Inadequate ↓
1640	Baltic sand beaches		Bad =	
2110	Embryonic shifting dunes		Inadequate	Inadequate
2120	Shifting dunes (white dunes)		Bad ↓	Bad ↑
6110	Rupicolous calcareous or basophilic grasslands		Bad ↓	Favourable
6120	Xeric and calcareous grassland		Bad ↓	Bad ↓
6280	Nordic alvar		Bad ↓	Inadequate ↓
8110	Siliceous scree	Favourable	Favourable	
8120	Calcaraeous and calcshist screes	Favourable	Favourable	
8210	Calcareous rocky slopes	Favourable	Favourable	
8220	Siliceous rocky slopes	Favourable	Favourable	Favourable
8230	Siliceous rock with pioneer vegetation		Bad ↓	Bad ↓
8240	Limestone pavements		Bad ↓	Inadequate ↓
8310	Caves	Favourable	Favourable	Favourable
8340	Glaciers	Bad ↓		
Butterflies				
1930	*Agriades glandon aquilo*	Bad =		
Plants				
1945	*Artemisia campestris subsp. bottnica*		Favourable	
1973	*Saxifraga osloënsis*		Inadequate ↓	
1944	*Arenaria humifusa*	Favourable		
1947	*Braya linearis*	Favourable		
1950	*Carex holostoma*	Favourable		
1956	*Draba cacuminum*	Favourable		
6952 (1964)	*Papaver radicatum subsp. laestadianum*	Favourable		
6953 (1965)	*Papaver radicatum subsp. radicatum*	Favourable		
6181 (1975)	*Silene involucrata subsp. tenella*	Favourable	Favourable	
1978	Viola rupestris ssp. relicta	Favourable		
4066	Asplenium adulterinum		Favourable	
Mosses				
1988	Tortella rigens		Favourable	Favourable
1379	Mannia triandra		Bad =	

Sparsely vegetated habitat types in the agricultural landscape are in general threatened by changes in land use. With few exceptions, these habitat types a have unfavourable conservation status (6110, 6280, 8230, 8240). In most cases, both area coverage and the "Structures and functions" criterion were assessed as inadequate or bad in the latest Article 17 report, meaning that the management regime needs to be improved in these habitat types and that additional restoration actions will be required in areas that have been abandoned, subjected to land use change, or exploitation. Coastal habitat types (1210, 1220, 1230, 1610, 1620, 1640, 2110, 2120), on the other hand, are mainly threatened by exploitation and littering, and their conservation status is assessed as unfavourable (except for 1230). In contrast, among the rocky habitat types within this group that are not tied to the agricultural landscape, the conservation status is assessed as favourable (8110, 8120, 8210, 8220, 8310, except for 8240 *Glaciers* which is affected by climate change).

The management of 6110, 6280, 8230, and 8240 are similar as for the grassland habitat types, however the fodder value is much lower than in the grassland habitat types. They are mainly maintained by current agricultural production holdings, enabled with subsidies for management of lands with biological values, but significant areas are also restored and maintained by the County Administrative Boards, municipalities, and non-profit organizations.

Associated species listed under Annex II in the Habitats directive or under Annex I in the Birds directive, that are currently not in favourable conservation status. but will be positively affected by conservation measures in dunes and sparsely vegetated habitats, are listed in the table in the conservation status section.

Measures needed to maintain or restore favourable conservation status

Among the habitat types listed as "rocky habitats, dunes, and sparsely vegetated lands" in Annex I of the Habitats Directive occurring in Sweden, four require active management through agricultural practices (6110, 6280, 8230, and 8240). Seven beach and dune habitats do not require traditional management but are threatened by exploitation and by pollution from the sea, plastics, Styrofoam, and other waste. (1210, 1220, 1610, 1620, 1640, 2110, and 2120).

As for the grassland habitat types, major efforts, both in terms of restorations and annual management measures, need to be implemented also in these three habitat types to improve their conservation status.

Surface areas reported in this document are based on areas reported under art 17. A total of 41 100 ha of management-dependent sparsely vegetated habitat area is currently recorded. 20 530 ha of this area is located within the Natura 2000 network.

19 930 ha within Natura 2000, and 19 970 ha in the larger GI needs traditional grazing management. An additional 3 178 ha in Natura 2000 and 2 591 ha of coastal habitats in the larger GI require recurring cleaning from plastics, Styrofoam, oil-spill etc.

Active annual management measures are required to ensure maintenance, avoid deterioration and/or progressively lead to an improvement of ecological condition in all Annex I habitat types. Active annual management measures include grazing (in 6110, 6280, 8230, and 8240), and soil disturbance (e.g. tillaging; 2120). Tillaging is however not appropriate every year even in habitats where it is useful, but rather with 10-year interval.

In addition to the traditional management measures, recurring decimation of problematic alien species, and beach cleaning are required to maintain good ecological status in several habitat types. Rosa rugosa is a problematic alien species occurring in 2120. Active cleaning of seaside habitats is

necessary in 1210, 1220, 1610, 1620, 1640, 2110, and 2120. Restoration measures are needed to increase the area in good conservation status in all habitat types.

In addition to the active management actions presented here, several other actions necessary to halt habitat deterioration can be listed for some habitat types.

List of measures needed and recommended for the period 2021-2027 to maintain or improve habitat status, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)
Grazing	R	19 930 ha/y
Tillaging	R	153 ha/y
Management of expansive plant species	R	460 ha/y
Beach cleaning	R	3 178 ha/y
Restoration of pastures	O	4 584 ha/7y
Restoration of sand dunes	O	300 ha/7y

* indicate whether the measure is recurring or one-off.

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)
Grazing	R	19 970 ha/y
Tillaging	R	170 ha/y
Management of expansive plant species	R	510 ha/y
Beach cleaning	R	2 591 ha/y
Restoration of pastures	O	2 297 ha/7y
Restoration of sand dunes	O	300 ha/7y

* indicate whether the measure is recurring or one-off.

Prioritization of measures to be implemented during the next MFF period

The active maintenance measures listed above are all essential to avoid further deterioration of the conservation status of these habitat types. Any reduction in the extent of the area actively managed would lead to a further deterioration of their conservation status. But based on practical feasibility and the currently (2021) available annual budget, it is not possible to prioritise all actions.

Maintenance of the current management of sparsely vegetated habitats under EAFRD schemes is prioritized, together with maintenance of recurring management actions carried out in protected areas by the site managers. Consideration of the possibilities to finance other recurrent management actions in the larger GI has led to their exclusion from the prioritized measures, although they are important for maintaining habitat quality.

Based on monitoring as well as statistics on subsidies for habitat management of lands with biological values, it is estimated that the area of grazed pastures (6110, 6280, 8230, 8240) that has been abandoned relatively recently and is practically and economically, based on available funds 2021, is possible to restore is 2 292 ha located inside Natura 2000 sites and 500 ha in the larger GI. In addition, the Swedish Species Information Centre has made assessments of restoration needs from aerial photos of sand dune habitats (2100-series). Corresponding restoration figures for the dune habitats (2110, 2120) are 300 ha, located inside Natura 2000 sites.

Assumptions regarding measures carried out by private voluntary actions: The prioritized areas for grazing depend on continued voluntary contributions from farmers and landowners. Since if the

EAFRD payments cover part of the calculated actual costs and income forgone, the estimated grazing costs presented below are thus on average lower than the true cost.

List of prioritized measures to be carried out, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Grazing	R	16 004ha/y	3 534 000 €	EAFRD, LIFE
Tillaging	R	153 ha/y	5 000 €	
Removal of rosa rugosa	R	460 ha/y	10 000 €	
Management of expansive plant species	R	460 ha/y	10 000 €	
Beach cleaning	R	3 088 ha/y	477 000 €	
Restoration of pastures	O	2 292 ha/7y	873 000 €	EAFRD, LIFE
Restoration of sand dunes	O	300 ha/7y	100 000 €	LIFE

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Grazing	R	2 217 ha/y	351 000 €	EAFRD
Tillaging	R	0 ha/y	0 €	
Removal of rosa rugosa	R	0 ha/y	0 €	
Management of expansive plant species	R	0 ha/y	0 €	
Beach cleaning	R	2 591 ha/y	389 000 €	
Restoration of pastures	O	500 ha/7y	136 000 €	EAFRD, LIFE
Restoration of sand dunes	O	0 ha/7y	0 €	LIFE

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

Estimated costs for maintenance and restoration measures are based on information from authentic management projects conducted in many different sites with very different local conditions and in different parts of the country. The variation in costs is therefore substantial but the standard costs suggested here are based on relevant figures and are near the median of those in the assembled background information. The only exception is the grazing costs, where the estimated cost is based on the current amount spent on EAGF and EAFRD payments, as well as some of the national costs for management of Natura 2000. These costs are thus below the estimated real costs of grazing these areas, since the contribution of these funds is below the calculated cost and income forgone.

In future management projects, the realized costs may therefore be lower or higher than those presented here.

Expected results for targeted species and habitat types

The suggested actions for dune habitats within Natura 2000 are expected to be able to improve the dune habitat status there.

The implementation of the above recurring maintenance measures targeting the sparsely vegetated habitat types will be important for maintaining current habitat types during 2021-2027, but since it only covers a part of the estimated total grazing needs, and only includes other important recurring

actions in Natura 2000, not in the GI, they are not expected to be sufficient for maintaining current habitat areas, or to stop the decline in species or habitat status.

Expected results: other benefits

The suggested measures contribute to an open and varied landscape, valuable for recreation and tourism. See also section F.

E.2.8. Freshwater habitats (rivers and lakes)

Current status of habitats and species, conservation measures taken until now and their impact so far, remaining pressures and threats

Current status of habitats and species

The following table lists the freshwater habitats and species listed in Annex I and Annex II of the Habitats Directive present in Sweden and their national conservation status as reported in the most recent Swedish article 17 report (2019).

Code	Name	Status ALP 2019	Status BOR 2019	Status CON 2019
Habitats				
3110	Oligotrophic soft water lakes		Inadequate ↓	Inadequate ↓
3130	Soft water lakes with base rich influences	Favourable	Inadequate =	Inadequate ↓
3140	Hard water lakes	Favourable	Inadequate =	Inadequate =
3150	Natural eutrophic lakes	Favourable	Inadequate =	Inadequate =
3160	Dystrophic lakes	Favourable	Favourable	Favourable
3210	Fennoscandian natural rivers	Inadequate ↓	Inadequate ↓	Inadequate ↓
3220	Alpine rivers	Favourable	Favourable	
3260	Water courses	Favourable	Inadequate ↓	Inadequate ↓
Species				
Fish				
1130	*Aspius aspius*		Bad ↑	Marginal presence
6963 (1149)	*Cobitis taenia*		Favourable	Favourable
1106	*Salmo salar*	Marginal presence	Inadequate ↑	Inadequate ↑
6965 (1163)	*Cottus gobio*	Marginal presence	Inadequate =	Favourable
Molluscs				
1029	*Margaritifera margaritifera*	Bad =	Bad ↓	Bad ↓
1032	*Unio crassus*		Bad ↓	Bad ↓
Plants				
1830	*Najas flexilis*		Favourable	Bad =
1831	*Luronium natans*		Favourable	Bad ↓
1942	*Arctophila fulva*		Bad =	
1966	*Persicaria foliosa*		Bad =	
1977	*Trisetum subalpestre*	Favourable		
Limnic invertebrates				
1037	*Ophiogomphus cecilia*		Favourable	
1042	*Leucorrhinia pectoralis*		Favourable	Favourable
1081	*Dytiscus latissimus*		Favourable	Favourable
1082	*Graphoderus bilineatus*		Favourable	Favourable
Reptiles				
1166	*Triturus cristatus*		Bad ↓	Bad ↓
Mammals				
1355	*Lutra lutra*	Inadequate ↑	Bad ↑	Bad ↑
Mosses				

Code	Name	Status ALP 2019	Status BOR 2019	Status CON 2019
1383	*Dichelyma capillaceum*		Favourable	Favourable
1985	*Hygrohypnum montanum*		Inadequate =	
1986	*Orthothecium lapponicum*	Unknown		
Bats				
1318	*Myotis dasycneme*		Bad ↑	Bad =

Considerable gaps in knowledge remain on the occurrence and distribution of several freshwater habitat types in Sweden, as well as their conservation status. This becomes particularly clear when looking at the habitat distribution within and outside Natura 2000. The 2019 article 17 reporting assessments presented above were primarily based on extrapolation or expert opinion from a limited amount of data.

Conservation measures taken until now and their impact so far

As indicated above, the Fennoscandian natural rivers (3210) in all regions, water courses of plain to montane levels (3260) in BOR and CON are considered to be in inadequate conservation status. These habitats are particularly important because, in their natural state, they provide a mosaic of different environments with excellent conditions for high biodiversity. The inadequate status of 3210 and 3260 are mainly due to fragmentation by barriers (e.g. dams), lack of natural flow dynamics and remnants of physical modifications from float ways for timber transport.

Sweden has begun the work to restore these rivers by recreating and restoring their natural habitats and functions. Over the past decade, several LIFE-projects have been initiated, covering large Natura 2000 areas (catchment, to sub-catchment level) which has enabled the adoption of a catchment area-approach looking at entire river systems to restore the ecosystem services provided by the floodplain, including re-wetting and flood protection. More than 500 km river have been restored so far, expected to result in an improvement in the status of 3210, 3260 and associated species, such as Atlantic Salmon (1106) and Freshwater Pearl Mussel (1029). Several of these Life-projects are still ongoing.

In 2019, a new law entered into force in Sweden, stipulating that all hydropower plants must apply for new licenses to ensure compliance with modern environmental requirements and EU directives. A national plan for the revision of hydropower plant licenses has been adopted by the government. The plan describes the process including a time-plan of revising all licenses over a 20-year period. About 450 Natura 2000 sites today experience a negative impact to various extent by hydropower plants in Sweden (either within the site or in proximity to the site). The management plans of 263 of these sites will be subject to the revision in the 2021–2027 period.

Sweden has had a comprehensive programme of liming since the 1980s to counteract the effects of anthropogenic acidification. Every year, many lakes and rivers are limed, at a cost of about EUR15.7 million each year. The liming programme has helped improve the status of lake and river ecosystems as well as species, including the Freshwater Pearl Mussel (1029) which is particularly sensitive to low pH.

The 2019 Swedish article 17 report notes that some measures have been taken to improve the status of freshwater Annex I habitats, resulting in sometimes significant improvements at the local scale. However, results are not easily achieved at the biogeographical scale and the report stresses that the extent and rate of measures need to be intensified.

An ecosystem-based approach is gradually applied and implemented to fisheries management in Sweden. Measures to manage recreational fishing, aquaculture, species introductions and transfers are implemented to protect biodiversity and to avoid introduction of new diseases and parasites Water with Northern crested newt (1166) is especially important to protect from the introduction of fish.

Some conservation measures have been carried out to improve the status of the Great Sea Lamprey (1095), which has an unfavourable-declining status in the CON region. For instance, two large-scale restoration projects have restored free passage ways in south west Sweden (rivers Rolfsån and Ätran). Evaluations of the measures have shown that the species already after one year passed what was previously impenetrable barriers[23].

Measures have been taken both inside and outside Natura 2000 areas in all regions to improve the status of Freshwater Pearl Mussel (1029), Thick Shelled River Mussel (1032), Atlantic Salmon (1106) and Eurasian otter (1355). Over the past decades, for instance, rivers have been restored and limed, reintroductions carried out and educational projects launched to support the Freshwater Pearl Mussel and Thick Shelled River Mussel. However, the effects of measures taken are often unknown[24], partly due to these species' long life cycles.

Sweden has about 40 populations of naturally reproducing Atlantic Salmon (1106). These migrate into the Baltic Sea, the Atlantic Ocean or Lake Vänern. In general, salmon populations in the northern parts of Sweden have improved significant over the past ten years, but for some populations the positive development has ceased. Salmon populations in the south and in the western parts of Sweden show little or no signs of improving despite extensive fisheries management measures and regulation of fishing. The salmon population in Lake Vänern remains in very poor condition.

Remaining pressures and threats

The future prospects for the structures and functions of all Swedish freshwater habitats were identified as "poor" in the article 17 report (except for habitats 3160 and 3220), in particular in the BOR and CON regions. No pressures or threats were identified as having "high" impact or importance for freshwater habitats in the 2019 Swedish article 17 report. However, according to the Swedish reporting under the Water Framework Directive, the hydromorphological impact is considered to be widespread and extensive with fragmentation and physical modifications identified both as continued pressures and future threats to all Swedish river habitats. Fragmentation also impacts lakes by impeding species dispersal. According to information from the Swedish County Administrative Boards (central government agencies acting as the regional competent authorities for, among other things, nature conservation), hydropower plants, dams and morphological alterations exert pressure on Annex I-habitats and Annex II-species throughout the country.

[23] National Action Plan for Great Sea Lamprey (2020), available at: https://www.havochvatten.se/download/18.473751eb16fd38f6a805a989/1586268660904/rapport-2020-8-atgardsprogram-havsnejonoga.pdf.

[24] National Action Plan for Freshwater Pearl Mussel (2020), available at: https://www.havochvatten.se/download/18.3398c7001724bfc953e2ecd1/1590762819624/rapport-2020-19-atgardsprogram-flodparlmussla.pdf

It is estimated that at most there were 30,000 km of float ways for timber transport in Sweden[25]. These float ways were cleared of stone and blocks, embanked and often dams were built to hold water. The floatways are no longer in use but constitute an ongoing pressure on the habitats.

Sweden's second river basin management plan[26] shows that 50% of water bodies are under significant pressure from hydromorphology. In 30% of these waterbodies, the pressure is foremost on the shoreline. In 50%, the pressure is from dams and other obstacles.

Habitats 3110, 3130, 3140, 3210 and 3260, among others, are under pressure from various impacts caused by forestry and agricultural activities. This pressure includes diffuse loading of nutrients and sediments. It also inculdes direct impact on the freshwater habitat caused by modification of hydrological flow, physical alternation of water bodies or adjacent land areas (e.g. lack of buffer zones).

Marine fish and shellfish harvesting causing a reduction of species/prey populations is identified as the highest impact pressure and future threat to the CON population of Great Sea Lamprey (1095). The future prospects for the population in terms of both range and population are bad and the future prospects for the habitat of the species is poor.

In the CON region, hydropower is identified in the article 17 report as a high pressure/ threat to the Atlantic Salmon (1106). The future prospects of the habitats important to the species are poor in both the BOR and CON regions. In light of the current status of the populations, primarily a result of historical habitat alterations, by hydropower development and timber floatways, both the BOR and CON populations of 1106 are under high pressure from professional fishing and hunting. This pressure is expected to continue to constitute a high importance threat to these populations in the near future.

The Freshwater Pearl Mussel (1029) is an important indicator species in many Swedish river ecosystems, due to its dependency on migratory fish for reproduction, sensitivity to excess nutrients, pH fluctuation and levels of dissolved oxygen[27]. In the 2019 article 17 report, both the ALP, BOR and CON populations were considered to be under high pressure and continued threat from, for instance, clear-cutting practices in forestry, the development and operation of dams and modification of the hydrological flow. Further, a warmer climate and increase of short-term regulation in rivers used for hydropower have been identified as emerging pressures/threats affecting the species in all regions in Sweden.

The same high impact pressures and threats identified for 1029 are also identified for Thick Shelled River Mussel (1032) in all regions in Sweden where it occurs. For this species, impacts from agricultural activities, such as maintenance of existing drainage systems, are particularly prominent, especially in the south.

The Northern crested newt (1166) has bad and declining status in BOR and CON. The status and trend is due to a lack of small waters (ponds) in the landscape and a continued high pressure on the

[25] Törnlund, E., & Östlund, L. (2006). Mobility without wheels: The economy and ecology of timber floating in Sweden, 1850-1980. Journal of Transport History, 27(1), 48–70. https://doi.org/10.7227/TJTH.27.1.5.
[26] https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments/pressures-and-impacts-of-water-bodies
[27] National Action Plan for Freshwater Pearl Mussel (2020), available at: https://www.havochvatten.se/download/18.3398c7001724bfc953e2ecd1/1590762819624/rapport-2020-19-atgardsprogram-flodparlmussla.pdf

existing habitat from urbanization, intensified agriculture, overgrowth through both tree planting and non-compliance.

Anthropogenic acidification is an ongoing pressure and future threat not only to the Freshwater Pearl Mussel, but also to, for instance, habitat types 3220 and 3260 and their respective typical species.

Invasive alien species (IAS) exert an increasing pressure to several Swedish Annex I habitats and Annex II species. The Fringed Water Lily (*Nymphoides peltata*) and Western Waterweed *(Elodea nuttallii)* are two examples. Noble Crayfish (*Astacus astacus,*1091) are particularly vulnerable to IAS as the greatest threat is the intentional or unintentional spread of the North American crayfish species (*Pacifastacus leniusculus)* and the accompanying crayfish plague (see section E.3.1). Pink salmon (Oncorhynchus gorbuscha) has recently been recognized as a threat to native salmon, the species is not yet listed as invasive but action is deemed necessary[28].

Measures needed to maintain or restore favourable conservation status

Ensuring the long-term future of freshwater habitats and species will require significant, integrated catchment management measures in order to restore free flowing rivers. This includes the management of water resources in the catchment area to improve flow regimes.

Continued restoration measures to improve the condition of freshwater habitat structures and functions are important, in particular increasing the connectivity by removing barriers, constructing faunal passages, reestablishing lateral connectivity, restoring habitats to mitigate historical impact and measures to mitigate modified hydrological regimes in order to re-establish more natural flows with erosion and sedimentation processes. Flow regimes that are close to natural with amplitude variations allow repeated inundation of the floodplain and are beneficial for several annex I and annex II habitats and species that are dependent of flooding periods. Pressures to address include physical modifications from timber transport, hydropower operation and other dams, drainage for infrastructure (e.g. road culverts), agriculture and other multi-purpose hydrological changes. These measures are important in order to improve the status of, for instance, habitats 3110, 3130, 3140, 3150, 3210 and 3260 in all regions they occur, and the species that rely on them. They are also important to migratory fish (1095, 1106, 1030) and species directly dependent on migratory fish for their reproduction (1029, 1032). Northern crested newt (1166) will benefits from newly created ponds and Eurasian otter (1355) and Pond bat (1318) will benefits from improved green infrastructure in the catchment area.

The same measures are important for improving the status of the Atlantic Salmon (1106) in the BOR and CON regions and 1029 in BOR and CON regions, 1032 in BOR and CON regions. The BOR population of the Aral Asp (1130) and the CON population of Great Sea Lamprey (1095), which are in unfavourable status, would also benefit from restoration measures.

Measures taken to improve the state of the freshwater environment in this regard could also help improve the conditions for some adjacent Annex I forest habitats, such as alluvial and riparian forests (91E0, 91F0).

[28] Petersson, E., Degerman, E., Axén, C. (2018). Översikt, riskbedömning och förslag på åtgärder för puckellax (Oncorhynchus gorbuscha). Aqua reports 2018:17. Institutionen för akvatiska resurser, Sveriges lantbruksuniversitet, Drottningholm Lysekil Öregrund https://www.slu.se/globalassets/ew/org/inst/aqua/externwebb/sidan-publikationer/aqua-reports-xxxx_xx/aquarapporter/2018/aqua-reports-2018_17.pdf

Increased buffer zones along agricultural waters[29] with the purpose to reduce the impact of multi-purpose hydrological changes and reduction of diffuse pollution, is needed. Where the buffer zones can be established and how they should be designed depend on the environmental and production conditions at each site. The measure is important for habitat 3260 in BOR and CON region and Thick Shelled River Mussel 1032 among other species.

Restoration of pastures and meadows in bordering grasslands and maintenance of existing extensive agricultural practices are also important measures to improve the condition of structure and functions in the shoreline zones of lakes and rivers and to maintain the area and quality of ponds. These have been identified as important measures to, for instance, habitats 3140 (in both BOR and CON region) and 3150 in all regions, 3210 and 3260 and species 1029 in BOR and CON regions, 1032 in BOR and CON regions. Measures to develop and implement environmentally friendly maintenance methods in existing drainage systems is important for Thick Shelled River Mussel 1032 in BOR and CON regions. Measures to protect small waters and ponds are particularly important for 1166 in BOR and CON. Some of these measures and their anticipated costs for the 2021–2027 period are further described in part E.2.4 (Grassland habitats). Other such measures and their anticipated costs for the 2021–2027 period are listed below.

Similarly, adjustments to forest practices and allocation of protected forest areas in connection to freshwater habitats can help improve the status of habitats 3210 and 3260 in the BOR and CON regions. It can also help improve the status of species 1029 in all regions and 1032 BOR and CON. Necessary measures include, for instance, leaving forested buffer zones along rivers. This is especially important in the large freshwater Natura 2000 areas in northern Sweden where only the aquatic environment is designated and surrounding land is not. Some of these measures and their anticipated costs for the 2021–2027 period are listed below. Also measures described in part E.1.2. Site administration and communication with stakeholders and E. 2.6. Woodland and forest can contribute to status of freshwater habitats and should therefore be taken into account when of importance. Furthermore, measures to improve the state of the freshwater environment are of great importance to improve the conditions for alluvial forests (91E0 and 91F0) as the hydrological regime are a vital ecological function in these forest habitats.

Measures to reduce the impacts of mixed source pollution and the input of nutrients and suspended matter (anthropogenic sources) to lakes and rivers are important and could benefit, for instance, habitats 3210 and 3260 in all regions, 3110 and 3130 in both the BOR and CON regions and 3150 in all regions. This can include mitigation of diffuse sources of nutrients and pollution by developing buffer zones along the water, construction of new wetlands, blocking ditches, increasing water retention time as well as mitigation of point source pollution by adequate wastewater treatment. These measures are relevant throughout the landscape and are mainly handled through the implementation of the Water Framework Directive.

Continued liming of selected lakes and rivers to reduce the effects of air pollution is necessary to avoid further worsening in the conservation status of lakes, rivers and associated species. 378 Natura 2000 areas including 391 lakes and 2 360 km waterways are limed today and are considered to be in need of liming also in the coming period. These measures will benefit in particular habitat 3110, 3130, 3210, 3260 and Freshwater Pearl Mussel (1029) and Noble Crayfish (1091).

[29] Report RA19:6, Kantzoner längs jordbruksvatten för en bättre vattenmiljö - Jordbruksv (jordbruksverket.se)

Additional measures to detect and combat IAS are important in the whole Swedish water catchment area, also far upstream from the locations of protected habitats and species. Such measures could help improve the status of, for instance, habitats 3150 in CON and BOR regions, 3210 in all regions, 3220 in all regions and 3260 in all regions. However, neither the magnitude of the current nor the future needs are fully known at this time, but are expected to increase.

Prioritization of measures to be implemented during the next MFF period

For the 2021–2027 financial period, integrated catchment management measures including the management of water resources and water shortages will be prioritized. Such measures will take considerable effort to deliver in full and cannot be delivered in a single MFF period. However, progress will continue to be made during this period.

Mitigation of physical barriers, including dams and application of ecological flows, will be prioritized. Many of these measures will, however, be covered by the 20-year process of revising hydropower licenses beginning in 2022. All costs associated with the revision, including construction of faunal passages if deemed necessary, will be borne by the hydropower industry[30] or the owner of operations and are therefore not included in the PAF. However, the improved connectivity and hydrological status due to measures in the field of hydropower will provide conditions for restoring areas and mitigation of obsolete barriers that until now have not been prioritized due to impact from hydropower. However, obsolete barriers may be of great value for other societal purposes such as for instance flood or draught management, or as part of the cultural heritage. This needs to be determined on a case-by-case basis.

Therefore, habitat restoration by enhancing morphological structures and functions of the freshwater Annex I habitats (such as reducing the impacts of adjustments made during the timber transporting period) and measures to mitigate the impacts of non-electricity-producing dams and other barriers to migration will be prioritised during the period. Sweden has 30,000 km of obsolete timber floatways. Of these, about 1/3 concern Natura 2000, although not all will be prioritised this period. An estimated 150 non-electricity-producing dams and other barriers will be remedied during the period.

Increasing connectivity to allow migration of e.g. fish, invertebrates and natural sediment transport both laterally and longitudinally is of great importance and prioritized for the period.

Forest management and forestry operations carried out with good environmental consideration in connection with freshwater habitats is a priority measure. Their anticipated costs for the 2021–2027 period are partly described in part E.1.2 others are listed below. For instance, a survey of Natura 2000 areas in the north shows that approximately 0.8 ditches need to be remedied per km of river. Sweden has app. 37,000 km of rivers inside Natura 2000 sites, a smaller proportion of the ditches, about 1000 are prioritized for action during the period.

Measures to establish buffer zones (here defined as edge zones with trees and shrubs) along agricultural waters and measures to develop and implement environmentally friendly maintenance methods in existing drainage systems are prioritized. Where the buffer zones can be established and

[30] According to the National plan for the revision of hydropower plant licenses.

how they should be designed depend on the environmental and production conditions at each individual site.

Continued liming of selected watersystems to reduce the effects of air pollution is prioritised to avoid further decrease in status for lakes, rivers and associated species.

Measures to combat invasive species are prioritised during the period, including the eradication of Pumpkinseed (*Lepomis gibbosus*) and Carolina fanwort (*Cabomba* caroliniana), Yellow floating-heart (*Nymphoides peltata*) among others. Action against Pink salmon (*Oncorhynchus gorbuscha*) which is not yet listed as invasive is deemed necessary. The prioritised measures can be increased when the state of knowledge improves.

A continued implementation and development of ecosystem-based management of fisheries is prioritized. Conservation measures targeting the endangered salmon population in Lake Vänern are particularly important and therefore prioritized during this period.

List of prioritized measures to be carried out, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Increasing connectivity of rivers by removal of dams, or construct of fishway at obsolete dams or similar barriers which are not subject to re-examination of hydropower (CB14, CJ02 CJ03), #1	O	150 barriers, incl. 10 fauna passages / 7 y	2 200 000	LIFE/ EMFAF/ ERDF
Removal and/or adaptation of culverts that pose a problem for water flow or migration (e.g. road passages etc.) (CJ03) #2	O	400 culverts /7 y	1 000 000	LIFE/ EMFAF
Reducing/minimizing the impact on Natura 2000 by imitating more natural like flows (ecological flows) in the operation of the dams and other constructions which are not included in the re-examination of hydropower (CB14, CJ02 CJ03) #3	O	45 Natura 2000 sites /7y	65 000	LIFE/ EMFAF
Reducing the impact of canalisation, straightening (e.g., from the timber transport period), increase natural physical structures and characteristics (CB14, CJ02 CJ03) #4	O	700 km/7y	5 000 000	LIFE/ EMFAF/ ERDF
Restoring hydrological regimes and protect from deposition of sediment by e.g., remedy ditches and recreate wetlands in woodlands and forests adjacent to lakes and streams (CB05, CB14, CJ02 CJ03) #5	O	800 ditches/7y	100 000	LIFE/ EMFAF/ ERDF
Establishing buffer zones along agricultural waters (CA15) #6	O	20 km /7y	57 000	/Life
Develop and implement environmentally friendly maintenance methods in existing drainage operations with Thick Shelled River Mussel (CA15) #7	R	10 soil drainage operations	38 000	Life
Measures directed against IAS on the list of Union concern (CI02) #8	O	10 extinctions-actions	43 000	LIFE/ EMFAF
Implementing management programs for Nuttall's waterweed (*Elodea nuttallii*) (CI02) #9	R	37 Natura 2000 sites	100 000	LIFE/ EMFAF
Measures directed against *Nymphoides peltata* (SE: Sjögull), incl. covering the species with plastic sheets (CI02) #10	O	5 ha/y	500 000	LIFE/ EMFAF
Measures directed against Oncorhynchus gorbuscha (SE: Puckellax) #11	R	3 rivers	100 000	LIFE/ EMFAF/ ERDF
Liming of selected watersystems #12	R	400 lakes/y and 2 500 km rivers/y	1 500 000	
Development and implementation of ecosystem-based fisheries management for Salmon in Natura 2000 areas (CG01 and CG02) #13	R	60 Natura 2000 sites	500 000	LIFE/ EMFAF
Restoration of littoral zone for birds (for example by cutting of reed) #14	O	Around 10 sites/y	400 000	LIFE/ ERDF

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

#1: The cost of dismantling a barrier varies greatly; an estimated average cost is EUR11,000 for small barriers (80%) and EUR125,000 for bigger (20%). The estimated average cost of constructing a fishway is EUR300,000.

#2: Target estimated based on need for measures and capacity to address the need. The cost is calculated based on experiences from the completed Life project Remibar.

#3: The County Administrative Boards have estimated that the hydrological flows in 45 Natura 2000 areas need to be remedied (not related to hydropower).

#4: Experiences from previous and ongoing projects, including Life projects, indicate that 700 km are possible to complete during the period.

#5: Target estimated based on need for measures and capacity to address the need. 1,000 ditches are prioritized for 2021-27, 800 of which inside Natura 2000 sites. Costs are estimated to EUR1000 per ditch.

#6: Target estimated based on number of freshwater Natura 2000 in direct connection to agricultural land in Sweden. Average cost estimated to EUR20,000 per ha of buffer zone.

#7: 46 drainage operations in Sweden has Thick Shelled River Mussel within their perimeter. 22 of these are within Natura 2000 areas. We estimate that 10 of these may be relevant for maintenance during the period. The cost includes development of methodology EUR200,000 and annual implementation EUR10000.

#8: Target based on measures implemented to date.

#9: 37 Natura 2000 sites have reported occurrence of Nuttall's waterweed.

#10: Target and costs are based on a Life application in progress.

11Target and cost are based on current species distribution.

#12: 480 targetareas has Freshwater Nature 2000 sites. In these target areas are 400 lakes (40,000 ha) and 260 rivers (2,360 km) and will be treated annually with 10,000 tons of lime.

#13: Target based on the estimated number of Natura 2000 areas located in one of the 5 large lakes with free fishing or that has salmon as a designated species. Cost estimated based on measures implemented to date.

#14: Nationally important bird sites, SPA areas, an estimate – measures handled by the County Administrative Boards.

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)**	Estimated cost in Euros (annualised)	Possible EU co-funding source
Increasing connectivity of rivers by removal of dams, or construct of fishway at obsolete dams or similar barriers which are not subject to re-examination of hydropower (CB14, CJ02 CJ03),	O	100 barriers, 10 fauna passages / 7 y	1 500 000	LIFE/ ERDF/ EMFAF
Removal and/or adaptation of culverts culverts that pose a problem for water flow or migration (e.g. road passages etc) (CJ03)	O	200 culverts /7 y	500 000	LIFE/ ERDF/ EMFAF
Reducing the impact of canalisation, straightening (e.g., from the timber transport period), increase natural physical structures and characteristics (measures CB14, CJ02 CJ03)	O	300 km/7y	2 000 000	LIFE/ ERDF/ EMFAF
Restoring hydrological regimes and protect from deposition of sediment by e.g., filling out ditches and recreate wetlands adjacent to lakes and streams (CB14, CJ02 CJ03)	O	200 ditches/7y	30 000	LIFE/ ERDF/ EMFAF
Establishing buffer zones along agricultural waters (CA15)	O	20 km /7y	43 000	Life
Develop and implement less harmful clearing techniques in existing soil drainage operations with Thick Shelled River Mussel #1	R	12 soil drainage associations	0	Life
Measures directed against IAS on the list of Union concern (CI02)	O	10 extinctions-actions	43 000	LIFE/ EMFAF
Implementing a management program for Nuttall's waterweed (*Elodea nuttallii*) (CI02) #2	R	40 sites	100 000	LIFE/ EMFAF
Measures directed against *Nymphoides peltata* (SE: Sjögull), incl. covering the species with plastic sheets (CI02)	O	5 ha/y	500 000	LIFE/ EMFAF
Liming of selected watersystems #3	R	2000 km rivers/y	1 000 000	
Development and implementation of ecosystem-based fisheries management for Salmon (CG01 and CG02) and other species#4	R	In lake Vänern, Mälaren and Hjälmaren	250 000	LIFE/ EMFAF

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent measures, both the targets and the costs are given on a yearly basis.

** Target estimated based on need for measures and capacity to address the need. Costs estimated as inside Nature 2000 sites.

#1 All costs associated to measurse in Nature 2000 sites.

#2 Due to the species' large spreading potential, the need is considered equivalent within and outside Natura.

#3 2000 km of watercourses outside Natura do not achieve good status due to acidification.

#4 Areas outside Nature 2000 in lake Vänern, Mälaren Hjälmaren Storsjön et. Al.

Expected results for targeted species and habitat types

Implementing all measures listed above coordinated with implementation of the Water Framework Directive, re-examination of hydropower and establishment of integrated catchment management is expected to lead to an improvement in the condition of the freshwater Annex I habitats and habitats of Annex II species, as indicated in this chapter.

Continued restoration efforts are expected to reverse the negative trend for habitats and species that depend on a functioning green infrastructure, a functioning limnic network and linked to free flowing rivers, such as habitats 3110, 3210 and 3260 and species that depend on dynamic habitats such as freshwater pearl mussel, thick-shelled mussel, Great Sea Lamprey.

However, due to the remaining knowledge gaps concerning the conservation status and the far-reaching impacts in freshwater habitats it is difficult to predict to which degree the condition of different habitats will improve during the period.

In several cases, notably restoration measures, the results of measures will take a long time to materialize, even well beyond 2027.

Species listed on Annex I of the Birds Directive that are expected to be positively affected by conservation measures in the freshwater habitats include: *Alcedo atthis, Anser erythropus, Botaurus stellaris, Chlidonias niger, Gavia stellate, Haliaeetus albicilla, Hydroprogne caspia, Limosa lapponica, Porzana porzana.*

Expected results: other benefits

Managing freshwater habitat and restoring them towards a favourable conservation status can help provide a series of ecosystem services such as reproduction areas for commercially targeted fish species, flood prevention, increased resistance to forest fires, increased water retention time (purification), sediment transport, increased biodiversity, improved drinking water quality and supply, opportunities for recreational fishing and other recreational activities.

E.2.9. Others (caves, etc.)

Current status of habitats and species, conservation measures taken until now and their impact so far, remaining pressures and threats

N.a.

Measures needed to maintain or restore favourable conservation status

N.a.

Prioritization of measures to be implemented during the next MFF period

N.a.

List of prioritized measures to be carried out, and estimated costs for these measures

Within Natura 2000 sites designated for the targeted habitats and species.

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Measure 1				
Measure 2				
etc.				

Additional measures beyond Natura 2000 (wider green infrastructure measures).

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Measure 1				
Measure 2				
etc.				

* indicate whether the measure is recurring or one-off

Expected results for targeted species and habitat types

N.a.

Expected results: other benefits

N.a.

E.2.10. References for site-related maintenance and restoration measures within and beyond Natura 2000

See footnotes.

E.3. Additional species-specific measures not related to specific ecosystems or habitats

E.3.1. Species-specific measures and programmes not covered elsewhere

Current status of the species

The species addressed in this section have unfavourable conservation status and are all subject to species-related programs. Reasons for the problematic situations varies, but often a lack of suitable habitat (within range) is included. Some species are also threatened in the long term by effects caused or aggravated by climate change, for example the arctic fox *(Vulpes lagopus).*

Regarding amphibians in Sweden, only the great crested newt *(Triturus cristatus)* is listed in annex 2 of the Habitats Directive; several others of our frogs and toads are listed in annex 4. A few of these species are common, widespread and in favourable conservation status, others are rare with limited range, fragmented distribution and unfavourable conservation status. The chytrid fungus *Batrachochytrium dendrobatidis* ("Bd") occurs in the wild in Sweden and can be lethal to frogs and toads, but mass mortalities have not been observed in Sweden yet.

Measures needed to maintain or restore favourable conservation status

The most important and costly measures of benefit for listed species are usually restoration of habitats. These measures are included in section E2. Other general measures such as project coordination, research and surveys are included in section E1. The measures described here are other species-specific measures. It is however in most cases essential that these measures are combined with restoration of habitats. To make this PAF reasonably concise, measures for species have been aggregated and are not described in full detail. An example is the arctic fox, listed in annex 2 and 4 of the Habitats Directive, which need a combination of measures including supplementary feeding, culling of red fox in vincinity of arctic fox, information to the public, sometimes breeding and release, and research and monitoring. Cooperation between Sweden and Norway is important for this species. Measures like this have increased the population of arctic foxes in the last decade, but the species is still endangered (EN) and in need of further conservation measures. It should also be noted that the County Administrative Boards handle coordination of species action plans, and the manpower for this is listed in section E.1.2.

Wildlife pathogens also needs to be monitored, and in some cases, measures need to be taken to limit their dispersal and support research. For example, measures are needed to limit the dispersal of the chytrid fungus *Batrachochytrium dendrobatidis* ("Bd"). Such measures include not translocating amphibians unless they are free from disease, disinfection of equipment and boots after visiting an area, and information to the public.

Prioritization of measures to be implemented during the next MFF period

Species-specific measures for threatened Annex II species that are subject to species related programs are prioritized, see the list below. Other measures of benefit to species are included in sections E1 and E2.

Astacus astacus (noble crayfish)

Measures to halt the spread of the North American crayfish species *(Pacifastacus leniusculus*) into or close to waters which is inhabited by the noble crayfish is a prioritized action for the latter. It will be managed within the species action program and the action framework for North American crayfish.

List of prioritized measures to be carried out, and estimated costs for these measures

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Arctic fox conservation measures (supplementary feeding, hunting of red fox, monitoring and other measures) #1	R	> 60 litters annually on average	200 000	ERUF (Interreg)
Measures for Nobel Crayfish including implementing management programs for signal crayfish (*Pacifastacus leniusculus*)	R		270 000	ERUF (Interreg) LIFE,
Lesser white-fronted goose conservation measures (breeding and release, predation preventions of red fox and white-tailed eagle, monitoring)	R		100 000	LIFE
Transplantation and hand pollination of plants	O	700 locations/7y	10 000	LIFE
Reintroduction of insects to new sites	O	105 locations/7y	80 000	LIFE
Cultivation of freshwater pearl mussel and Thick Shelled River Mussel	R	1 running operation	250 000	ERUF (Interreg) Life
Culling of Mustela vison and other invasive/alien species within Natura 2000 sites (for several bird species)	R	5 932 ha/y	830 000	
Culling of Mustela vison and other invasive species outside of Natura 2000 sites (for several bird species)	R	4 460 ha/y	624 000	
Dendrocopos leucotos (white-backed woodpecker): breeding and release into the wild, monitoring, research, species-specific analysis etc) #3	R	Maintain or improve population status # 3	160 000	LIFE
Monitoring of wildlife pathogens, and information to limit their dispersal. #2	R	# 2	# 2	

* indicate whether the measure is recurring or one-off. N.B For one-off-measures, the costs are given as yearly mean cost, while the targets are presented for the whole period 2021-2027. For recurrent me and asures, both the targets and the costs are given on a yearly basis.

#1: Felles Fjellrev was funded in 2017-2019 with 1 000 000 euro, see http://www.fellesfjellrev.se/om-felles-fjellrev/detaljerad-projektbeskrivning/ out of which a bit more than half was funded by ERUF. The number of litters (and cubs in each) naturally varies between years, so a multiannual average is indicated, but this is not a strict target.

#2: In Sweden, the National Veterinary Institute (SVA) work together with the Swedish EPA, the Swedish Agency for Marine and Water Management and the 21 County Administrative Boards in these issues, within current budgets and mandates. For this version of the PAF, costs or targets have not been calculated, but the funding is normally national.

#3: A long-term target is 200 reproducing couples nationally, but during this PAF period, a realistic target is rather to keep the species reproducing in Sweden, while aiming for a gradually increasing population.

Expected results for targeted species

Implementation of the listed measures is needed to maintain or improve the conservation status of the species concerned. In many cases, habitat restoration followed by recurring measures for securing the habitat quality is also needed, alongside the species-specific measures, to maintain the positive effects.

As an exemple, for the arctic fox the measures are designed to at least maintain the sizes of all subpopulations and in some cases increase them, facilitate migration between subpopulations, and

make the Swedish-Norwegian population size increase over time (the annual variation is naturally large). This is in line with the conservation objectives for the Natura 2000 sites concerned and for the species in general.

Species listed under Annex IV in the Habitat directive or under Annex I in the Birds directive, that are currently not in favourable conservation status but should be positively affected by the conservation measures in this PAF include:

Plants: Arctophila fulva, Artemisia oelandica, Alisma wahlenbergii, Hippuris tetraphylle, Liparis loeselii, Luronium natans, Pulsatilla patens, Pulsatilla vulgaris ssp. gotlandica

Insects: Cerambyx cerdo, Euphydryas maturna, Lopinga achine, Parnassius Mnemosyne, Phengaris arion

Expected results: other benefits

The plants and insects listed above contribute to a varied landscape with important functions for ecosystem services such as pollination, cultural heritage and tourism.

E.3.2. Prevention, mitigation or compensation of damage caused by protected species

Current status in terms of prevention, mitigation and compensation for damages

For large carnivores the main topics are damages on livestock and on reindeer herding. The problems are dealt with in different ways. The compensation system in the reindeer husbandry area is mainly performance based; the sami-villages (reindeer herding companies) get compensation depending on the number of large carnivore reproductions/occurrence found and documented in their area. Totally, the compensation for 2021 is funded with 5 570 000 Euro, but the herders sometimes claim larger impact on the reindeer livestock. For damages on other livestock there is a compensation system, based on inspection of the damage by regional authorities plus the value of the damage. The number of animals killed varies between years, but the annual cost is generally 100 000 – 200 000 Euro. The farmers can apply for subsidies for mitigating measures, primarily fencing out carnivores. The annual cost varies but is generally around 1 000 000 Euro. Fencing seems to be quite effective, but the cost is quite high. Large carnivores' attacks dogs occasionally and the last 5 years, 45 – 70 dogs have been injured or killed each year. Subsidies are paid to dog owners for purchasing wolf-safe vests. As the wolf population grow and spread, the damages will probably increase. Several measures aim towards a higher acceptance for large carnivores, but that is hard to measure.

Crop losses in Sweden caused by large grazing birds (only protected species) the last 5 years sum up to around 3 000 000 Euro. The yearly variation is large, due to the connection between weather conditions and damage situation. In addition to these reported damages there is an unknown extent of damage (unreported) caused by both protected and unprotected species. Subsidies are more constant, approximately 100 000 euro annually.

Damage preventive measures currently used are scaring practices, restricted lethal control and diversionary fields on which large grazing birds are left undisturbed to forage. Damage of crops also leads to complex secondary effects, such as negative attitudes towards conservation initiatives of wetland birds. Moreover, there is an increasing number of reports from managers and conservationists about the impact from these birds on vulnerable flora and fauna within wetlands. For example, reed beds seem to disappear because of overgrazing by geese, and cranes are reported to negatively affect waders by predation on chicks and eggs.

Small-scale fishing can receive compensation for damage caused by seals. Compensation can be paid for preventive measures and compensation for damage caused by seals to gear and catch. The annual cost is estimated at 2 000 000 €.

Measures needed

The measures described need to be continued, and the funding revised if necessary, according to the development of damages and wildlife populations.

Prioritization of measures to be implemented during the next MFF period

Continuation of the described actions along with efforts to increase knowledge about the underlaying mechanisms, both for wildlife and people.

To make informed decisions and to implement effective measures, it is of fundamental importance to understand the probability of finding large grazing birds at certain stop-over sites and fields under different conditions. There is a need for a more holistic approach than today and joint management of reserves, birds and agriculture.

Management plans are needed for species of large grazing birds with clear goals at an international, national and regional level to facilitate communication of common goals and strategies.

List of prioritized measures to be carried out, and estimated costs for these measures

Name and short description of the measures	Type of measure*	Target (Unit & quantity)	Estimated cost in Euros (annualised)	Possible EU co-funding source
Prevention crop damages	R	Affected areas	400 000	
Compensation crop damages	R	Affected areas	750 000	
Prevention damages on live stock	R	Affected areas	1 000 000	
Compensation damages on live stock	R	Affected areas	150 000	
Prevention damages on dogs	R	Dog owners, mainly hunters, in affected areas	100 000	
Compensation injured or killed dogs	R	Dog owners, mainly hunters, in affected areas	50 000	
Damages on reindeer	R	Affected sami villages	5 570 000	
Information and education	R	National	700 000	
National plan for management of large grazing birds	O	National	50 000	
Pre-emptive measures and compensation for damage by seals on fishing #1	R	Affected fisheries	2 000 000	EMFAF

* indicate whether the measure is recurring or one-off.

#1: 20 000 000 SEK for 2020 according to Swedish Agency for Water and Marine Management, information in report to Swedish EPA on costs for measures under the Convention on Biodiversity (Swedish EPA case no NV-02223-21).

Expected results for targeted species

Predation on reindeer: Populations of large carnivores can be kept at levels above favourable conservation status.

The compensation system in the reindeer husbandry area is performance based. The compensation thus works as an incentive to have large carnivore reproductions as well as reporting their occurrence to the rangers from the County Administrative Boards.

Predation on sheep and apiaries: Populations of large carnivores can be kept at levels above favourable conservation status.

Predation on dogs: Populations of large carnivores can be kept at levels above favourable conservation status.

Fear and anxiety among residents in areas with bears and/or wolves: Populations of large carnivores can be kept at levels above favourable conservation status.

Divert targeted species from vulnerable crops to less damage prone areas (stubble fields and diversionary fields). Keep breeding/moulting geese within wetlands and not on adjacent agriculture fields (fences along land and waterbodies). Decreased number of individuals to elevate detrimental effects on other flora and fauna (overgrazing of reed beds and depredation on other bird species and animals). Increased fencing and use of other preventive measures result in less attacks on livestock.

Expected results: other benefits

Lowered conflict between agriculture and conservation interests. Positive effects on other flora and fauna. Facilitated communication between interest groups by having well motivated and clear goals and strategies (management plans). Increased acceptance for large carnivores. This a complex and hard-to-measure issue.

E.3.3. References for additional species-specific measures not related to specific ecosystems or habitats

See footnotes. More on arctic fox: http://www.fellesfjellrev.se/om-felles-fjellrev/detaljerad-projektbeskrivning/

F. Further added values of the prioritized measures

Based on the current funding period, there is a large gap between the estimated costs of managing the European Natura 2000 network and the estimated available financing (Kettunen et al., 2011). Article 8 of the Habitats Directive commits EU to co-funding of the implementation of the Natura 2000 network through a combination of EU financial instruments. In the past funding period the member states have fallen short of closing the financing gap. The challenge is to secure enough funding for the network. Here, the key is to strengthen the linkages between conservation measures and wider social, economic and cultural policies and financing instruments, such as rural development, opportunities for small and medium enterprises, nature tourism, and climate mitigation and adaptation. A related important factor is to recognize Natura 2000 sites and other areas assigned to conserve biodiversity in a wider landscape perspective. The benefits associated with ecosystem service provision crucially depend on the management of surrounding areas as well as the area's infrastructure. To increase the potential of Natura 2000 and other conservation sites to contribute significantly to the provision of ecosystem services, it is crucial to develop strategies to prioritize between habitat types, management methods, and location. Part of the solution is to improve cooperation between different layers of decision-making. Kettunen et al. (2017) identified the following necessary improvements to the existing financing framework: i) earmarking expenditure for biodiversity priorities under the sectoral EU funds, ii) addressing eligibility gaps, iii) improving coordination and coherence, iv) reducing the administrative burden, v) improving monitoring, vi) continuing efforts in awareness raising and stakeholder cooperation. The Life project GRIP has potential to develop a first blueprint for the creation of such collaborative mechanisms to secure funding.[31]

Ecosystem services

The most comprehensive compilation of the economic values associated with the full Natura 2000 network is a syntheses report by the European Commission (ten Brink et al., 2013). The report builds on 26 structured interviews with a broad set of stakeholders in 26 member states, and a review of around 60 studies. The study estimates that the Natura 2000 network delivers gross benefits of ecosystem services amounting to between €200 – 300 billion annually, which represents around 1.7 – 2.5 % of EU GDP. The study also points out that the estimates vary significantly between habitat types. The mean estimate of benefits per hectare and year ranges from €1,898 for grasslands to €7,866 for heath and scrub lands.

It is important to point out a few caveats here. The estimates are expected to be conservative as they are derived from base studies that only consider a subset of the total economic value - mainly related to employment, tourism, and recreation for which data is more readily accessible. The estimates are based on benefit transfer methods that involve a substantial number of assumptions and uncertainties with respect to effect sizes. One reason for valuing ecosystem services in monetary terms is to be able to put them on a single scale which is useful for cost comparisons. However, even if monetary valuation provides a tool for a comprehensible quantification of ecosystem services, it should not be used as a single yardstick for decision-making. Ecosystems deliver several types of ecosystem services and it is often not possible, nor desirable, to disentangle these effects and estimate their monetary value – particularly considering the risk of underestimating their value. In

many cases, qualitative or quantitative descriptions of ecosystem services is a more viable tool to communicate their benefits and, hopefully, integrate that understanding into decision-making processes[32].

There are no studies estimating the economic benefits specifically related to Natura 2000 sites in Sweden. However, the project "Communicating ecosystem services"[33] (Naturvårdsverket, 2018a) that ran between 2014–2017, led to the compilation of several reports on ecosystem services in different sectors. The qualitative and quantitative benefits associated with different nature types are listed below.

Marine and coastal waters

The maritime industry contributes to about 2 % of the Swedish GDP and provides employment to about 3 % of the people on the employment market. Marine tourism is the largest sector, contributing to almost 40 % of the net value, whereas the fishing industry contributes to about 1 % of the net value (Havs- och vattenmyndighet, 2018).

36 percent of the Swedish population is located within 5 km from the coastline, and 49 % within 10 km from the coastline (SCB, 2012). Tourism and production of food and health products are the most straightforward ecosystem services to quantify in monetary terms. There are also a range of cultural ecosystem services that contributes to human wellbeing including recreational services, health benefits, contribution to education and scientific information, employment opportunities, as well as the cultural identity and landscapes related to coastal small-scale activities. Coastal and marine tourism is estimated to make up 23-29 % of the total revenues in the tourism sector. The economic value of recreational fisheries has for example been estimated to SEK 1 billion, and the sector employs around 2000 people yearly (Naturvårdsverket, 2011). In Europe, the overall value of sea activities is estimated to about €500 billion and the sector is estimated to sustain around 5.4 million jobs (European Commission, 2012).

All the ecosystem services above depend on supporting and regulating ecosystem services such as primary production, regulating biogeochemical cycles and decomposition of environmental toxins in sediments, habitats and climate regulation. Loss of biodiversity jeopardizes the marine ecosystems to provide these services and thereby to support the wide range of socio-economic benefits derived from marine activities. Marine protected areas (MPA) constitutes one way of reducing human impacts and maintain or restore marine biodiversity. While the initial cost of establishment may outweigh the benefits, in the longer term MPAs are important for the blue economy. The Kosterhavet MPA, consisting of two marine Natura 2000 sites, is one example where conservation is combined with wider socio-economic benefits. The park has actively engaged in nature-based tourism, small-scale fisheries and development of selective gear, education and research on sustainable use of marine areas, as well as industrial algae production. The site has become one of Sweden's most visited National parks and is particularly popular among recreational boat owners. The catch rate of Northern shrimp increased by 78 % during the period 2012-2015 (Russi et al., 2016). This is not a unique example – a recent report on the economic benefits of MPAs in Europe

concludes that they are associated with wide local economy and community benefits (European Commission, 2018). The report identifies direct benefits tied to changes in biodiversity and indirect benefits such as increased revenues from fisheries, actual or perceived improvements in recreation activities, and changes in numbers and distribution of tourists over the year. In sum, the MPAs are contributing to reduce seasonality, increase access to finance, and broaden sector revenues and profits. Still, the report recognizes that there are very few studies that establish robust estimates of the net benefits associated with MPAs.

Indicators for assessing marine ecosystem services have been compiled by the Swedish Agency for Marine and Water Protection (2015). In the latest assessment of the environmental condition of the North and Baltic seas (2018), it was concluded that the negative marine environmental status substantially limits the provision of ecosystem services. This affect the economic viability of marine tourism and fisheries negatively. The current marine environmental status is associated with an estimated loss for the fisheries industry of about EURO 1,2 million per year. The corresponding loss in the marine tourism sector is estimated to EURO 4,9 million per year. The total annual welfare loss is estimated to about EURO 7 million compared with a situation with good environmental status.

Woodlands and forests

About two thirds of the Swedish surface is covered by forest, even though the distribution varies across the country. Forest recreational activities are important ecosystem services. The frequency of visiting forests for recreational purposes has been estimated to 85 visits per person and year (Ezebilo, 2016). The total recreational value of forest has been estimated to be between SEK 14-60 billion per year, which was corresponding to the total production value of timber per year (Hansen and Malmaeus, 2016). Studies have shown that the recreational value increase when forests are managed less intensively and display fewer traits of industrial production methods (Naturvårdsverket, 2011).

Besides recreational services, protected forests help sustaining a wide range of ecosystem services including filtration and regulation of water flows, climate regulation, erosion protection, and absorption of nitrogen. Forests also provide habitat for cattle and reindeer grazing, and forest edges adjacent to agricultural land are particularly beneficial for wild pollinators. The availability of pollinating insects was associated with a 40 % increase in the harvest yield of broad bean in a Swedish study (Bartomeus et al., 2014).

A compilation of the ecosystem services in forests have been compiled by the Swedish Forest Agency (2017).

Freshwater habitats (rivers and lakes)

In Sweden, many houses and weekend cottages are in the proximity of lakes systems. Fresh water systems are important providers of cultural ecosystem services for e.g. swimming, angling, and bird watching. Recreational angling in fresh water alone attracts more than one million people annually (Havs- och vattenmyndigheten, 2017). Rivers and lakes also give rise to esthetical and cultural values, including landscape formation - such as the river systems in Torneträsk. These tangible ecosystem services are, among others, dependent on freshwater systems providing supporting services including primary production, biogeochemical cycling, water circulation, and sustenance of the food web.

Fresh water also provides natural protection in terms of regulating ecosystem services including climate regulation, erosion prevention, mitigation of eutrophication and pathogens, water purification, and flood protection. These ecosystem services are most easily interpreted as avoidance of costs. For example, loss of natural flood protection could imply costly technical solutions to achieve the same service.

Indicators for assessing ecosystem services in freshwater systems have been compiled by the Swedish Agency for Marine and Water Protection (2017).

Bogs, mires, fens and other wetlands

Among other adverse effects, degraded wetlands incur additional costs on water companies that must replace natural purification services with chemical removal of pollutions. In a recent study by the Swedish Board of Agriculture (2018), the estimated effect of restoring agricultural land and organic soils to wetlands is a reduction in CO2-equivalents from 30 to 9 tons per hectare and year. Restoration of wetlands in low productive areas can be a cost-effective and rather quick way to reduce emissions of greenhouse gases in Sweden. The socio-economical benefits from restoration depends on the location as well as the way uncertainties are accounted for. Despite the large uncertainties in the estimations, the study concludes that restoration generates economic net benefits for the society, particularly if the positive effects on biodiversity and nitrogen fixation are considered.

Grasslands, Heathlands and shrubs, Other agroecosystems (incl. croplands)

An important ecosystem service from grazing animals is food production. A varied landscape with different small biotopes is also sustaining a wide range of ecosystem services. Many of the red listed species are tied to the agricultural landscape, particularly grasslands, heathlands and shrubs (Sandström et al., 2015). Besides providing the necessary ecosystems to sustain the regulating and supporting ecosystem services necessary for food production, e.g. pollination by bees, a varied landscape provides predator insects important for pest control which reduces pesticide costs. It has also been shown that heterogenous agricultural landscapes are valued higher in terms of esthetical and cultural attributes by the Swedish population (Hasund et al., 2009).

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