Appendix 1

Monitoring of Natura 2000 natural habitat types

This appendix contains proposals for conservation objectives and monitoring methods for a selection of Swedish natural habitat types listed in the Habitats Directive. It should be noted that the conservation objectives for these habitats have yet to be formally adopted and represent preliminary proposals drawn up in the framework of the Natura 2000 monitoring project.

The appendix includes a separate document on each habitat type, comprising a matrix listing the objectives proposed and an explanatory text. The rows of each matrix are grouped according to whether the parameters in question relate to the extent of the habitat, its structure and functions, or typical species.

The columns of the matrices provide information on the following:

- **Conservation objectives** – national conservation objectives, progress towards which is to be reported at the level of the biogeographical region. An ‘X’ in conjunction with a measure indicates that the proposed figure defining favourable conservation status is a preliminary one that will be adjusted in the light of the baseline survey.

- **Indicators** – often negative indicators, which do not in themselves constitute conservation objectives or provide a basis for assessing conservation status. As a rule, their function in the monitoring system is, in the event of their giving a negative indication, to trigger intensified monitoring on the site in question. Only after the parameters listed in the matrix have been monitored on the site can an assessment of conservation status be made. An ‘X’ in conjunction with a measure indicates that the proposed figure defining favourable conservation status is a preliminary one that will be adjusted in the light of the baseline survey.

- **Measures** – measures of parameters and units of measurement.

- **BS/Mon** – proposed spatial resolution/scope of the baseline survey and of monitoring. Here it is stated whether progress towards conservation objectives is to be monitored on all designated sites or on the basis of a random sample etc.

- **BS methods** – baseline survey methods. Abbreviated references to descriptions of methods are given in parentheses. Full references will be found in the explanatory text.

- **Mon. methods** – monitoring methods. Abbreviated references to method descriptions are given in parentheses. Full references are provided in the explanatory text.

- **Mon. frequency** – proposed frequency of monitoring.
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1110 **Sandbanks which are slightly covered by sea water all the time**

| Area in the Natura 2000 network: 131 880.6 ha, divided among 47 sites. This habitat type occurs in the Boreal and Continental biogeographical regions. |

**Summary**

The natural habitat type ‘Sandbanks which are slightly covered by sea water all the time’ is an example of a widespread Natura 2000 habitat. It comprises several different biotopes, of which elodeid (long-stemmed) vegetation and bivalve beds are the most prominent. In southern Sweden, the dominant elodeid species is eelgrass (*Zostera marina*).

Monitoring of water chemistry and typical species of macrophytes, and of the extent of the subgroups elodeid vegetation and bivalve beds, will be undertaken at a sample of sites. In regions where water quality status is not good, typical species will be monitored at all sites.

The baseline survey will consist of an estimate of the extent of the habitat, based primarily on existing knowledge about the geology and topography of the seabed. For sandbanks located in offshore waters, existing mapping of extent will be used.
Parameters and methods for Natura 2000 monitoring

Reporting units

Regional reporting units
A regional subdivision based on the differentiation into types required under the Water Framework Directive is judged necessary to determine relevant target levels for monitoring parameters, since differences in salinity give rise to considerable variation in terms of the occurrence of typical species etc. (SMHI 1994).

Ecological subgroups
The following subgroups will constitute separate reporting units in the monitoring system:
1. Sands with virtually no vegetation and with highly mobile benthic sediment.
2. Eelgrass meadows and other elodeid vegetation in areas where there is less movement of the sand.
3. Bivalve beds (common mussel (*Mytilus edulis*), Iceland scallop (*Chlamys islandica*), horse mussel (*Modiolus modiolus*) or common oyster (*Ostrea edulis*)), with a mollusc cover of more than 25%.

Survey methods

Baseline survey
The baseline survey will comprise a determination of the extent of the habitat and of its subgroups within designated sites. In the case of the major offshore banks, this will be done by means of multi-beam scanning, combined with photography of a stratified sample of the seabed (Kautsky in prep.). This mapping exercise is expected to provide a very good picture of the extent of the habitat. For the inshore sites not covered by it, approximate delineation of the habitat will be based on the outline mapping carried out in 2003 (SGU 2003), combined with data on seabed geology, shore surveys (infrared aerial photography according to Metria 2003) and existing charts. Baseline survey methods have yet to be finalized and need to be studied during 2004.

Monitoring
The extent of the habitat will be monitored at infrequent intervals (every 24 years) by means of multi-beam scanning. The elodeid vegetation and bivalve bed subgroups will be mapped more frequently (every 6 years) at a sample of sites. Monitoring will be undertaken at at least one site per type area defined under the Water Framework Directive, and at all sites with fisheries involving the use of dragged gear. Monitoring methods will consist of multi-beam scanning combined with drop-down video (Kautsky in prep.) Depending on the size and depth of the site, alternative monitoring methods can be used, such as towed diver-operated video (Länsstyrelsen i Kalmar län 2001), or aquascope surveys from boats. These methods should be used if they are judged to be more cost-effective for the site concerned.

Water quality will be monitored in the Water Framework Directive reference areas, which are located both within and outside proposed Natura 2000 sites. Water chemistry parameters will comprise total nitrogen, total phosphorus and chlorophyll *a* (Naturvårdsverket 1997). Limit values for the habitat will be correlated with the existing system of environmental quality criteria for coasts and seas (Naturvårdsverket 1999), and with Water Framework Directive limit values for good ecological status. If good ecological status is not attained in Framework Directive measurements, monitoring of typical species and extent of elodeid vegetation will be triggered at all sites located within the type area in question.
Parameters and methods for Natura 2000 monitoring

Typical species of macrophytes, all of which are of the elodeid growth form, will be monitored at at least one site per type area. In addition, surveys will be carried out at all sites with commercial fisheries using dragged gear. Transect surveys will be performed, using divers or video, according to the method described in the Environmental Protection Agency’s environmental monitoring handbook for coasts and seas (Naturvårdsverket in prep.). Objectives regarding the depth distribution and cover of typical species will be coordinated with the Water Framework Directive and summarized in terms of an Ecological Evaluation Index (EEI) (Andersson et al. 2003). This index will be used to make a site-level assessment of conservation status. The abundance and depth distribution of individual typical species will be evaluated at the biogeographical region level. On the basis of typical species, a picture will be obtained of the eutrophication situation, and of the effects of any turbidity caused by boat use or similar activities.

References – methods


Kautsky, H. (in prep.), Inventeringsmetod för marina bottnar inom Östersjöns utsjöbankar.


Naturvårdsverket (in prep.), Handbok Miljöövervakning. Vegetationsklädda bottnar, ostkust (N in prep.).

SGU (2003), Förekomst och utbredning av sandbankar, berg och hårdbottnar inom svenskt territorialvatten och svensk ekonomisk zon.

SMHI (1994), Svenskt Vattendirektivs havsområdesregister.
**1170 REEFS**

Area in the Natura 2000 network: 68 197.0 ha, divided among 93 sites. This habitat type occurs in the Boreal and Continental biogeographical regions.

**Summary**

The natural habitat type ‘Reefs’ is an example of a widespread Natura 2000 habitat, with just over a third of its total area in Sweden estimated to be protected within the network. The subgroup ‘Biogenic reefs’ is probably limited in extent. The often rich flora and fauna of this habitat vary considerably, depending on depth and exposure to wave action.

Monitoring of water chemistry and typical species of macrophytes will be undertaken at a sample of sites. In regions where water quality status is not good, all sites will be monitored. Within the biogenic reefs subgroup, the extent of reefs will be monitored, together with typical species of invertebrates. At sites where fishing with demersal gear takes place, monitoring will be performed to ensure that the seabed has a natural structure that is not damaged by fishing gear.

The baseline survey will consist of an estimate of the extent of the habitat, based on mapping of shore areas, combined with exposure data, and seabed topography. This will be supplemented with field mapping of biogenic reefs at sites where such reefs are documented. For reefs located within offshore banks, existing mapping of extent will be used.
**Reporting units**

**Regional reporting units**
A regional subdivision based on the differentiation into types required under the Water Framework Directive is judged necessary to determine relevant target levels for monitoring parameters, since differences in salinity give rise to considerable variation in terms of the occurrence of typical species etc. (SMHI 1994).

**Ecological subgroups**
The following subgroups will constitute separate reporting units in the monitoring system:
1. Rocky reefs
2. Biogenic reefs

**Survey methods**

**Baseline survey**
The baseline survey will comprise a determination of the extent of the habitat and its subgroups within designated sites. In the case of the major offshore banks, this will be done by means of multi-beam scanning, combined with photography of a stratified sample of the seabed (Kautsky in prep.). This mapping exercise is expected to provide a very good picture of the extent of the habitat. For the inshore sites not covered by it, approximate delineation of the habitat will be achieved by combining shore surveys (infrared aerial photography according to Metria Geodata 2003), data on degree of exposure, and existing knowledge of benthic structure (nautical charts etc.). Using a GIS application, the extent of the habitat will subsequently be able to be determined with a confidence of 70–80%.

Mapping of biogenic reefs where they are documented as occurring will be performed by means of multi-beam scanning, combined with field transect surveys using divers (Naturvårdsverket in prep.) or remote-operated vehicles (Davies et al. 2000/Grönberg 1998), depending on available equipment.

Any existing anthropogenic disturbance of the marine environment will be documented by the supervisory authorities.

**Monitoring**
The extent of the habitat will be monitored at infrequent intervals (every 24 years) by means of multi-beam scanning. Biogenic reefs will be mapped more frequently (every 6 years).

At all sites with commercial fisheries involving the use of dragged gear, damage to vegetation or animal communities will be monitored. In the case of biogenic reefs, bottom areas will be monitored every 6 years, at other sites every 12 years. A negative indication will trigger monitoring of typical species.

Water quality will be monitored in the Water Framework Directive reference areas, which are located both within and outside sites. Water chemistry parameters will comprise total nitrogen, total phosphorus and chlorophyll a (Naturvårdsverket 1997). Limit values for the habitat will be correlated with the existing system of environmental quality criteria for coasts and seas (Naturvårdsverket 1999), and with Water Framework Directive limit values.

Typical species of vascular plants and algae will be monitored at least one site per type area defined under the Water Framework Directive, and at all sites located in type areas where water quality is not of a good ecological standard. Transect surveys will be performed, using divers or video, as described in the Environmental Protection Agency’s environmental monitoring handbook for coasts and seas (Naturvårdsverket in prep.). Objectives regarding the depth
distribution and cover of typical species will be coordinated with the Water Framework Directive and summarized in terms of an Ecological Evaluation Index (EEI) (Andersson et al. 2003). This index will be used to make a site-level assessment of conservation status. The abundance and depth distribution of individual typical species will be evaluated at the biogeographical region level. On the basis of typical species, a picture will be obtained of the eutrophication situation, and of the effects of any turbidity caused by boat use or similar activities.

For the subgroup biogenic reefs, survey methods for and lists of typical species of invertebrates will be developed during 2004.

References – methods

Metria (2003), Kartografisk kartering av Natura-2000-habitat marin miljö.
Metria Geodata (2003), Möjlig heter att använda IR-flygbilder vid Natura 2000 basinventering och uppföljning. (M03)
Kautsky, H. (in prep.), Inventeringsmetod för marina bottnar inom Östersjöns utsjöbankar.
Naturvårdsverket (1997), Handbok Miljöövervakning. Hydrografi och närsalter. (NV97)
Naturvårdsverket (1999), Kust och hav. Bedömningsgrunder för miljökvalitet. (NV99)
Naturvårdsverket (2001), Handbok Miljöövervakning. Siktdjup. (NV01)
Naturvårdsverket (in prep.), Handbok Miljöövervakning. Vegetationsklädda bottnar, ostkust. (N in prep.)
SGU (2003), Förekomst och utbredning av sandbankar, berg och hårdbottnar inom svenskt territorialvatten och svensk ekonomisk zon.
SMHI (1994), Svenskt Vattendirektivs havsområdesregister.
www.jncc.gov.uk/marine/mmh/Contents.htm. (ROV)
1630  *Boreal Baltic coastal meadows*

| Area in the Natura 2000 network: 2927.0 ha, divided among 146 sites (approx. 32% of the total area of 9130 ha). This habitat type occurs in the Continental and Boreal regions. |

**Summary**

The natural habitat type ‘Boreal Baltic coastal meadows’ is a priority Natura 2000 habitat of limited extent, with roughly a third of its total area in Sweden protected within the network. The nature conservation interest of this habitat is linked to its closely grazed field-layer vegetation. It often supports a rich bird fauna.

Monitoring and assessment of conservation status will be undertaken at the site level. During each monitoring period, sward height, area of open water along the shoreline, negative indicator species and invasive woody vegetation will be recorded. Less frequent monitoring is proposed with regard to extent, typical species of vascular plants, tree and shrub layer cover, and structure in terms of shallow depressions. Typical bird species will be monitored in all SPAs and on all large sites.

The baseline survey will consist of the existing Meadows and Pastures Inventory.

Natura 2000 sites in Sweden with habitat 1630
Parameters and methods for Natura 2000 monitoring

**Reporting units**

**Regional reporting units**
This habitat type will be reported for the Boreal and Continental biogeographical regions. For the purposes of assessing typical species, the Boreal zone should be divided into two areas: Öland–Gotland–Kalmarsund and Northern Baltic–Bothnian Sea–Bothnian Bay.

**Ecological subgroups**
This is a complex habitat, which almost always consists of several different vegetation types, the most characteristic ones being the red fescue (*Festuca rubra*) community, the saltmarsh rush (*Juncus gerardii*) community, salt pans, and the species-poor vegetation of shallow depressions. Monitoring of sward height will focus on the red fescue community, the vegetation type that is least palatable to grazing livestock and, as a rule, is grazed last of all.

The following subgroups will be distinguished:
- Grassy sward communities.
- Shallow depressions and salt pans.

**Methods**

**Baseline survey**
The baseline survey method for this habitat will consist of the existing Meadows and Pastures Inventory (Jordbruksverket 2002). This includes, in addition to recording of the extent of the habitat, data on historical land use, characteristic species etc. Natura 2000 sites not covered by the inventory will be surveyed using the same method. Presence of freshwater discharges, cover of depressions and salt pans, and tussocky vegetation (photographic evidence) will be documented. The cultural heritage element of the Meadows and Pastures Inventory, however, will not be included in the baseline survey of the Natura 2000 network.

In conjunction with the baseline survey, an initial round of monitoring should be undertaken, the aim being to establish a good basis for work on conservation plans and to reduce travel costs to and from sites.

**Monitoring**
The extent of the habitat will be monitored in conjunction with monitoring of typical species (every 12 years), by means of field checks on its boundaries. In addition, monitoring will take place in the event of any change in the area of the habitat caused by development or other activities.

At least once every 6 years, sward height will be monitored on all sites. This will be done using a pasture ruler, according to Ekstam 1996 (>3 sampling points per site), in those parts of sites that are expected to be poorly grazed, i.e. in the red fescue community. Sampling points will be chosen subjectively, which will require expert judgement. If this subjective monitoring indicates insufficient grazing, and at least every 12 years, sward height will be measured in a sufficient number of plots, stratified within the red fescue community (Bladh 2004), to allow progress towards site objectives to be assessed with statistical significance. Measurement by ruler can be replaced with visual estimation if suitably experienced field workers are available.

Negative indicator species belonging to the field layer, and saplings and other invasive woody vegetation >1.3 m, will be monitored every 6 years in subjectively selected plots, in conjunction with
sward height measurements (method according to Esseen 2003). Plots will be located in areas of sites where the poorest conditions may be expected to be found.

Invasive vegetation and negative indicator species will be monitored in greater detail if a negative indication is obtained, and also every 12 years. These parameters will be recorded at the same points as are used to survey typical species. Within these plots, monitoring of invasive woody vegetation will be performed using nearest neighbour methods (Alexandersson 2003). For negative indicator species, presence/absence in plots will be recorded, according to Bladh 2004.

The area of open water along the shoreline, and the occurrence of significant dense stands of common reed (*Phragmites australis*), sea club-rush (*Bolboschoenus maritimus*), grey club-rush (*Schoenoplectus tabernaemontani*) or reed canary-grass (*Phalaris arundinacea*), will be monitored every 6 years. Extent will be estimated in the field or by aerial photo interpretation (Allard 2003), if aerial photographs are available. A negative indication will trigger monitoring of typical species.

Presence/absence of typical species will be monitored in >30X 0.25 m² sample plots selected at random along permanent transects (according to Bladh 2004). The same plots will be used to monitor a selection of negative indicator species. For sites with considerable variation within the habitat and among the plots studied, the number of plots will be adjusted on the basis of the coefficient of variation, according to Bladh 2004. Since this habitat generally includes several vegetation types, the number of sample plots should as a rule be at least 50 per site. In the case of sites smaller than 5 ha, transects will be distributed over the entire site. For sites exceeding 5 ha, monitoring will take place in randomly selected areas within the site. On sites where Annex II species occur, they will be monitored using flora guardian methods (Länsstyrelsen i Östergötland 2001). Monitoring will be performed at least every 12 years.

At the site level, typical plant species will be assessed in relation to defined objectives expressed in terms of the number of such species found per sample plot. At the biogeographical region level, each of the typical species for the two subgroups will be individually assessed.

In monitoring of typical species, a record will be kept of which sub-group each plot belongs to (depression or grassy sward vegetation). The data will primarily be used for biogeographical region assessment.

Typical species of birds will be monitored using a modified version of the combined point count/line transect method (Naturvårdsverket 1978). Surveys will be performed along parallel transects 200 m or 400 m apart, depending on the size of the site (Blank 2002). Monitoring will be carried out every 6 years on all sites larger than 10 ha and in all SPAs (a total of >30 per region).

### References – methods


Allard, A. (2003), Instruktioner för flygbildstolkning NILS. Draft report. (A03)


Blank, H. (2002), Inventering av fåglar på högmosse. (B02)


Jordbruksverket (2002), Metodhandledning Inventering av värdefulla Ängs- och Betesmarker. Version 1.2. (J02)

Länsstyrelsen i Östergötland (2001:2), Standardisering av metodik för övervakning av rödlistade kärlväxtarter. Miljövårdsenheten, rapport 2001:19. (L01)

**1650 BOREAL BALTIC NARROW INLETS**

Area in the Natura 2000 network: 784.7 ha, divided among 19 sites (some 20% of the total area of 3950 ha). This habitat type only occurs in the Boreal biogeographical region.

**Summary**

The natural habitat type ‘Boreal Baltic narrow inlets’ is an example of a Natura 2000 habitat of limited extent, with roughly one-fifth of its total area in Sweden protected within the network. The often rich flora and fauna of this habitat vary widely, depending on the salinity of the inlet.

The parameters of conservation status to be monitored at all sites are growth of helophytes (reeds etc.) and extent of floating filamentous algae. If a negative change in these indicators is observed, monitoring of water chemistry and typical species of vascular plants and algae will be triggered within the site concerned. Monitoring of typical species of macrophytes will also be undertaken within a sample of the sites. In addition, breeding populations of typical bird species will be monitored at a sample of sites.

The baseline survey will consist of aerial photo interpretation to map the extent of the habitat, emergent vegetation, and any physical disturbance or exploitation. In addition, field surveys of submerged vegetation will be conducted at all sites.
Reporting units

A regional subdivision based on the differentiation into types required under the Water Framework Directive is judged necessary to determine relevant target levels for monitoring parameters, since differences in salinity give rise to considerable variation in terms of the occurrence of typical species etc. (SMHI 1994).

Survey methods

Baseline survey

The first step in the baseline survey will be a determination of the extent of the habitat by means of aerial photographs (Granath 1997, Metria Geodata 2003). The presence of any jetties and other physical disturbance of the shore environment will be documented according to Tullback 2000.

On coasts where postglacial uplift is occurring, steps will be taken in conjunction with work on conservation plans to check that there are undeveloped coastal areas adjoining sites, so that the continued existence of shallow inlets can be safeguarded and their extent maintained. This will be done on the basis of studies of charts (Metria 2003).

In conjunction with the baseline survey, an initial round of monitoring will be undertaken, to determine the area of water not covered by emergent vegetation and the cover of helophytes (reeds etc.). Field visits will be paid to all 19 sites. Submerged vegetation will be mapped according to Sandström et al. 2004.

Monitoring

It is proposed that monitoring should be undertaken at two levels. A basic level for all sites will involve aerial photo interpretation. If this monitoring provides an indication of eutrophication, water quality and typical species will be monitored at the site in question.

The extent of the habitat will be monitored at infrequent intervals (every 24 years), and also in the event of exploitation or the inclusion of additional areas (Granath 1997).

For all sites, rapid growth of helophytes and/or extensive occurrence of floating filamentous algae will be monitored as an indication of eutrophication. Cover of helophytes (>80X% cover) and floating filamentous algae will be monitored with the aid of digitized low-altitude aerial photographs (Allard 2003). Cover will be analysed from digitized images using the Sigma Scan program, according to the method employed at the Kristineberg Laboratory. This method should be further developed in 2004.

It is proposed that all sites should be monitored at least every 6 years. If the baseline survey reveals a high cover of helophytes or filamentous algae, as detailed above, monitoring will be extended to include annual aerial photography. An indication of eutrophication will trigger monitoring of water chemistry and typical macrophytes (see below).

In its natural state, this habitat becomes overgrown with emergent plants, both on coasts affected by postglacial uplift and on shifting coasts. For this reason, the total area of open water not covered by dense stands of common reed (*Phragmites australis*) or other helophytes will be monitored in each type area (Allard 2003). If the area of open water is below a certain value per hectare (to be determined following the baseline survey) at the biogeographical region level, new sites must be incorporated in the network in order to maintain
favourable conservation status. The conservation objective will be monitored at all sites at least every 12 years.

Water quality will be analysed according to methods in the Environmental Protection Agency’s environmental monitoring handbook (Naturvårdsverket 1999, ‘Intensive monitoring’) at sites where a negative indication in the form of helophyte growth or filamentous algae has been recorded. Water chemistry parameters will comprise total nitrogen, total phosphorus and chlorophyll \( a \). Limit values for the habitat will be correlated with environmental quality criteria for coasts and seas (Naturvårdsverket 1999) and with Water Framework Directive limit values.

Typical species of vascular plants and algae will be monitored at at least one site per type area, and at all sites with a negative indication in the form of filamentous algae and helophyte expansion. Macrophyte vegetation will be monitored using the methods of Sandström et al. 2004. Objectives regarding typical species will be coordinated with the Water Framework Directive and summarized in terms of an Ecological Evaluation Index (EEI) (Andersson et al. 2003).

Typical species of birds will be monitored on the basis of the existing Survey of Breeding Coastal Birds, which is under way in most counties (Naturvårdsverket 1998). The method will be modified to use designated N2000 habitats as reporting units. Another proposed modification is that the number of survey visits should be limited to two per survey year.

References - methods


Granath, L. (1997), Bildtolkning av sjöar och vattendrag. En handledning. Naturvårdsverket, Rapport 4806. (G97)

Metria (2003), Kartografisk kartering av Natura-2000-habitat marin miljö.

Metria Geodata (2003), Möjkheter att använda IR-flygbilder vid Natura 2000 basininventering och uppföljning. (M03)


Naturvårdsverket (1997), Handbok Miljöövervakning. Hydrografi och närsalter. (N97)

Naturvårdsverket (1998), Handbok Miljöövervakning. Inventering av häckande kustfåglar. (N98)

Naturvårdsverket (1999), Kust och hav. Bedömningsgrunder för miljökvalitet. (NV99)

Naturvårdsverket (2001), Handbok Miljöövervakning. Siktdjup. (N01)


SGU (2003), Förekomst och utbredning av sandbankar, berg och hårdbottnar inom svenskt territorialvatten och svensk ekonomisk zon.

SMHI (1994), Svenskt havsområdesregister.
Parameters and methods for Natura 2000 monitoring

**2100 Treeless Coastal Sand Dunes** (2110 Embryonic shifting dunes, 2120 Shifting dunes along the shoreline with Ammophila arenaria (white dunes), 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes), 2140 Decalcified fixed dunes with Empetrum nigrum, 2170 Dunes with Salix repens ssp. argentea (Salicion arenariae), 2190 Humid Dune Slacks

Area in the Natura 2000 network: 2891 ha (83% of the total area of 3495 ha), divided among some 35 sites. These habitat types occur in the Boreal and Continental biogeographical regions.

**Summary**

The natural habitat types listed in the heading represent a complex of habitats which almost always co-occur, and for monitoring purposes they are therefore considered as a group. They frequently form a small-scale mosaic, in which some of them (e.g. 2170) often only occupy small patches of a few tens of square metres. Treeless coastal sand dunes are very restricted in extent, and as much as 83% of their total area in Sweden is to be protected within the network. Habitats 2170: Dunes with *Salix repens* ssp. *argentea* (Salicion arenariae) and 2190: Humid dune slacks are particularly scarce, with areas of only 28 and 144 ha, respectively, within proposed sites. In the inner areas of dune complexes, the habitats referred to often make way for wooded dunes. Typical species differ considerably between northern and southern Sweden.

Monitoring and assessment of conservation status will be undertaken at the site level. Sward height will be measured on grazed sites, and abundance of tree saplings on all sites, every 6 years. The extent of each habitat, the area of bare sand, typical species and presence of negative indicator species and exotic species will be monitored every 12 years.

The baseline survey will consist of infrared aerial photography and transect surveys in southern Sweden and low-altitude aerial photography in the north of the country.

Natura 2000 sites in Sweden with habitats 2120 (left) and 2140 (right)
Survey methods

Baseline survey
The baseline survey will, in addition to recording of habitat extent, include data on historical land use, to enable management objectives to be defined for individual sites. In conjunction with the baseline survey, an initial round of monitoring should be undertaken, the aim being to establish a good basis for work on conservation plans and to reduce travel costs to and from sites.

Interpretation of infrared aerial photographs (according to Metria Geodata 2003) will be performed in the Continental region and on Öland and Gotland, with the aim of demarcating dune complexes from other habitats (such as wooded dunes). In northern Sweden, the extent of all habitats will be determined by means of low-altitude aerial photography (Allard 2003). The methodology for low-altitude aerial photo interpretation should be tested in the course of 2004.

Field mapping of habitat extent along transects will be carried out on all sites in the Continental region and on Öland and Gotland (Flodin in prep.). For rarely occurring habitats (in particular, 2170 and 2190), extent will be determined with the help of GPS and orthophotos. This method is time-consuming (around 2 days/site), but given the small-scale mosaic character of the vegetation it is currently the only available approach.

Monitoring
Habitat extent will be monitored every 12 years, together with any changes in extent due to development or other activities.

Sward height will be measured on grazed sites, using a pasture ruler according to Ekstam 1996. This will be done in those areas of sites that are expected to be poorly grazed. Sampling points will be chosen subjectively, which will require expert judgement. If this subjective method indicates insufficient grazing, and at least every 12 years, sward height will be measured in a sufficient number of plots, randomly distributed over the site (Bladh 2004), to allow progress towards site objectives to be assessed with statistical significance. Monitoring will focus on habitats 2130, 2170 and 2190. In the last two of these habitats, it will also include counting of tree saplings >1 m in randomly located circular plots with an area of 100 m². Monitoring of the structural elements mentioned above will be performed every 6 years. If this reveals that defined objectives are not being met, monitoring of typical species will be initiated.

Saplings and other invasive woody vegetation >1 m will be monitored in all habitats, at the same points as are used to survey typical species. This will be done at least every 12 years by measuring the distance to the three nearest saplings at each sampling point, using a laser device (Alexandersson 2003). In addition, measurements concentrated in humid dune slacks, where scrub invasion is most rapid, will be performed every 6 years.

Presence/absence of typical species will be monitored in >30X 0.25 m² plots/habitat, stratified along permanent transects (according to Bladh 2004). On sites with considerable variation within the habitat and among the plots studied, the number of plots will be adjusted on the basis of the coefficient of variation, according to Bladh 2004. In the case of habitat 2120, typical species will be monitored by means of a timed qualitative search (Länsstyrelsen i Östergötland 2001:2). Typical species will be monitored at least every 12 years.
In the same plots as typical species, a selection of negative indicator species will also be monitored. For the invasive exotic species Japanese rose (*Rosa rugosa*), moreover, the number of square metres of cover within each site will be counted. At the site level, typical plant species will be assessed in relation to defined objectives expressed in terms of the number of such species found per sample plot. At the level of the biogeographical region, each of the typical species will be individually assessed.

The typical species tawny pipit (*Anthus campestris*) will be monitored using the territory mapping method (Naturvårdsverket 1978), modified to include only two, or if necessary three, visits per year.

**References - methods**


Allard, A. (2003), Instruktioner för flygbildstolkning NILS. Draft report. (A03)


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Metria Geodata (2003), Möjligheter att använda IR-flygbilder vid Natura 2000 basinventering och uppföljning.

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**3110**  **Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)**

Area in the Natura 2000 network: 7073.1 ha (64% of the total area), divided among 19 sites. This habitat type occurs in the Boreal and Continental biogeographical regions.

**Summary**

The natural habitat type ‘Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)’ is an example of a Natura 2000 habitat that is limited in extent, with around two-thirds of its total area in Sweden protected within the network. It is found on glacifluvial deposits, and its shore vegetation often exhibits a mosaic character. On exposed shores, isoetid vegetation predominates, while helophytes and floating-leaved plants are a feature of sheltered shores. This habitat type has very close affinities with 3130, and monitoring of the two will be partly coordinated.

Favourable conservation status for this habitat is dependent on clear water. As an indicator for the water quality objective, the parameters rapid growth or extensive cover of helophytes or floating-leaved plants will be monitored. Any change will trigger monitoring of water quality and typical plant and fish species. Depth distribution and cover of typical vascular plant species (isoetid vegetation) will be monitored at infrequent intervals at all sites, while typical bird and fish species and noble crayfish (*Astacus astacus*) will be monitored at a sample of sites.

The baseline survey will consist primarily of aerial photo interpretation to map the extent of helophyte and floating-leaved vegetation, together with the occurrence of any dams and barriers to migration. Field visits will also be paid to all lakes, to inspect dams and migration barriers, measure Secchi depth and map isoetid vegetation.
Survey methods

Baseline survey

The first step in the baseline survey will involve an interpretation of infrared aerial photographs of lake shores (according to Granath 1997), with the aim of mapping areas of exposed shore (isoetid vegetation), helophytes (reeds etc.) and floating-leaved vegetation (according to Allard 2003). Any existing development and physical disturbance of the shore below the average water level, in the form of jetties, embankments etc., will be documented using the method of Tullback 2000. Existing dams and man-made barriers to migration in up- and downstream running waters, as far as the nearest significant lake or confluence, will be mapped (Naturvårdsverket 2003) if they are judged to be of importance for the biodiversity of the site.

A one-off measurement of Secchi disk depth will be performed as part of the baseline survey. If Secchi depth is found to be less than 5 m, monitoring of water chemistry will be triggered, involving an analysis of pH, total phosphorus, absorbance and Secchi depth (Naturvårdsverket 1996, 2001, see below).

In conjunction with the baseline survey, an initial round of monitoring will be performed, involving mapping of the cover and depth distribution of isoetid vegetation (see below).

Monitoring

The extent of the habitat will be monitored at infrequent intervals (every 24 years) and in the event of development or inclusion of additional areas of the habitat (Granath 1997).

Aerial photo analysis (according to Allard 2003) of the areas covered by helophytes and floating-leaved vegetation will be repeated every 12 years at all sites. The reason for monitoring this type of vegetation is to obtain an indication of eutrophication, and one which, moreover, is relatively cheap to measure.

Water quality will be monitored at 5 sites per water district, for both this habitat and habitat 3130. This will involve an analysis of pH, total phosphorus, absorbance (Naturvårdsverket 1996) and Secchi disk depth (Naturvårdsverket 2001).

If the lakes in a water district do not meet the criteria for condition class 2 at least (Naturvårdsverket 2000), monitoring of water quality with regard to acidification, water colour and eutrophication will be triggered at sites within the district. Site-level monitoring will also be carried out if strong growth of helophytes and water lilies (Nymphaeaceae) is observed at sites.

Dams and barriers to migration in associated running waters, if judged to be of significance for the biodiversity of the site, will be monitored at all sites, following remedial action.

Typical species of vascular plants (isoetids) will be monitored on at least two randomly selected exposed areas of shore for each lake. Species will be recorded in 0.5 x 0.5 m sample plots along at least two transects per shore area, as described in the Environmental Protection Agency’s environmental monitoring handbook (Naturvårdsverket 2002). For larger lakes, the same method will be used as for surveys of macrophytes in the marine environment (Naturvårdsverket in prep.). Plots will be spaced along transects in such a way that there is a depth change of 0.5 m between them.

Site objectives will be defined for typical species, in terms of depth distribution (dm) and cover (%), which should not decrease or fall below specified values. It is proposed that monitoring should take place every 12 years. If monitoring of growth of helophytes or
floating-leaved vegetation indicates eutrophication, more frequent monitoring will be triggered.

Typical bird species will be monitored at sites with a bird fauna of particular conservation interest. The method used will be breeding pair counts of waterbirds and osprey (Pandion haliaetus), according to the Coastal Bird Survey approach (Naturvårdsverket 1998). The method will be modified to comprise just one visit per survey year (preferably at the end of survey period 2).

Typical fish species and noble crayfish will be monitored at a random sample of sites, comprising at least 5 sites per water district together with habitat 3130, and in lakes where a negative indication has been obtained regarding growth of helophytes or floating-leaved vegetation. Monitoring will primarily be carried out in lakes where sampling is already taking place. A frequency of once every 6 years is proposed. Fish will primarily be monitored by sampling using a multimesh gill-net (Naturvårdsverket 2001) and crayfish according to Fiskeriverket 1997.

References - methods
Allard, A. (2003), Instruktioner för flygbildstolkning NILS. Draft report. (A03)
Fiskeriverket (1997), Kräftprovfiske i sjöar och vattendrag. Fiskeriverket f-Fakta 12. (F97)
Granath, L. (1997), Bildtolkning av sjöar och vattendrag. En handledning. Naturvårdsverket, Rapport 4806. (G97)
Naturvårdsverket (2000), Sjöar och vattendrag, Bedömningsgrunder för miljökvalitet.
Naturvårdsverket (2003), Handbok Miljöövervakning. Biotopkartering - vattendrag. (N03a)
3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation

Area in the Natura 2000 network: 2916.5 ha, divided among 127 sites (12% of the total area). This habitat type occurs in the Boreal and Continental biogeographical regions.

Summary

The habitat type ‘Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation’ is an example of a moderately widespread Natura 2000 habitat, and only 12% of the rivers and streams representing it in Sweden are included in the network. Some monitoring will therefore be undertaken outside Natura 2000 sites.

This habitat can either be dominated by aquatic mosses and almost entirely shaded by forest, or else exposed to the sun, slow-flowing and dominated by floating-leaved vegetation. The latter type usually has more or less unforested banks. In view of the considerable ecological differences, certain parameters will be reported separately for these two subgroups.

Benthic fauna and extent of dense stands of helophytes (reeds etc.) will be monitored at all sites. Extent of aquatic moss-dominated vegetation, and typical fish species, will be monitored at a sample of sites. Water quality will be monitored within a random sample of the habitat, both within and outside Natura 2000 sites. Where relevant, restoration measures affecting barriers to migration and stretches cleared for log driving will be monitored.

The baseline survey will comprise interpretation of aerial photographs of bank vegetation (buffer zones), together with recording of any dense helophyte stands, barriers to migration, stretches cleared for log driving, and regulation of river flow.

Natura 2000 sites in Sweden with habitat 3260
Reporting units
This habitat can either be dominated by aquatic mosses and almost entirely shaded by forest, or exposed to the sun, slow-flowing and dominated by floating-leaved (nymphae) vegetation. The latter type usually has more or less unforested banks, but can vary widely in appearance, depending on the soil type or geology of the area.

The following ecological subgroups are proposed (both can occur within the same site):
- Rivers and streams with aquatic mosses.
- Rivers and streams with floating-leaved vegetation.

Prior to the baseline survey, these two subgroups should be defined in terms of measurable criteria.

Survey methods

Baseline survey
The first step in the baseline survey will consist of an interpretation of infrared aerial photographs of the rivers or streams and their banks (Granath 1997). The extent of the floating-leaved subgroup will be determined (Granath 1997), as will the extent of dense stands of bulrushes (*Typha* spp.) or common reed (*Phragmites australis*) (Allard 2003). Any existing development and physical disturbance of the banks, in the form of jetties, embankments etc., will be documented using the method of Tullback 2000. Existing flow regulation schemes will be documented and indications of stretches cleared for log driving and man-made barriers to migration recorded with the aid of aerial photographs (national Water Framework Directive handbook). Field visits will be paid to all rivers and streams with indications of migration barriers and log-driving disturbance, with a view to assessing the degree of disturbance and the feasibility of restoration (Naturvårdsverket 2003).

Monitoring
The extent of the habitat will be monitored at infrequent intervals (every 24 years) and in the event of development or inclusion of additional areas of the habitat (Granath 1997). The extent of the subgroup rivers and streams with aquatic mosses will be monitored within sites by measuring tree layer cover within a stratified sample. At least 30 sites in the Boreal region and all sites in the Continental region will be monitored at least every 12 years. In the first instance, sites located within a 5x5 km square of the NILS monitoring programme will be surveyed, but additional sites will probably need to be included in the sample.

The hydrological variation of rivers and streams will be monitored using available data from SMHI. Favourable conservation status in terms of hydrological parameters has yet to be defined, and this question should be studied during 2004. Site-level objectives will probably need to be formulated and monitored. Existing barriers to migration and stretches cleared for log driving will be monitored following remedial action.

Benthic fauna will be monitored in all watercourses, at intervals of 18 years in the Boreal region (around 30 sites per 6-year period) and at 6-year intervals in the Continental region. In the Boreal region, temporary sample plots will be used (Naturvårdsverket 1996:1). In the Continental region, which is to be monitored more frequently, permanent plots will be employed (Naturvårdsverket 1996:2). The aim will be to assess the degree of eutrophication and acidity, by means of an analysis of standardized benthic faunal indices (Naturvårdsverket 2000). In the longer term, this method will be replaced with recording of typical species.
Within the subgroup rivers and streams with floating-leaved vegetation, changes in dense stands of common reed or bulrushes will be monitored at all sites (Allard 2003). A stretch of at least 1 km, observed in the baseline survey to have a high cover of helophytes, will be monitored every 12 years at each site. A negative indication for this parameter will trigger monitoring of water quality.

Water samples for analysis of total phosphorus and pH will be taken in rivers and streams where sampling programmes are already in progress, both within and outside Natura 2000 sites (method according to Naturvårdsverket 1996). Water quality will also be analysed at all sites with a negative indication regarding reed and bulrush stands.

It is proposed that typical species of fish and bivalves should be monitored in at least five rivers or streams per water district. This will be coordinated with existing sampling in the watercourses concerned. The methods used will be fish sampling and monitoring of large bivalves, as described in the Environmental Protection Agency’s environmental monitoring handbook (Naturvårdsverket 1999 and 2002).

In southern Sweden, typical species of benthic fauna should in the longer term be monitored in the Natura 2000 framework in conjunction with other surveys of this group of organisms. However, a more carefully considered list of typical species of watercourses with aquatic mosses and with floating-leaved vegetation needs to be prepared before this form of monitoring can begin. It will then replace other monitoring methods for benthic fauna (structure and functions).

**References - methods**

Granath, L. (1997), Bildtolkning av sjöar och vattendrag. En handledning. Naturvårdsverket, Rapport 4806. (G97)

Naturvårdsverket (1996), Handbok Miljöövervakning. Vattenkemi i sjöar. (N96)

Naturvårdsverket (1996), Handbok Miljöövervakning. Bottenfauna i sjöars litoral och i vattendrag – inventering. (N96:1)

Naturvårdsverket (1996), Handbok Miljöövervakning. Bottenfauna i sjöars litoral och i vattendrag – tidsserie. (N96:2)

Naturvårdsverket (1999), Handbok Miljöövervakning. Övervakning av stormusslor. (N96:2)

Naturvårdsverket (2000), Sjöar och vattendrag, Bedömningsgrunder för miljökvalitet.

Naturvårdsverket (2002), Handbok Miljöövervakning. Elfiske i rinnande vatten. (NV02)

Naturvårdsverket (2003), Handbok miljöövervakning. Biotopkartering - vattendrag. (N03a)

4030 **EUROPEAN DRY HEATHS**

Area in the Natura 2000 network: 6157.3 ha, divided among 116 sites (approx. 42% of the total area of 14 705 ha). This habitat type occurs in the Continental and Boreal regions.

**Summary**

The natural habitat type ‘European dry heaths’ is a Natura 2000 habitat of limited extent, with a large proportion of its total area in Sweden protected within the network. This habitat used to be far more widespread. Its flora and fauna vary between sites, depending on their management history. In addition, considerable geographical differences exist between eastern and western Sweden.

Monitoring and assessment of conservation status will be undertaken at the site level. Typical vascular plant species, sward height, invasive vegetation, tree and shrub layer cover, and controlled burning will be monitored on all sites.

The baseline survey will consist of the existing Meadows and Pastures Inventory. On certain sites, supplementary surveys of trees will be necessary.
Reporting units

Regional reporting units
This habitat type will be reported for the Boreal and Continental biogeographical regions.

Ecological subgroups
The following subgroups are proposed for monitoring of typical species:
- Calluna heaths.
- Grass heaths.

Survey methods

Baseline survey
The baseline survey method for habitat 4030 will consist of the existing Meadows and Pastures Inventory (Jordbruksverket 2002). This includes, in addition to recording of the extent of the habitat, data on historical land use, characteristic species etc. Natura 2000 sites not covered by the inventory will be surveyed using the same method. The cultural heritage element of the Meadows and Pastures Inventory, however, will not be included in the baseline survey of the Natura 2000 network. In conjunction with the baseline survey, an initial round of monitoring should be undertaken, the aim being to establish a good basis for work on conservation plans and to reduce travel costs to and from sites.

As part of the Meadows and Pastures Inventory, large and pollard trees have been surveyed, but their positions have not been determined. For sites hosting several Natura 2000 habitats, supplementary data on trees will be required, as the inventory of trees is not related to component habitats, but to each site in its entirety. The same is true of the cover of trees and shrubs. Methods for this supplementary survey work should be chosen in the light of conditions on the sites concerned. Usually, a brief field visit will probably be sufficient to determine to which habitat valuable trees and areas of tree cover belong. On other sites there may be a large number of trees of high conservation interest, spread across several habitats. In such cases, an initial round of monitoring will be undertaken, involving cover estimates of the tree and shrub layers based on infrared aerial photography (NILS) and determination of the positions of pastureland trees of conservation interest (Länsstyrelsen i Östergötland 2001:1).

Monitoring
The extent of the habitat will be monitored in conjunction with monitoring of typical species (every 12 years), by means of field checks on its boundaries. In addition, monitoring will take place in the event of any change in the area of the habitat caused by development or other activities.

At least once every 6 years, sward height will be monitored on all sites. This will be done using a pasture ruler, according to Ekstam 1996 (>3 sampling points on sites <10 ha), in those parts of sites that are expected to be poorly grazed. Sampling points will be chosen subjectively, which will require expert judgement. If this subjective monitoring indicates insufficient grazing, and at least every 12 years, sward height will be measured in a sufficient number of plots, randomly distributed over the site (Bladh 2004), to allow progress towards site objectives to be assessed with statistical significance. In the same plots, the percentage of bare ground will be recorded (Esseen 2003).
The cover of the tree and shrub layers will be monitored at intervals of 18 years by means of aerial photographs, according to Allard 2003.

Pollard, large and hollow trees will be monitored according to Länsstyrelsen i Östergötland 2001. In the first round of monitoring, the positions of these trees will also be determined, by means of orthophotos and GPS. On sites with more than 100 pastureland trees, randomly selected parts of the site will be monitored, so as to include at least 50 trees. The frequency of monitoring should be at least every 18 years.

Saplings and other invasive woody vegetation >1.3 m will be monitored every 6 years in subjectively selected plots, in conjunction with sward height measurements. In addition, scrub encroachment will be monitored in greater detail every 12 years, at the same points as are used to survey typical species. Monitoring will be performed at least every 12 years, using nearest neighbour methods (Alexandersson 2003).

Management by means of controlled burning will be documented on a map and the area burnt will be determined. Occurrence of burning will trigger monitoring of typical species.

Presence/absence of typical species will be monitored in >30X 0.25 m² sample plots per site, selected at random along permanent transects (according to Bladh 2004). The same plots will be used to monitor a selection of negative indicator species. For sites with considerable variation within the habitat and among the plots studied, the number of plots will be adjusted on the basis of the coefficient of variation, according to Bladh 2004. In the case of sites smaller than 5 ha, transects will be distributed over the entire site. For sites exceeding 5 ha, monitoring will take place in randomly selected areas within the site. Rarely occurring typical species will where necessary be monitored using flora guardian methods or adaptive sampling (Länsstyrelsen i Östergötland 2001). Monitoring will be performed at least every 12 years. In burnt areas, typical species will also be monitored 2 years after the year of the burn.

At the site level, typical plant species will be assessed in relation to defined objectives expressed in terms of the number of such species found per sample plot. At the biogeographical region level, each of the typical species will be individually assessed.

References - methods
Allard, A. (2003), Instruktioner för flygbildstolkning NILS. Draft report. (A03)
Jordbruksverket (2002), Metodhandledning Inventering av värdefulla Ängs- och Betesmarker. Version 1.2. (J02)
Länsstyrelsen i Östergötland (2001:2), Standardisering av metodik för övervakning av rödlistade kärlväxtarter. Miljövårdsenheten, rapport 2001:19. (L01)
Area in the Natura 2000 network: 890 186.9 ha, divided among 71 sites (approx. 34% of the total area of 2 100 000 ha). A small proportion of the area, 124 709.8 ha, is in the Boreal region, the remainder in the Alpine region.

Summary

The natural habitat type ‘Alpine and Boreal heaths’ is a very widely distributed habitat, with around a third of its total area in Sweden protected within the Natura 2000 network. It mainly occurs in the Alpine region, but large areas are also found in the Boreal region. This is a heterogeneous habitat, comprising several ecologically clearly distinct subgroups (dwarf heaths on siliceous soils, dry and extremely dry heaths, and mountain avens (Dryas octopetala) heaths).

The parameters of conservation status to be monitored are the structural elements tree and shrub layers, extent of paths, and extent of the subgroup dry and extremely dry heaths and of bare ground. Typical species of vascular plants, lichens and birds will also be monitored. Monitoring will primarily be carried out through the existing environmental monitoring system NILS. Satellite image interpretation of extremely dry and dry heaths will be undertaken at a regional level if changes are observed in the NILS system. If adverse structural changes are observed, site-based monitoring will be performed, using a denser network of sample plots.

The baseline survey will primarily involve a determination of the extent of the habitat, with the help of the existing satellite-based CORINE Land Cover survey.
Parameters and methods for Natura 2000 monitoring

Reporting units

Regional reporting units
This habitat type will be reported for the Boreal and Alpine biogeographical regions. A preliminary subdivision of the Alpine region into the following regional reporting units is proposed: the eastern, continental part of the Scandinavian mountain range, and the western part of the range, where precipitation is heavier. An evaluation of the NILS system of sample plots will establish what units can be distinguished with sufficient statistical confidence.

Ecological subgroups
The habitat will be divided into the following ecological subgroups for the purpose of assessing typical species and certain structural elements:
- Dwarf heaths on siliceous substrates.
- Dry and extremely dry heaths (lichen heaths and windswept ground blown clear of snow).
- Mountain avens (Dryas octopetala) heaths.

In addition, for practical reasons, small snow-beds (area <0.25 X ha) will be included in the area of this habitat. In field studies of other parameters, however, snow-beds (snow-patch communities) will be included in grass heaths.

Survey methods

Baseline survey
The extent of the habitat in the Alpine region will be mapped on the basis of data from the existing satellite-based CORINE Land Cover programme.

Monitoring
The National Inventory of Landscapes in Sweden (NILS) will provide the basis for the monitoring programme. Within NILS, data will be collected both by aerial photo interpretation (Allard 2003) and by fieldwork based on permanent plot and line transect surveys (Esseen 2003).

Using aerial photographs, the extent of the habitat and its subgroups (primarily dry and extremely dry heaths), tree and shrub layer cover, and extent of bare ground will be mapped. Sample plots will comprise one large plot with a radius of 10 m, in which more detailed measurements of the tree and shrub layers will be made, and three smaller plots with a radius of 0.28 m, in which cover of typical plant species and biomass and cover of reindeer-moss lichens (Cladina spp.) will be recorded. Monitoring of typical vascular plant species may need to be supplemented with recording of certain species in the 10 m radius plots. Field-based line transect surveys will include monitoring of the extent of paths.

If the NILS data point to an increased area of bare ground, or of the subgroup dry and extremely dry heaths, the parameter will in addition be monitored at the regional level using satellite-based change analysis, according to Nordberg in press. If this analysis establishes that an adverse change has occurred at the site level, site-based monitoring of structural elements and typical species will be triggered, using a denser network of sample plots to ensure that at least 30 plots are monitored within the site concerned (Marklund 2004).

If changes in other structural and functional parameters monitored by NILS are found to have occurred within a regional reporting unit, this will trigger site-level monitoring of the parameter in question and of typical species, using a denser network of plots than NILS provides, as described in Franzon 2003. A negative indication for
the tree layer parameter will also trigger monitoring of habitat extent at the site level.

Typical species of birds will be monitored in the framework of the Swedish Breeding Bird Survey, which uses sample plots coordinated with those of NILS (combined point count/line transect method, Naturvårdsverket 1978). Willow grouse/ptarmigan (*Lagopus* spp.) are also surveyed within NILS.

For the Boreal biogeographical region, the NILS sample will not be sufficient, as it will include too small a number of plots containing this habitat. Here, a random sample of the habitat will be monitored, comprising at least 10 sites (including relevant NILS plots). Monitoring will be performed in such a way as to allow site-level assessment (i.e. >30 plots per site). For the Boreal region, a monitoring frequency of >50% of sites every 6 years is proposed.

**References - methods**

Allard, A. (2003), Instruktioner för flygbildstolkning NILS. Draft report. (A03)


Metria Geodata (2003), Möjligheter att använda IR-flygbilder vid Natura 2000 basinventering och uppföljning. (M03)

Naturvårdsverket (1978), Biologiska inventeringsnormer, BIN, Fåglar. Punkt-linjekartering. (N78)

Nordberg, M.-L. & Evertsson, J. (in press), Monitoring Change in Mountainous Dry-heath Vegetation at a Regional Scale using Multitemporal Landsat TM data, Ambio. (N in press)
6270  * FENNOSCANDIAN LOWLAND SPECIES-RICH DRY TO MESIC GRASSLANDS

Area in the Natura 2000 network: 5041.6 ha (18% of the total area of 27 600 ha), divided among 472 sites. This habitat type occurs in the Boreal and Continental biogeographical regions.

Summary

The natural habitat type ‘Fennoscandian lowland species-rich dry to mesic grasslands’ is a priority Natura 2000 habitat of limited extent, with only around 18% of its total area in Sweden protected within the network. It used to be far more widespread in the landscape. Tree and shrub layers, and flora and fauna, vary between sites, depending on their management history. In addition, considerable geographical differences exist between northern and southern Sweden.

Monitoring and assessment of conservation status will be undertaken at the site level. Typical vascular plant species, sward height, invasive vegetation, tree and shrub layer cover, and pastureland trees of high conservation interest will be monitored on all sites. Typical species of butterflies and of dung-feeding scarab beetles will be monitored on a sample of sites.

For the baseline survey, use will be made of methods and data from the existing Meadows and Pastures Inventory. On certain sites, supplementary surveys of trees will be necessary.
Parameters and methods for Natura 2000 monitoring

Reporting units

Regional reporting units
This habitat type will be reported for the Boreal and Continental biogeographical regions.

Survey methods

Baseline survey
The baseline survey method for this habitat will consist of the existing Meadows and Pastures Inventory (Jordbruksverket 2002). This includes, in addition to recording of the extent of the habitat, data on historical land use, characteristic species, pollard trees etc. Natura 2000 sites not covered by the inventory will be surveyed using the same method. The cultural heritage element of the Meadows and Pastures Inventory, however, will not be included in the baseline survey of the Natura 2000 network. In conjunction with the baseline survey, an initial round of monitoring should be undertaken, the aim being to establish a good basis for work on conservation plans and to reduce travel costs to and from sites.

As part of the Meadows and Pastures Inventory, large and pollard trees have been surveyed, but their positions have not been determined. For sites hosting several Natura 2000 habitats, supplementary data on trees will be required, as the inventory of trees is not related to component habitats, but to each site in its entirety. The same is true of the cover of trees and shrubs. Methods for this supplementary survey work should be chosen in the light of conditions on the sites concerned. Usually, a brief field visit will probably be sufficient to determine to which habitat valuable trees and areas of tree cover belong. On other sites there may be a large number of trees of high conservation interest, spread across several habitats. In such cases, an initial round of monitoring will be undertaken, involving cover estimates of the tree and shrub layers based on infrared aerial photography (NILS) and determination of the positions of pastureland trees of conservation interest (Länsstyrelsen i Östergötland 2001:1). On sites with more than 100 trees, the number will be estimated.

Monitoring
The extent of the habitat will be monitored at infrequent intervals (every 12 years) in conjunction with monitoring of typical species, and in the event of any change in the area of the habitat resulting from development or other activities. The method used will consist of field checks on habitat boundaries (see typical species, below, for further details). The extent of grazed lowland grasslands outside designated sites will constitute a separate conservation objective when less than 20% of the total area is protected within the Natura 2000 network. This parameter will be monitored every 4 years, in conjunction with monitoring of progress towards the relevant national environmental objectives and targets.

At least once every 6 years, sward height will be monitored on all sites. This will be done using a pasture ruler, according toEkstam 1996 (>3 sampling points on sites <10 ha), in those parts of sites that are expected to be poorly grazed. Sampling points will be chosen subjectively, which will require expert judgement. If this subjective monitoring indicates insufficient grazing, typical species and, at the same time, sward height will be measured in a sufficient number of plots, randomly distributed over the site, to allow progress towards site objectives to be assessed with statistical significance.
The cover of the tree and shrub layers will be monitored at intervals of 18 years by means of infrared aerial photographs, according to Allard 2003.

Pollard, large and hollow trees will be monitored according to Länsstyrelsen i Östergötland 2001. In the first round of monitoring, the positions of these trees will also be determined, by means of orthophotos and GPS. On sites with more than 100 pastureland trees, randomly selected parts of the site will be monitored, so as to include at least 50 trees. The frequency of monitoring should be at least every 18 years.

Negative indicator species belonging to the field layer, and saplings and other invasive woody vegetation >1.3 m, will be monitored every 6 years in subjectively selected plots, in conjunction with sward height measurements (method according to Esseen 2003). Plots will be located in areas of sites where the poorest conditions may be expected to be found. Scrub encroachment will be monitored in greater detail if a negative indication is obtained, and every 12 years, at the same points as are used to survey typical species. Within these plots, monitoring will be performed using nearest neighbour methods (Alexandersson 2003).

Presence/absence of typical species will be monitored in >30X 0.25 m² sample plots per site, selected at random along permanent transects (according to Bladh 2004). The same plots will be used to monitor a selection of negative indicator species. For sites with considerable variation within the habitat and among the plots studied, the number of plots will be adjusted on the basis of the coefficient of variation, according to Bladh 2004. For rarely occurring species, flora guardian methods may sometimes need to be used (Länsstyrelsen i Östergötland 2001). Typical species will be monitored on all sites at intervals of no more than 12 years. In the case of sites smaller than 5 ha, transects will be distributed over the entire site. For sites exceeding 5 ha, monitoring will take place in randomly selected areas within the site.

At the site level, typical species will be assessed in relation to defined objectives expressed in terms of the number of such species found per sample plot. At the biogeographical region level, each of the typical species will be individually assessed.

Typical species of dung-feeding scarab beetles and of butterflies will be monitored in a stratified sample of the habitat, within and outside sites. The sample will be stratified in such a way as to ensure that at least 30 sites falling within the NILS system of sample plots are analysed. The proposed frequency of monitoring is every 6 years. To survey dung-feeding beetles, the method described in the Environmental Protection Agency’s environmental monitoring handbook (Naturvårdsverket 2002) will be used, on two occasions. For butterflies, the handbook’s method for species community surveys will be used, modified to comprise only two recording visits (Naturvårdsverket 2003). These will be timed to coincide with the flight periods of the typical species and with the survey of dung-feeding beetles.

References - methods


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Jordbruksverket (2002), Metodhandledning Inventering av värdefulla Ängs- och Betesmarker. Version 1.2. (J02)
Naturvårdsverket (2002), Handbok miljöövervakning. Spillningslevande bladhorningar. (N02)
Naturvårdsverket (2003), Handbok miljöövervakning. Dagaktiva fjärilar. (N03)
Parameters and methods for Natura 2000 monitoring

6530 *Fennoscandian wooded meadows*

<table>
<thead>
<tr>
<th>Parameters and methods for Natura 2000 monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area in the Natura 2000 network: 406.3 ha (50% of the total area of 819 ha), divided among 57 sites. This habitat type occurs in the Boreal and Continental biogeographical regions.</td>
</tr>
</tbody>
</table>

**Summary**

The natural habitat type ‘Fennoscandian wooded meadows’ is a priority Natura 2000 habitat of very limited extent, with around 50% of its total area in Sweden protected within the network. It used to be far more widely distributed in the landscape, occurring on land that is now used for grazing or commercial forestry. The principal nature conservation interest of this habitat is linked to its ground- and field-layer vegetation, and to large deciduous trees. Tree and shrub layers, and flora and fauna, vary between sites, depending on their management history. In addition, major geographical differences exist between northern and southern Sweden.

Monitoring and assessment of conservation status will be undertaken at the site level. During each monitoring period, sward height, invasive woody vegetation and typical vascular plant species will be recorded. Tree and shrub layer cover, pollard trees and large pastureland trees will be monitored every 18 years. Typical species of butterflies will be monitored on a sample of meadow sites.

For the baseline survey, use will be made of methods and data from the Meadows and Pastures Inventory. On certain sites, supplementary surveys of trees will be necessary.
Reporting units

Regional reporting units
This habitat type will be reported for the Boreal and Continental biogeographical regions.

Survey methods

Baseline survey
The baseline survey method for this habitat will consist of the existing Meadows and Pastures Inventory (Jordbruksverket 2002). This includes, in addition to recording of the extent of the habitat, data on historical land use, characteristic species and pollard trees. Natura 2000 sites not covered by the inventory will be surveyed using the same method. The cultural heritage element of the Meadows and Pastures Inventory, however, will not be included in the baseline survey of the Natura 2000 network. In conjunction with the baseline survey, an initial round of monitoring should be undertaken, the aim being to establish a good basis for work on conservation plans and to reduce travel costs to and from sites.

As part of the Meadows and Pastures Inventory, large and pollard trees have been surveyed, but their positions have not been determined. For sites hosting several Natura 2000 habitats, supplementary data on trees will be required, as the inventory of trees is not related to component habitats, but to each site in its entirety. The same is true of the cover of trees and shrubs. Methods for this supplementary survey work should be chosen in the light of conditions on the sites concerned. Usually, a brief field visit will probably be sufficient to determine to which habitat valuable trees and areas of tree cover belong. On other sites there may be a large number of trees of high conservation interest, spread across several habitats. In such cases, an initial round of monitoring will be undertaken, involving cover estimates of the tree and shrub layers based on infrared aerial photography (Allard 2003) and determination of the positions of pastureland trees of conservation interest (Länsstyrelsen i Östergötland 2001:1). On sites with more than 100 trees, the number will be estimated.

Monitoring
The extent of the habitat will be monitored in conjunction with monitoring of typical species (every 6 years), by means of field checks on its boundaries.

At least once every 6 years, sward height will be monitored on all sites. This will be done using a pasture ruler, according to Ekstam 1996 (>3 sampling points on sites <10 ha), in those parts of sites that are expected to be poorly grazed. Sampling points will be chosen subjectively, which will require expert judgement. If this subjective monitoring indicates insufficient management, typical species and, at the same time, sward height will be measured in a sufficient number of plots, randomly distributed over the site, to allow progress towards site objectives to be assessed with statistical significance.

The cover of the tree and shrub layers will be monitored at intervals of 18 years by means of infrared aerial photographs, according to Allard 2003. A target cover will be defined for each site, varying between 25% and a maximum of 75%.

Pollard, large and hollow trees will be monitored according to Länsstyrelsen i Östergötland 2001. In the first round of monitoring, the positions of these trees will also be determined, by means of orthophotos and GPS. On sites with more than 100 pastureland trees, randomly selected parts of the site will be monitored, so as to
include at least 50 trees. The frequency of monitoring should be at least every 18 years. When a negative indication is obtained in the form of invasive woody vegetation, more frequent monitoring will be carried out.

Saplings and other invasive woody vegetation >1.3 m will be monitored every 6 years. This parameter will be measured under the crowns of valuable pastureland trees, in areas of sites that may be expected to be most poorly managed. Within these plots, monitoring will be performed using nearest neighbour methods (Alexandersson 2003). A negative indication will trigger more detailed monitoring of large and pollard trees.

Presence/absence of typical species will be monitored in >30X 0.25 m² sample plots per site, selected at random along permanent transects (according to Bladh 2004). The same plots will be used to monitor a selection of negative indicator species. For sites with considerable variation within the habitat and among the plots studied, the number of plots will be adjusted on the basis of the coefficient of variation, according to Bladh 2004. For rarely occurring species, flora guardian methods may sometimes need to be used (Länsstyrelsen i Östergötland 2001). Typical species will be monitored on all sites at intervals of no more than 12 years. In the case of sites smaller than 5 ha, transects will be distributed over the entire site. For sites exceeding 5 ha, monitoring will take place in randomly selected areas of the site.

At the site level, typical species will be assessed in relation to defined objectives expressed in terms of the number of such species found per sample plot. At the level of the biogeographical region, each of the typical species will be individually assessed.

Typical species of butterflies will be monitored in a random sample of the habitat, within and outside sites. The sample will be stratified in such a way as to ensure that at least 30 sites falling within the NILS system of sample plots are analysed. The proposed frequency of monitoring is every 6 years. The methods for species community surveys described in the Environmental Protection Agency’s environmental monitoring handbook will be used, modified to comprise only two recording visits (Naturvårdsverket 2003). These will be timed to coincide with the flight periods of the typical species.

References - methods


Allard, A. (2003), Instruktioner för flygbildstolkning NILS. Draft report. (A03)


Jordbruksverket (2002), Metodhandledning Inventering av värdefulla Ångs- och Betesmarker. Version 1.2. (J02)


Naturvårdsverket (2003), Handbok miljöövervakning. Dagaktiva fjärilar.
7110  *ACTIVE RAISED BOGS*

Area in the Natura 2000 network: 29 684.1 ha (approx. 13% of the total area of 227 373 ha), divided among 129 sites. This habitat type occurs in the Boreal and Continental biogeographical regions.

**Summary**

The natural habitat type ‘Active raised bogs’ is a moderately widespread priority Natura 2000 habitat, with around 13% of its total area in Sweden protected within the network. Active raised bogs are complex habitats made up of several different small-scale habitats.

The parameters of conservation status that are to be monitored are the structural elements vegetation height (including presence of negative indicator species), tree layer cover and stem density, and presence of drainage ditches. Typical species of vascular plants, bryophytes and birds will also be monitored. Monitoring will be carried out in a sample of the habitat, both within and outside designated sites.

The baseline survey will consist of the existing Wetlands Inventory, which includes data on the extent of the habitat and on the structural elements tree layer cover and presence of drainage ditches which lower the water table. For sites not covered by this inventory, a baseline survey will be undertaken by means of aerial photo interpretation. Field surveys will be performed on all sites with drainage ditches.

Natura 2000 sites in Sweden with habitat 7110
Reporting units

Regional reporting units
This habitat type will be reported for the Boreal and Continental biogeographical regions.

The Boreal region will be divided into two regional reporting units:
- The south-west (where air pollutant deposition is high).
- Other parts of the Boreal region.

Ecological subgroups
Raised bogs are made up of several different types of vegetation. Most comprise a treeless mire expanse and a forested margin (rand), with ombrotrophic (rain-fed) vegetation, and a lagg with fen vegetation. Only the mire expanse is included in this habitat type. The forested margin is referred to habitat 91D0, while the lagg will be reported as habitat 7140 or 91D0.

The mire expanse of a raised bog is a complex habitat made up of several different small-scale habitats and hydrological structures, such as small pools, carpets, lawns, hummocks and mud bottoms. However, this complexity is not judged to necessitate distinct ecological subgroups for reporting purposes.

Survey methods

Baseline survey
The baseline survey will comprise a determination of the extent of the habitat, together with mapping of tree layer cover and ditches. In the first instance, use will be made of the existing Wetlands Inventory (Naturvårdsverket 1983). In the case of sites not covered by this inventory, or where the forested margin and lagg have not been clearly demarcated, the initial survey will be based on aerial photo interpretation (method according to Naturvårdsverket 1983/Metria 2003). This will also be undertaken for sites where an analysis of Wetlands Inventory data highlights a need for supplementary survey work, and for sites with drainage ditches. In the case of the latter, the cover of the tree layer, and of hollows and carpet vegetation, will be estimated by means of aerial photographs (Allard 2003) for all relevant sites. In addition, field checks will be performed on these sites, to assess the drainage effect of the ditches and the need for restoration measures.

Monitoring
Monitoring of progress towards conservation objectives will only be undertaken at the level of the biogeographical region. In the Continental region, and in the case of sites with drainage ditches, parameters will be monitored with respect to all sites. Many mires in the south-west of the country are affected by nitrogen deposition, which can result in increased vegetation height, increased cover and stem density of trees, and the spread of species not normally associated with bogs. South-west Sweden will therefore be reported as a separate unit, which means that at least 10 sites will be monitored in this part of the Boreal biogeographical region. In the rest of the Boreal region, a sample of 10 sites will be monitored.

Monitoring will be coordinated with the NILS environmental monitoring programme. The regular network of plots covered by NILS is expected to provide an insufficient number of sampling points within designated Natura 2000 sites to ensure statistically robust data, and will therefore need to be supplemented. This will primarily be done by including sites falling within the 1x1 km squares of the NILS system, and secondarily by including those falling within the 5x5 km squares. In these additional plots,
monitoring will be based on a modified sample plot method. A minimum of 3 circular plots containing at least 10 smaller plots of 0.25 m² each will be selected at random on each site.

For active raised bogs outside designated sites, parameters relating to structure and functions, and typical species, will be monitored using the regular NILS network of sample plots (methods according to Esseen 2003).

The extent of the habitat will be monitored at least every 18 years, by means of aerial photography (Allard 2003). Monitoring of extent should also be undertaken outside designated sites. These measurements should be coordinated with monitoring of progress towards the national environmental objectives. When sample-based monitoring of habitat extent, or monitoring of tree layer cover, indicates unfavourable status, it may be necessary to measure extent on all sites. In the future, the existing method for overall monitoring of the area covered by this habitat is likely to be replaced by satellite image interpretation.

Vegetation height and cover of *Sphagnum* mosses will be monitored in 0.28 m² plots, located within the circular plots of the NILS programme (method for measuring vegetation height according to Gunnarsson 2003, sample plot method and cover estimation according to Esseen 2003). A frequency of every 6 years is proposed.

Where the stem density of trees and shrubs >0.5 m exceeds 1000/ha, this parameter will be recorded in permanent circular plots (Esseen 2003 and Gunnarsson 2003). A monitoring frequency of every 6 years is proposed.

Presence of negative indicator species not associated with the bog habitat will be monitored by timed qualitative searches of areas of sites where conservation status may be expected to be least favourable.

Tree layer cover, and extent of hollows and carpet vegetation, will be estimated on the basis of aerial photographs (Allard 2003). This should be coordinated with monitoring of habitat extent, taking place every 18 years on all sites.

In reporting units where the sites studied exhibit unfavourable conservation status with respect to the structural elements mentioned above, monitoring of the elements concerned and of typical species on all sites will be triggered.

The drainage effect of existing ditches will be monitored following any restoration measures.

Typical species of vascular plants and bryophytes will be monitored in the smaller plots set up within circular plots (Esseen 2003). Where an extended random sample is used, in addition to regular NILS plots, the smaller plots will be divided into quadrants. For each typical species, the number of quadrants in which they are found will be recorded (method according to Gunnarsson 2003). Presence/absence of typical species in sample plots will be recorded at intervals of no more than 6 years. At the level of the biogeographical region, each of the typical species will be individually assessed.

Site-level assessment may be necessary for sites affected by restoration measures. Monitoring will then be performed in relation to site objectives, using the method described in Gunnarsson 2003.

Typical species of birds will be monitored by combined point count/line transect surveys (Svensson 1975) on a sample of sites. Site-level monitoring will also be carried out in all SPAs. For sites larger than 3 km², line transect surveys will be used, while smaller sites will be comprehensively surveyed using territory mapping (Blank 2002).
References - methods

Blank, H. (2002), Inventering av fåglar på högmosse. (B02)
Gunnarsson, U. (2003), Metodbeskrivning Övervakning av Natura 2000 objekt för Högmossar (7110) och Degenererade Högmossar (7120). (G03)
Metria Geodata (2003), Möjligheter att använda IR-flygbilder vid Natura 2000 basinventering och uppföljning. (M03)
Naturvårdsverket (1978), Biologiska inventoringsnormer, BIN, Fåglar. Punkt-linjekartering. (N78)
Naturvårdsverket (1983), Inventering av Sveriges våtmarker. Metodik. SNV pm 1680. (N83)
7230 **ALKALINE FENS**

Area in the Natura 2000 network: 13,839.2 ha (approx. 16% of the total area in Sweden of 86,050 ha), divided among 359 sites. This habitat type occurs in the Alpine, Boreal and Continental biogeographical regions.

**Summary**

The natural habitat type ‘Alkaline fens’ is a moderately widespread Natura 2000 habitat, the majority of areas occurring in the northern part of the Boreal region. It is also relatively extensive in the Alpine region and on Gotland. In the boreo-nemoral part of the Boreal region and in the Continental region, on the other hand, it covers very small areas. This is a complex habitat that can consist of several different small-scale habitats.

The parameters of conservation status that are to be monitored are the structural elements sward height (including presence of negative indicator species), tree layer cover and stem density, and presence of drainage ditches. Typical species of vascular plants and bryophytes will also be monitored. In southern Sweden, and on all actively managed sites, monitoring will be carried out at the site level. In the north of the Boreal region and in the Alpine region, a sample of the habitat will be monitored.

The baseline survey will consist of the existing Wetlands Inventory, which includes data on the extent of the habitat and the structural elements tree layer cover and presence of drainage ditches which lower the water table. For sites not covered by this inventory, a baseline survey will be undertaken by means of aerial photo interpretation. Field surveys will be performed on all sites with ditches.
Parameters and methods for Natura 2000 monitoring

Reporting units

Regional reporting units
This habitat type will be reported for the Alpine, Boreal and Continental biogeographical regions. The Boreal region will be subdivided as follows:
- Southern and central Sweden: the boreo-nemoral physical geographical zone (Nordiska ministerrådet 1984), together with the counties of Dalarna and Gästrikland.
- The boreal physical geographical zone (northern Sweden proper).

In the Continental region and the southern part of the Boreal region, alkaline fens are small but numerous (231), and generally affected by past management, and a common monitoring approach will therefore be applied to them.

In the boreal physical geographical zone, within the Boreal region, and in the Alpine region, alkaline fens are more widespread and are less often significantly shaped by past management, and therefore a common monitoring system based on randomly selected sample plots will be used for these areas. Actively managed alkaline fens in the northern Swedish part of the Boreal region and in the Alpine region will be monitored in the same way as sites in the boreo-nemoral zone.

Ecological subgroups
The following two subgroups will constitute separate reporting units within the monitoring system:
- Alkaline fens with a cover of trees or of willow (Salix spp.).
- Open (treeless) alkaline fens.

Open alkaline fens are complex habitats that can be made up of several different small-scale habitats and hydrological structures, such as small pools, carpets, lawns, hummocks and mud bottoms. However, this complexity is not judged to necessitate further ecological subdivisions for reporting purposes. Monitoring of typical species of the habitat will, though, be concentrated on lawn vegetation.

Survey methods

Baseline survey
Continental region and southern part of Boreal region
Infrared aerial photo interpretation will be carried out for all sites, to map subgroups on the basis of tree and shrub layer cover (Allard 2003). For forested mires, aerial photo interpretation will be supplemented by mapping of existing drainage ditches using topographical and, where available, orienteering maps. Sites will also be mapped in the field, in conjunction with which an initial round of monitoring will be undertaken, involving supplementary determination of boundaries using GPS, mapping of ditches, fixed-point photography (Esseen 2003), and recording of characteristic species, typical species (all taxonomic groups) and Annex species.

Existing background data from the Wetlands Inventory (WI) and site-level surveys will form an important part of the baseline survey. The management history of sites should be analysed as a basis for defining objectives for the tree and shrub layers, and for site management.

Boreal zone – northern Sweden proper
Data from the Wetlands Inventory (Naturvårdsverket 1983) will form the basis for the baseline survey of the boreal zone. Where necessary, if alkaline fens are not clearly demarcated from other...
mire areas, these data may need to be supplemented. What additional work is required will be decided in each individual case. For certain sites, supplementary fieldwork and infrared aerial photo interpretation (Nystrand in prep.) will probably need to be undertaken in order to determine the boundaries of the habitat and its subgroups, and to map existing ditches and determine to what extent they lower the water table. In Jämtland county, where a large proportion of designated sites are located, a separate survey of alkaline fens has been conducted, and this will probably suffice as a baseline survey (Nystrand in prep.).

**Alpine region**
A baseline survey method for the Alpine region has not been decided on or tested. As a minimum, the extent of the habitat in this region will be mapped on the basis of information from existing vegetation maps of mountain areas, or alternatively CORINE, combined with geological maps. The method should be tested in the course of 2004 and the habitat boundaries established by it compared with the field-surveyed kilometre squares of the NILS system. If discrepancies in extent greater than 10% are found, a new interpretation of infrared aerial photographs, using WI methods (Naturvårdsverket 1983) or those of Nystrand in prep., should be considered for all sites.

**Monitoring**
As management requirements, exposure to air pollution and the extent and distribution of this habitat differ so widely between northern and southern Sweden, it is justifiable for the purpose of monitoring open alkaline fens to use zones that do not entirely coincide with the EU biogeographical regions. In the south of the country, it is proposed that monitoring should be performed against site objectives and on all sites. In the north, where the majority of the area of alkaline fens is to be found, a sample of the habitat, and of sites, will be monitored. Tree-covered alkaline fens will be monitored on this basis throughout the Boreal region.

**Continental region and southern part of Boreal region**
In southern Sweden, monitoring will be undertaken in relation to the objectives set for individual sites. This is because this habitat varies very appreciably, depending on whether or not it is actively managed, and owing to the very large number of vegetation types which it comprises. The system is designed in such a way that rapidly measured parameters (sward height, and cover of negative indicator species) will be monitored at least every 6 years. If these parameters indicate unfavourable conservation status, more detailed monitoring of structural elements and typical species will be performed. On managed sites and sites with drainage ditches, detailed monitoring of typical species and structures will otherwise take place every 12 years. For unmanaged sites, the frequency will be every 18 years. Parameters measured by aerial photo interpretation will be monitored every 18 years.

The extent of the habitat will be monitored at least every 18 years, or when monitoring of stem density reveals values exceeding 2500/ha. This will be done by means of field checks on habitat boundaries, in conjunction with other monitoring. Habitat extent should also be monitored outside designated sites, coordinated with monitoring of progress towards the national environmental objectives.

Cover of the tree and shrub layers, and extent of the hydromorphological structures strings, mud-bottom flarks, floating carpets and pools, will be monitored by means of aerial photography (Allard 2003/Nystrand in prep.). In conjunction with tree layer interpretation, dense stands of helophytes (reeds etc.) will also be searched for (see above). Smaller structural features, such as hummocks, and
rare small structures, such as marl flats or small pools, will be monitored either in sample plots along permanent transects (see typical species) or by GPS.

At least once every 6 years, sward height will be monitored on all sites. This will be done using a pasture ruler, according to Ekstam 1996 (>3 sampling points on sites <10 ha), in those parts of sites that are expected to be poorly grazed. Sampling points will be chosen subjectively, which will require expert judgement. If a negative indication is obtained, and at least every 12 years, sward height will be measured in a sufficient number of plots, randomly distributed over the habitat (Bladh 2004), to allow progress towards site objectives to be assessed with statistical significance.

Stem density of trees and shrubs >0.5 m will be recorded in permanent circular plots, where stem densities exceed 1000/ha (Gunnarsson 2003), and using nearest neighbour methods (Alexandersson 2003), where they are below 1000/ha.

On sites with drainage ditches which lower the water table, checks will be made to ensure that ditches have been dammed in such a way as to eliminate this effect. Presence of ditches will trigger more frequent monitoring.

Typical species of vascular plants and bryophytes will be monitored in 0.5 x 0.5 m plots, stratified along permanent transects (method as described in Sundberg 2003). 30–50 plots will be monitored in each mire complex that has been randomly chosen for monitoring. In the case of mire complexes with considerable variation within the habitat and among the plots studied, the number of plots will be adjusted on the basis of the coefficient of variation, according to Sundberg 2003. Plots will be divided into quadrants, and typical species will be surveyed in terms of the number of quadrants in which they are found within each plot. Within the plots, cover of certain dominant species will also be recorded (Esseen 2003 and Sundberg 2003). Uncommon typical species can where necessary be monitored using flora guardian methods (Länsstyrelsen i Östergötland 2001).

Alpine region and boreal zone – northern Sweden proper

In the north of Sweden, monitoring will be based on the standardized aerial photo interpretation and sample plot surveys of the NILS programme (according to Allard 2003 and Esseen et al. 2003), which are performed every 5 years. The NILS network of plots will probably need to be supplemented, to permit a sufficient number of sites hosting the habitat and within Natura 2000 to be monitored (>30 NILS plots with the habitat in each of the Boreal and Alpine regions, and >3X sites per county). This extended monitoring will primarily be carried out within the 1x1 km squares of the NILS system, secondarily within its 5x5 km squares, and as a third alternative in additional, randomly selected squares outside the existing NILS network. Monitoring of the habitat will take place both within and outside Natura 2000 sites.

Standardized aerial photo interpretation will yield polygons whose habitat cover can be determined by field checks. Changes in the extent of the habitat and its subgroups, hydrological structures, and cover of trees and shrubs will be monitored by means of this interpretation of aerial photographs (Allard 2003). The extent of the tree and shrub layers will be monitored in the NILS programme’s 10 m radius circular plots. Monitoring of habitat extent on all sites should be undertaken at infrequent intervals (every 24 years), unless NILS monitoring indicates negative trends.

Typical species will be recorded in circular plots (0.28 m radius). To obtain sufficient data, it may be necessary to search 10 m radius plots for a wider range of such species (Esseen 2003).

The drainage effect of existing ditches will be monitored following restoration measures.
References - methods


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Sundberg, S. (2003), Programförslag för övervakning av rikkärr.
7310 *AAPA MIRES

Area in the Natura 2000 network: 453 504.3 ha (approx. 22% of the total area of 2 007 300 ha), divided among 151 sites. This habitat type occurs in the Alpine and Boreal biogeographical regions.

Summary

The natural habitat type ‘Aapa mires’ is a priority Natura 2000 habitat with a wide distribution, and with around 22% of its total area in Sweden protected within the network. It is a composite habitat, comprising several different types of mire, most of which are in turn made up of a variety of small-scale habitats, such as mud-bottom, lawn and carpet vegetation.

The parameters of conservation status that are to be monitored are the structural elements tree layer cover and stem density, hydrological structures, and presence of drainage ditches. Typical species of vascular plants, bryophytes and birds will also be monitored. Monitoring will be carried out in a sample of the habitat within designated sites.

The baseline survey will consist of the existing Wetlands Inventory, which includes data on the extent of the habitat and on the structural elements tree layer cover and presence of drainage ditches which lower the water table. For sites not included in this inventory, a baseline survey will be undertaken by means of aerial photo interpretation, with the exception of sites in the Alpine region, for which the existing satellite-based CORINE Land Cover survey will be used. Field surveys will be performed on all sites with ditches.
Reporting units

Regional reporting units
This habitat type will be reported for the Alpine and Boreal biogeographical regions.

Ecological subgroups
Habitat 7310 is a heterogeneous habitat composed of several different types of mire. Typical species differ appreciably between these mire types, and subgroups should therefore be distinguished for the purpose of monitoring this parameter. The following ecological subgroups are proposed:

- Poor fens.
- Intermediate fens.

The mire types included in these subgroups are often in turn complex habitats made up of several different hydrological structures, such as strings, flark pools, floating carpets (quaking mires), lawns, hummocks and mud-bottom flarks. However, this complexity is not judged to necessitate further ecological subdivisions. Conservation status will, though, be monitored by tracking the extent of the structures requiring the wettest conditions.

Survey methods

Baseline survey
In the Boreal region, the baseline survey will consist of the existing Wetlands Inventory (Naturvårdsverket 1983), which includes data on the boundaries and extent of the various mire types, cover of the tree layer, and presence of drainage ditches. In the case of sites not covered by this inventory, a baseline survey will be undertaken by means of aerial photo interpretation, using methods according to Naturvårdsverket 1983/Metria 2003. This will also be done for sites where an analysis of Wetlands Inventory data highlights a need for supplementary survey work, and for all sites with drainage ditches. In the case of the latter, the cover of the tree layer will be estimated and strings, mud-bottom flarks, floating carpets, flark pools and other pools will be mapped with the aid of aerial photographs (Allard 2003). In addition, field checks will be performed on these sites, to assess the drainage effect of the ditches and the need for restoration measures.

A baseline survey method for the Alpine region, which is not covered by the Wetlands Inventory, has not been decided on or tested. As a minimum, the extent of the habitat in this region will be mapped on the basis of information from the existing satellite-based CORINE Land Cover programme, combined with geological maps. The method should be tested in the course of 2004 and the habitat boundaries established by it compared with the field-surveyed plots of the NILS system. If discrepancies in extent greater than 10X% are found, a new interpretation of infrared aerial photographs, using Wetlands Inventory methods, should be performed for the entire region.

Monitoring
The extent of the habitat will be monitored every 5 years on the basis of aerial photographs. This will be done both within and outside designated sites, by means of aerial photo interpretation of NILS 1x1 km squares (Allard 2003). In the case of designated sites, habitat extent will be mapped every 18 years on all sites falling within 5x5 km squares of the NILS system. If the area recorded within NILS plots decreases by more than 10%, monitoring of the extent of the habitat on all sites in the region will be triggered. In the future, the existing method for site-level monitoring of the area
covered by this habitat is likely to be replaced by satellite image interpretation.

Structural elements and functions, and typical species, will be monitored in a random sample of the habitat, within and outside Natura 2000 sites. The mires monitored will primarily be those falling within plots set up under the NILS monitoring system. Secondarily, additional sites falling within the 1x1 km and 5x5 km squares of NILS will be included.

Cover of the tree and shrub layers, and extent of the hydromorphological structures strings, mud-bottom flarks, floating carpets, flark pools and other pools, will be monitored by aerial photo interpretation (Allard 2003). Monitoring will be carried out within existing NILS plots, and for all sites with ditches. The frequency of monitoring within NILS 1x1 km squares is every 5 years. In the case of designated sites, interpretation will in addition be undertaken every 12 years for all sites falling within the 5x5 km squares of the NILS system. Intermediate fens and sites with drainage ditches will be assessed in relation to site objectives, and poor fens at the biogeographical region level.

If the tree layer within a sample plot is found to increase by >20% in 12 years, this will trigger more detailed field-based, site-level monitoring of typical species, stem density of trees and shrubs, and vegetation height according to Gunnarsson 2003 (see below for further details). This monitoring will be performed in relation to site-specific objectives for each parameter.

The stem density of trees and shrubs will be recorded in permanent circular plots covered by the NILS system (Esseen 2003), at 5-year intervals. For site-level monitoring, where stem density is <1000/ha it will be measured using nearest neighbour methods (Alexandersson 2003). Where it exceeds 1000/ha, permanent circular plots will be used (Gunnarsson 2003). A monitoring frequency of every 12 years is proposed.

The drainage effect of existing ditches will be monitored following restoration measures.

Typical species of vascular plants and bryophytes will be monitored on undrained sites hosting the habitat (both within and outside designated sites), using the NILS network of plots. This network will probably need to be supplemented. At least 40 plots representing the two ecological subgroups should be monitored, to capture the considerable variation within this habitat. Species will be recorded in permanent plots with a radius of 0.28 m (Esseen 2003). An extension to include a search of 10 m radius plots should possibly be considered for certain easily identified, but scarce, typical species. The frequency of monitoring within the NILS programme is every 5 years. For supplementary plots, a frequency of every 10 years is proposed. At the level of the biogeographical region, each of the typical species will be individually assessed.

Where site-level monitoring is undertaken (mires with a negative indication for structural elements and functions, and sites with drainage ditches), typical species will be monitored in at least 30 0.5 x 0.5 m plots per site. On highly heterogeneous sites, more plots may possibly be required (the number being calculated according to Sundberg 2003). Sample plots will be randomly located along transects, and divided into quadrants, and typical species will be surveyed in terms of the number of quadrants in which they are found within each plot (method as described in Gunnarsson 2003). Monitoring will be performed in relation to site objectives regarding the number of typical species to be found per sample plot.

Typical species of birds will be monitored by combined point count/ line transect surveys (Naturvårdsverket 1978) in a sample of the habitat and of sites. Site-level monitoring will also be carried out in
all SPAs. For sites larger than 3 km², line transect surveys will be used, while smaller sites will be comprehensively surveyed using territory mapping (Blank 2002).

References - methods


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8110  **SILICEOUS SCREE OF THE MONTANE TO SNOW LEVELS (Androsacetalia alpinae and Galeopsietalia ladanī)**

Area in the Natura 2000 network: 31 918.6 ha (approx. 72% of the total area in Sweden of 43 825 ha), divided among 54 sites. Occurs in the Alpine and Boreal biogeographical regions.

**Summary**

The natural habitat type ‘8110 Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladanī)’ is moderately widely distributed. The majority of this habitat occurs in the Alpine biogeographical region and is protected within the Natura 2000 network.

The parameters of conservation status that are to be monitored are the structural elements tree, shrub and vegetation cover and, in the Boreal region, cover of deciduous tree species sensitive to grazing. Typical species of vascular plants and lichens will be monitored on a sample of sites.

In the Boreal region, the baseline survey will consist of aerial photo interpretation and field checks to map the extent of the habitat and structural features important for favourable conservation status. The baseline survey of the Alpine region will comprise a determination of habitat extent by means of data from the existing satellite-based CORINE Land Cover programme.
Reporting units

Regional reporting units
This habitat type will be reported for the Boreal and Alpine biogeographical regions.

Ecological subgroups
Identification of ecological subgroups is not judged to be necessary.

Survey methods

Baseline survey
In the Boreal region, the extent of the habitat will be mapped by means of interpretation of infrared aerial photographs of all sites (Metria Geodata 2003). In the Alpine region, it will be determined using data from the satellite-based CORINE Land Cover programme.

In the Boreal region, field surveys will be carried out on all sites to map the area of exposed rock face (Esseen 2003) and to document characteristic, typical and Annex species, using monitoring methods (see below). For the Alpine region, field visits to all sites are not considered necessary. Where field checks are undertaken, they will be coordinated with the baseline survey of Annex II species. As data on these species are limited for many of the sites in the Alpine region, known localities will need to be systematically revisited in connection with the baseline survey. At the same time, occurrences of typical and characteristic species within sites will be surveyed using monitoring methods (see below). On slopes of >25° in alpine settings and >30° in forested terrain, systematic searches will, for safety reasons, be confined to the lowest two metres of the mountainside.

Monitoring
Monitoring will be based on standardized aerial photo interpretation according to Allard 2003. This method will be used to monitor the extent of the habitat and the cover of all vegetation, trees sensitive to grazing, and the tree and shrub layers. In the Alpine region, monitoring will involve infrared aerial photo interpretation of all mountain slopes in the 5x5 km squares of the NILS network. In the Boreal region, all sites will be monitored by means of infrared aerial photo interpretation at intervals of 18 years (Allard 2003).

For a small number of sites in the Alpine biogeographical region, the sample plots of the NILS network will coincide with occurrences of this habitat type. In these permanent plots, cover of trees and shrubs, percentage of bare ground, and cover of typical species will be monitored by means of field surveys (Esseen et al. 2003). The NILS survey method for typical species should be extended to include searches of 10 m radius plots (Esseen et al. 2003). NILS inventories are expected to provide only a limited amount of data, since this habitat is only moderately widespread (which means that there will be few plots containing it) and, with the current methodology, fieldwork is not attempted in inaccessible locations. The data from NILS should be evaluated after the first round of monitoring.

The presence and abundance of typical species will vary from one site to another. Monitoring of this parameter will therefore be undertaken in relation to site-specific objectives. For uncommon species, flora guardian methods are most appropriate (Länsstyrelsen i Östergötland 2001). On slopes of >25° in alpine settings and >30° in forested terrain, systematic searches will, for safety reasons, be confined to the lowest two metres of the mountainside (it should be noted, though, that the foot of the mountain will sometimes be...
inaccessible owing to bouldery terrain). For commoner typical species, a belt transect survey method (still to be described) involving a 2 m wide strip of land is proposed. This method should be tested in the field in the course of 2004. The number of metres along transects with occurrences of the species concerned will be recorded.

Typical species of lichens (cyanolichens) will be monitored by means of line transect surveys of areas at the foot of mountain slopes, as well as recording of their abundance on trees growing in the scree. Methods and choice of species will be based on the methodology for monitoring lichens on deciduous tree trunks described by Esseen et al. (2003). This approach should be modified for use in bouldery terrain and tested in the field in 2004.

Typical species of lichens and vascular plants will be monitored on all sites in the Boreal region. A monitoring frequency of every 12 years is proposed. For sites in the Alpine region, monitoring of typical species will be coordinated with monitoring of Annex II species, and will take place on a sample of mountain slopes within sites.

References - methods

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Metria Geodata (2003), Möjligheter att använda IR-flygbilder vid Natura 2000 basinventering och uppföljning. (M03)
**9010  **WESTERN TAIGA

Area in the Natura 2000 network: 984 923.6 ha (approx. 50% of the total area), divided among 1285 sites. This habitat type occurs in the Alpine, Boreal and Continental biogeographical regions. Its occurrence in the Continental region is so marginal that the latter will be assessed in conjunction with the Boreal region.

**Summary**

The natural habitat type ‘Western taiga’ is a very widespread priority Natura 2000 habitat, with around half its total area in Sweden protected within the network. It is a complex habitat made up of several different biotopes, its flora and fauna varying according to the biotope concerned. For this reason, ecological subgroups will be recognized.

The parameters of conservation status that are to be monitored are the structural elements proportion of deciduous trees, dead wood, and presence of drainage ditches in wet forest habitats. The function occurrence of fires will also be monitored, as will typical species of vascular plants, lichens and birds.

The baseline survey will consist of aerial photo interpretation to map the extent of the habitat, the subgroups present, and structural features important for favourable conservation status. In stands where unfavourable status is suspected, field surveys will be conducted. Sites supporting habitats that require management will also be visited in the field.

Natura 2000 sites in Sweden with habitat 9010
Reporting units

Regional reporting units
This habitat type will be reported for the Boreal and Alpine biogeographical regions. Occurrences in the Continental region will be included in the Boreal region. For some parameters, the Boreal region will be divided into the following zones:

• The boreal zone.
• The boreo-nemoral zone.
• For parameters relating to acidification, south-west Sweden (Blekinge – western Värmland) will also be reported separately.

Ecological subgroups
For the purposes of monitoring typical species and extent, western taiga will be divided into the following subgroups:

1. Biotopes requiring active management:
   • natural old pine forests,
   • natural old boreal deciduous forests,
   • recently burnt areas,
   • younger succession stages that have developed after fire, e.g. young deciduous stands.

2. Areas with minimum intervention management:
   • natural old spruce forests,
   • natural old mixed forests (may in certain cases require management),
   • natural old wet coniferous forests.

To this list we can add forested scree and forested rocky slopes. When conservation plans are adopted, each subgroup will be assigned to a group defined in terms of the management interventions required. Such interventions may include fencing, scrub clearance around trees, and prescribed burning.

Survey methods

Baseline survey
The baseline survey will consist primarily of a determination of the extent of the habitat and of the subgroups present by means of aerial photography (Metria Geodata 2003, Metria Geodata 2003:1). The structural elements forest stratification, mixed-age stands, proportion of deciduous trees, and presence of drainage ditches in wet coniferous forests will be documented using the same method. The aim of the baseline survey of structural elements is to identify stands requiring management and stands not at favourable conservation status. If aerial photo interpretation indicates that subgroups requiring management are present, that structure and functions fall short of the requirements for favourable conservation status, or that the habitat does not in fact consist of western taiga, field checks will be carried out. Existing survey data (nature conservation surveys, commercial valuations, forestry plans) will be reviewed to provide further support for an assessment of whether field visits are necessary.

Field checks will involve recording of the tree species composition, standing volume, amount of dead wood, stratification, presence of old/large trees and stand age (method according to Svefa 2003). This will be done in subjectively chosen plots that are judged to be representative of the stand. It should be noted that, where infrared aerial photo interpretation indicates that the habitat consists of western taiga at favourable conservation status and not requiring management, field checks will not be performed.
In conjunction with the baseline survey, the foundations will also be laid for a system to record natural forest fires and prescribed burning for nature conservation purposes.

**Monitoring**

Monitoring will be based on the Swedish National Forest Inventory (NFI), which involves measurements of a range of parameters on a random sample of sites (SLU 2003). This sample consists of a network of permanent plots, more widely scattered in the north of the country. Site-level monitoring will primarily be carried out in areas where there are habitats requiring management and where management interventions are occurring.

The extent of the habitat within sites will be monitored using NFI data. A comprehensive survey will be performed at infrequent intervals, every 24 years, using infrared aerial photographs or, in years to come, possibly satellite data (Metria 2003). Monitoring of habitat extent at the site level will also be undertaken in the event of any development of sites or increase in their total area.

The extent of the subgroup natural old pine forests will primarily be monitored through the NFI. The sample of Natura 2000 sites covered by this inventory is expected to provide a good picture of changes in the extent of pine-dominated forest, since this subgroup covers a relatively large area. The NFI will also, if possible, be used to monitor the extent of the subgroup natural old boreal deciduous forest (dominated by or rich in deciduous trees). As these subcategories are relatively scarce, the NFI sample is only expected to provide a clear picture of their status in parts of the country where they occur widely, i.e. the Alpine region and Norrbotten county. Elsewhere, monitoring will probably need to be carried out at infrequent intervals by means of infrared aerial photography (Metria 2003, every 24 years).

Young deciduous stands that develop in the wake of a fire will be recorded and monitored in conjunction with natural fires and prescribed burns. The latter will trigger site-level monitoring of several structural elements. Occurrence of fires will be monitored at the biogeographical region level, both within and outside designated sites. More development work will need to be done in 2004 to create a coordinated recording system at the landscape level for this important function.

The NFI’s sample-based survey of Natura 2000 sites will be the most important tool in monitoring the structural features dead wood, presence of exotic tree species, and proportions of grazing-sensitive and other deciduous trees. If the baseline survey reveals unfavourable conservation status with respect to dead wood or exotic tree species, these parameters will be monitored at the site level, using the same method as in the baseline survey (Svefa 2003). The same principle applies to monitoring of existing ditches. Once favourable conservation status has been achieved regarding the structures mentioned, site-level monitoring will be discontinued in favour of NFI monitoring.

Typical species of lichens and vascular plants will primarily be monitored through the NFI and NILS (National Inventory of Landscapes in Sweden) networks of permanent sample plots (SLU 2003 and Esseen 2003). Additional information on Annex II species will be obtained from flora guardian monitoring of these more rarely occurring species (Länsstyrelsen i Östergötland 2001).

Typical species of birds will be monitored in the framework of the Swedish Breeding Bird Survey, whose sample plots are coordinated with those of NILS. Combined point count/line transect surveys will be used (Svensson 1975). Site-level monitoring of SPAs may be needed to obtain statistically robust data. In smaller SPAs, the point count/line transect method will be modified to comprise parallel
transects 250 or 500 m apart, depending on the size of the area. NFI monitoring of woodpecker signs will provide an indicator of the status of the coniferous-forest bird fauna. If this indicator reveals a negative trend at the county level, monitoring on sites larger than 50 ha will be triggered.

References – methods
Allard, A. (2003), Instruktioner för flygbildstolkning NILS. Draft report. (A03)
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**9020** *Fennoscandian hemiboreal natural old broad-leaved deciduous forests (Quercus, Tilia, Acer, Fraxinus or Ulmus) rich in epiphytes*

Area in the Natura 2000 network: 6622.4 ha (approx. 24% of the total area of 28 100 ha), divided among 287 sites. This habitat occurs in the Continental and Boreal biogeographical regions.

Summary

The natural habitat type ‘Fennoscandian hemiboreal natural old broad-leaved deciduous forests (Quercus, Tilia, Acer, Fraxinus or Ulmus) rich in epiphytes’ is a Natura 2000 habitat of limited extent, with some 24% of its total area in Sweden protected within the network. It comprises many different types of deciduous forest.

The parameters of conservation status that are to be monitored are the structural elements tree species composition (including the proportion of spruce), dead wood, and regeneration of key species. Monitoring will involve rapid, relascope-based recording of subjectively chosen plots. In single-layer forests, more detailed measurements will as a rule be made in plots selected at random. Typical species of bryophytes and lichens will be monitored on permanent sample trees, stratified across the site. In the southwestern areas of Sweden that are significantly affected by air pollution, the vascular plant flora will also be monitored on a sample of sites.

The first step in the baseline survey will consist of aerial photo interpretation to map the extent of the habitat and to classify stands on the basis of structural elements important for favourable conservation status. Field visits will subsequently be paid to all sites.

Field surveys will record structural features and species using key habitat inventory methods, and using sample plot methods to provide a subjective description of stands.
Parameters and methods for Natura 2000 monitoring

Reporting units

Regional reporting units
This habitat type will be reported for the Continental and Boreal biogeographical regions. Most of the area which it covers is situated in the Boreal region.

Ecological subgroups
The habitat comprises a wide range of types of warmth-demanding deciduous forest. Its diversity is a result of the fact that it almost always has a history as wooded pasture or meadowland. The current composition of the vegetation depends on the management history of the site in question and the stage of succession which the forest has reached. Norway spruce (Picea abies) is generally absent in the Continental region, but forms a natural part of the flora of this habitat on many sites in the Boreal region. Despite the wide variation within the habitat, it is not considered necessary to distinguish ecological subgroups for monitoring purposes. However, it is important when monitoring typical species and structure and functions to take the existing geographical and between-site variation into account.

Survey methods

Baseline survey
The baseline survey will consist primarily of a determination of the extent of the habitat and of component stands by means of aerial photography (Metria Geodata 2003, Metria Geodata 2003:1). Stand boundaries will be delineated in such a way as to ensure uniformity in terms of the structural elements forest stratification, mixed-age stands, and tree species composition. Field checks will subsequently be carried out on all sites. On sites smaller than 100 ha, all stands will be visited; on those exceeding 100 ha, stands will be randomly selected in such a way that at least 25% of them or 100 ha are visited. On all sites however, regardless of sampling procedure, visits will be paid to all stands where there is uncertainty as to whether they represent this habitat type. The same applies where mapping of structural elements on the basis of aerial photo interpretation gives cause to suspect that conservation status is unfavourable, i.e. in the case of single-layer or young stands.

Existing survey data (nature conservation surveys, key habitat inventories, commercial valuations, forestry plans) will be reviewed to provide further support for an assessment of to what extent field visits to larger sites are necessary.

Data on stand boundaries obtained from aerial photographs will be supplemented with field checks and qualitative searches for typical species using key habitat inventory methods (Norén et al. 2002). Sample plot analysis, involving quantified measures of structural elements and functions, will be performed on all sites. Within plots, vegetation type, tree species composition, standing volume, amount of dead wood, stratification, presence of old/large trees and stand age will be recorded (method according to Svefa 2003). More detailed accounts of methods to describe stratification and to measure dead wood are given in SLU 2003 and Ståhl 2003. Data will be recorded in three or four temporary plots per stand, chosen subjectively by the field worker. These plots should be representative of the stand. Measuring techniques will comprise the relascope method, together with height measurement and age determination of certain trees. These field methods should be tested in deciduous forest settings in the course of 2004.
If the subjective sample plot analysis of age structure and tree species composition shows conservation status to be unfavourable, a more detailed survey can where necessary be carried out and permanent plots set up, to provide basic information about the stand prior to restoration. Within the site, circular plots with a radius of 20 m will be selected at random. Plots are to be laid out according to the ‘extensive method’ described in the Environmental Protection Agency’s environmental monitoring handbook: 10 plots on sites smaller than 20 ha, >13 plots on sites 20–100 ha, and 16 plots on sites 100–1000 ha (Naturvårdsverket 1999). Within these plots, all small trees (1–9 cm dbh) within a radius of 3.5 m will be counted, and all trees 10–39 cm dbh within a 10 m radius and large trees >40 cm dbh within a 20 m radius will be measured using a calliper (method modified after Fritz 2004). The quantity of dead wood in plots will also be measured (Ståhl 2003). As baseline survey methods for deciduous forests have not been tested in the field and are not fully developed, extensive testing needs to be carried out in the course of 2004.

**Monitoring**

Site-level monitoring will be undertaken, involving a rapid method to record structural elements and functions and less frequent recording of typical species on permanent sample trees. The reason for monitoring this habitat at the site level is that it is a deciduous forest environment which requires management, and which in the natural state becomes overgrown with spruce and other tree species. When major management interventions are to take place, more in-depth monitoring will be possible.

The extent of the habitat will be monitored at infrequent intervals using infrared aerial photo interpretation or, in years to come, possibly satellite data (Metria 2003, every 24 years).

Tree species composition, age structure and regeneration will be monitored using the method employed for the baseline survey (Svefa 2003), i.e. in three or four subjectively chosen plots. Sites exhibiting favourable status should be monitored every 12 years and those with unfavourable status every 6 years. If a negative indication is obtained, more detailed monitoring of the parameters, using randomly selected permanent plots, may be considered (Fritz 2004 and others; for methods, see baseline survey documentation). This approach should primarily be used if costly restoration measures are to be implemented on the site.

Typical species of wood-inhabiting fungi, lichens and bryophytes will be monitored on permanent sample trees chosen at random within sites (stratification according to the ‘extensive method’, Naturvårdsverket 1999). At each sampling point, all trees >50 cm dbh within a radius of 20 m will be selected for monitoring, together with two trees 30–50 cm dbh. In all, >30 large trees hosting typical species will be monitored per site. Each sample tree will be permanently marked and its position determined using GPS. Typical species and cover on each tree will be recorded on a scale of 1–9 cm², 10–99 cm², 100–999 cm² and >1000 cm². A monitoring frequency of every 18 years is proposed. On sites with a negative indication for structure and functions, monitoring will take place every 6 years.

At the site level, typical species of bryophytes, lichens and wood-inhabiting fungi will be assessed in relation to defined objectives expressed in terms of the number of such species to be found per sample tree. At the level of the biogeographical region, each of the typical species will be individually assessed.

Typical species of vascular plants will be monitored on a random sample of sites in the more severely polluted south-western area of the Boreal region. Habitats 9020 and 9160–9180 will be monitored.
as a single entity, and a total of at least 40 deciduous forest sites will be surveyed. Sample plot design and site selection will be coordinated with NILS and the National Forest Inventory (Esseen 2003, SLU 2003). The survey method will be modified to include recording of certain rarely occurring typical species in 10 m radius plots. At least four plots per site will be surveyed. Typical species of vascular plants will only be assessed at the biogeographical region level.

References - methods


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Svefa (2003), Förslag till objektsbaserat inventeringssystem för basinventering vid upprättande av bevarandeplaner inom Natura 2000-nätverket. (S03)
9040 NORDIC SUBALPINE/SUBARCTIC FORESTS WITH Betula pubescens ssp. czerepanovii

Area in the Natura 2000 network: 796 298.5 ha, divided among 74 sites (approx. 55% of the total area of 1 443 402 ha). This habitat type occurs in the Alpine and Boreal regions.

Summary

The natural habitat type ‘Nordic subalpine/subarctic forests with Betula pubescens ssp. czerepanovii’ (mountain birch) is a very widespread habitat, with just over half its total area in Sweden protected within the Natura 2000 network. Subalpine/subarctic birch forests primarily occur in the Alpine region, but there are also large areas in the Boreal region. This is a heterogeneous habitat type, comprising several ecologically distinct subgroups (lichen type, bryophyte type, herb type, tall-herb type).

The parameters of conservation status that are to be monitored are the structural elements tree layer composition, amount of dead wood, extent of paths, presence of lodgepole pine (Pinus contorta) and extent of bare ground. Typical species of vascular plants, lichens and birds will also be monitored. Monitoring will primarily be carried out through the existing environmental monitoring system NILS. Satellite image interpretation will be undertaken at a regional level if NILS monitoring reveals an adverse change in the composition of the tree layer. If an adverse structural change is observed, site-based monitoring will be performed, using a denser network of sample plots.

In the baseline survey, the extent of the habitat will be determined with the help of the existing satellite-based inventory CORINE Land Cover.

Natura 2000 sites in Sweden with habitat 9040
Reporting units

Regional reporting units
This habitat type will be reported for the Boreal and Alpine biogeographical regions. A preliminary subdivision of the Alpine region into the following regional reporting units is proposed: the eastern, continental part of the Scandinavian mountain range, and the western part of the range, where precipitation is heavier. An evaluation of the NILS system of sample plots will establish what units can be distinguished with sufficient statistical confidence.

Ecological subgroups
The habitat will be divided into the following ecological subgroups for the purpose of assessing typical species:
- Lichen type.
- Bryophyte type.
- Herb type.
- Tall-herb type.

In addition, for practical reasons, small snow-beds (area <0.25X ha) will be included in the area of this habitat. In field studies of other parameters, however, snow-beds (snow-patch communities) will be included in grass heaths.

Survey methods

Baseline survey
The extent of the habitat will be mapped using data from the satellite-based CORINE Land Cover programme.

Monitoring
The National Inventory of Landscapes in Sweden (NILS) will provide the basis for monitoring of structure and functions, and of typical species. Within NILS, data will be collected both by aerial photo interpretation (Allard 2003) and by fieldwork based on permanent plot and line transect surveys (Esseen 2003).

The extent of the habitat will be mapped from aerial photographs of NILS 1x1 km squares (Allard 2003). Measurements will also be obtained from the sample plot surveys. In years to come, comprehensive surveys based on satellite data will probably be able to be carried out in the GMES (Global Monitoring for Environment and Security) framework. With existing technology, this habitat can be mapped with a high degree of confidence.

The NILS programme’s analysis of aerial photographs involves mapping of tree and shrub layer cover and the extent of bare ground, using the method described by Allard 2003. The proportion of coniferous trees and presence of lodgepole pine can also be monitored by this method.

Each NILS sample plot consists of a large plot with a radius of 10 m, in which more detailed measurements are made of the tree and shrub layers and of dead wood. Within this circular plot, there are three smaller plots with a radius of 0.28 m, in which cover of typical plant species and biomass and cover of reindeer-moss lichens (Cladina spp.) are recorded (Esseen 2003). Monitoring of typical species of vascular plants may possibly need to be supplemented with recording of certain species in the 10 m radius plots. Field-based line transect surveys will among other things be used to monitor the extent of paths.

If the NILS data point to an increase in the area of bare ground, or indicate that the proportion of coniferous trees has exceeded the
limit, this will trigger site-level monitoring of structural elements and typical species in at least 30 plots within each site concerned (Marklund 2004).

If changes in other structural and functional parameters monitored by NILS are found to have occurred within a regional reporting unit, this will trigger site-level monitoring of the parameter in question and of typical species, using a denser network of plots than NILS provides, as described in Marklund 2004. A negative indication for the tree layer parameter will also trigger monitoring of habitat extent at the site level.

Typical species of birds will be monitored in the framework of the Swedish Breeding Bird Survey, which uses sample plots coordinated with those of NILS (combined point count/line transect method, Naturvårdsverket 1978). Willow grouse and ptarmigan (*Lagopus* spp.) are also surveyed within NILS.

For the Boreal biogeographical region, the NILS sample will not be sufficient, as it will include too small a number of plots containing birch forest of this type. Here, a random sample of the habitat will be monitored, comprising at least 10 sites (including relevant NILS plots). Monitoring will be performed in such a way as to permit site-level assessment (i.e. >30 plots per site). For the Boreal region, a monitoring frequency of >50% of sites every 6 years is proposed. This will be coordinated with habitat 4060.

References - methods
Allard, A. (2003), Instruktioner för flygbildstolkning NILS. Draft report. (A03)
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<tbody>
<tr>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase in all WFD type areas.</td>
<td></td>
<td></td>
<td>BS at all sites.</td>
<td>IR of shores (M03) + GIS application + existing survey of offshore banks (to be studied 2004).</td>
<td>Multi-beam + drop-down video (K in prep.).(2)</td>
<td>Every 12 years + when exploited or new area added</td>
</tr>
<tr>
<td>The area of seabed with elodeid vegetation within Natura 2000 sites should be maintained or increase in all type areas.</td>
<td></td>
<td></td>
<td>Mon. at sample of sites.</td>
<td>Multi-beam + drop-down video (K in prep.).(2)</td>
<td>&gt;every 6 years</td>
<td></td>
</tr>
<tr>
<td>The area of bivalve beds within Natura 2000 sites must not decrease &gt;X % or increase &gt;Y %, in all type areas.</td>
<td></td>
<td></td>
<td>Mon. at sample of sites hosting subgroup.</td>
<td>Multi-beam + drop-down video (K in prep.).(2)</td>
<td>&gt;every 6 years</td>
<td></td>
</tr>
<tr>
<td>Structure and functions</td>
<td>At &gt;90% of sites and in &gt;90% of the designated area, total nitrogen, total phosphorus and chlorophyll a should, as a minimum, meet the criteria for condition class 2X (NV99).</td>
<td>Yes/no. P+Ntot +µmol/l, chlorophyll +µg/l.</td>
<td>Mon. in type areas, within or outside sites, + at all sites within type areas with NI for water quality.</td>
<td>Environmental monitoring handbook (NV 97), WFD handbook.</td>
<td>Freq. coordinated with Water Framework Dir. NI triggers mon. of typical species + extent elodeid veg. at all sites in type area</td>
<td></td>
</tr>
<tr>
<td>Typical species</td>
<td>&gt;90% of sites and the designated area should meet site objectives regarding the Ecological Evaluation Index for macrophytes. At the biogeographical region level, the cover and depth distribution of vascular plants and algae should be maintained or increase.</td>
<td>Yes/no – ha.11 Evaluation of EEI. Depth distribution (cm) + cover %.</td>
<td>Mon. at stratified sample of sites in each region, &gt;1 / type area, and at all sites with fisheries using dragged gear, + NI for water quality.</td>
<td>Estimation of cover and depth distribution along transects (NV in prep.).</td>
<td>Every 2 years</td>
<td></td>
</tr>
</tbody>
</table>

Footnotes
(1) Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
(2) Depending on size and depth of site, alternative monitoring methods can be used: towed diver-operated video (L01)/aquascope surveys from boats along transects. These methods should be used if judged more cost-effective for site concerned.

Abbreviations used in matrix:
BS – Baseline survey
Mon. – Monitoring
NI – Negative indication, i.e. level defined for conservation objective or indicator not achieved
Site – Natura 2000 site
WFD – Water Framework Directive

Objective to be monitored at sample of sites. If negative indication, to be monitored at all sites.
If negative indication, objective to be monitored at all sites.
Conservation objective to be monitored at all sites.
### 1170 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase in all regions.</td>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase in all regions.</td>
<td>Ha.</td>
<td>BS at all sites. Mon. at sample of sites.</td>
<td>IR of shores (M03) + GIS application.</td>
<td>Multi-beam (K in prep.)</td>
<td>Every 12 years + when exploited or new area added.</td>
</tr>
<tr>
<td>The extent of the subgroup biogenic reefs within N2000 sites should be maintained or increase in all regions.</td>
<td>The extent of the subgroup biogenic reefs within N2000 sites should be maintained or increase in all regions.</td>
<td>Ha.</td>
<td>BS + mon. at all sites hosting subgroup.</td>
<td>Multi-beam + video (K in prep.).</td>
<td>Multi-beam + video (K in prep.).</td>
<td>Every 6 years.</td>
</tr>
<tr>
<td>At &gt;90% of sites and in &gt;90% of the designated area, total nitrogen, total phosphorus and chlorophyll a should, as a minimum, meet the criteria for condition class 2X (NV99).</td>
<td>At &gt;90% of sites and in &gt;90% of the designated area, total nitrogen, total phosphorus and chlorophyll a should, as a minimum, meet the criteria for condition class 2X (NV99).</td>
<td>Yes/no. P*Ntot = μmol/l, chlorophyll = μg/l.</td>
<td>Mon. in type areas, within or outside sites, at all sites within WFD type areas with Ni.</td>
<td>Environmental monitoring handbook (NV 97). WFD handbook.</td>
<td>Environmental monitoring handbook (NV 97). WFD handbook.</td>
<td>Freq. acc. to WFD. Ni triggers mon. of water quality + typical species at sites in type area.</td>
</tr>
<tr>
<td>Physical damage to the benthic vegetation or attached animal communities of the reef resulting from fisheries etc. should not occur.</td>
<td>Physical damage to the benthic vegetation or attached animal communities of the reef resulting from fisheries etc. should not occur.</td>
<td>Yes/no, % cover.</td>
<td>BS + mon. of indicator at sites with indication that fishing with dragged gear occurs.</td>
<td>Estimation of cover along transects (NV in prep.) or diver-operated video.</td>
<td>Estimation of cover along transects (NV in prep.) or diver-operated video.</td>
<td>&gt;50% of sites every 6 years. Ni triggers mon. of typical species.</td>
</tr>
<tr>
<td>&gt;90% of sites and the designated area should meet site objectives regarding the Ecological Evaluation Index for macrophytes. At the biogeographical region level, the cover and depth distribution of macrophytes should be maintained or increase.</td>
<td>&gt;90% of sites and the designated area should meet site objectives regarding the Ecological Evaluation Index for macrophytes. At the biogeographical region level, the cover and depth distribution of macrophytes should be maintained or increase.</td>
<td>Yes/no (ha) (1) evaluation of EEI. Depth distribution (cm) + cover %.</td>
<td>Mon. at sample of sites in each region, &gt;1 site per type area, at all sites with Ni for water quality/benthic structure.</td>
<td>Estimation of cover and depth distribution along transects (NV in prep.).</td>
<td>Estimation of cover and depth distribution along transects (NV in prep.).</td>
<td>Every year.</td>
</tr>
<tr>
<td>&gt;90% of sites hosting biogenic reefs should meet site objectives for typical species of invertebrates. Typical species must be defined before monitoring can become operational.</td>
<td>&gt;90% of sites hosting biogenic reefs should meet site objectives for typical species of invertebrates. Typical species must be defined before monitoring can become operational.</td>
<td>Yes/no (ha). (1) Cover %</td>
<td>Mon. at sample of biogenic reef sites in each region, &gt;1 site per type area.</td>
<td>Estimation of cover along transects/in sample plots (method not defined).</td>
<td>Estimation of cover along transects/in sample plots (method not defined).</td>
<td>Not defined.</td>
</tr>
</tbody>
</table>

(1) Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.

**Abbreviations used in matrix:**
- BS – Baseline survey
- IR – Infrared aerial photo interpretation
- Mon. – Monitoring
- NI – Negative indication, i.e. level defined for conservation objective or indicator not achieved
- Site – Natura 2000 site
- WFD – Water Framework Directive

- Objective to be monitored at sample of sites. If negative indication, to be monitored at all sites.
- If negative indication, objective to be monitored at all sites.
- Conservation objective to be monitored at all sites.
### 1630 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Establish</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase.</td>
<td>Cover or frequency of negative indicator species&lt;sup&gt;5a&lt;/sup&gt; in red fescue community should be &lt;5%.</td>
<td>Yes/no (ha)&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>Sward height cm.</td>
<td>BS + mon. on all sites.</td>
<td>-</td>
<td>Ruler (E96) + cover estimation 100 m² plots (E03) in subj. selected + stratified plots (B03, E96).</td>
</tr>
<tr>
<td>At least 95% of the sites and the designated area should be well grazed&lt;sup&gt;2&lt;/sup&gt; at the end of each growing season.</td>
<td>No dense stands &gt;10 m² of large invasive indicator species&lt;sup&gt;5a&lt;/sup&gt; should be present on shore above average water level.</td>
<td>Yes/no (ha)&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>% of area.</td>
<td>Mon. on all sites.</td>
<td>-</td>
<td>Cover estimation of negative indicator species + open water along shore (E03).</td>
</tr>
<tr>
<td>At least 80% of the shore area below the average water level should consist of open water on at least 90% of sites.</td>
<td>The extent of depressions and salt pans should not decrease at the biogeographical region level.</td>
<td>Invasive woody vegetation&lt;sup&gt;3b&lt;/sup&gt; should not be present.</td>
<td>Cover %, and/or stems/ha, of invasive vegetation.</td>
<td>BS + mon. on all sites.</td>
<td>Orthophotos (J02), + mon. method on sites not covered by MPI.</td>
<td>Field method for invasive vegetation (A03:1), subjectively selected + stratified plots.</td>
</tr>
<tr>
<td>The habitat should as a rule be free of shrubs and trees. At least 95% of sites and the designated area should meet site objectives regarding crown cover of trees and shrubs established in a well-managed landscape&lt;sup&gt;3a&lt;/sup&gt;.</td>
<td>At the biogeographical region level, the abundance and range of typical bird species should be maintained or increase. At least 90% of sites and the total area should meet site objectives regarding the abundance of typical vascular plant and Annex II species&lt;sup&gt;4&lt;/sup&gt;.</td>
<td>At the biogeographical region level, the abundance and range of typical bird species should be maintained or increase. At least 90% of sites and the total area should meet site objectives regarding the abundance of typical bird species.</td>
<td>Frequency % of each species.</td>
<td>Yes/no (ha)&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>Mon. on all sites.</td>
<td>-</td>
</tr>
</tbody>
</table>

### Footnotes

(1) Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.

(2) ‘Well grazed’ means that, at the end of the growing season, the average sward height of the red fescue(Poa trivialis) community is no more than 3 cm. (2a) Visual estimation by an experienced recorder can replace ruler measurement as a monitoring method.

(3a) ‘Trees and shrubs established in a well-managed landscape’ means trees and shrubs that served a function in earlier land use, and were shaped by that use, and those whose age, stem diameter and habit clearly show that they could have become established in a well-managed landscape. In earlier land use, areas of a pasture which, when well managed, were able to support grass were kept largely free of trees and shrubs. Shrubs and saplings were cleared at regular intervals to promote grass production. What trees and shrubs permitted in earlier land use had in common was that they grew, often in managed forms, in areas of the pasture that could not support grass, even when well managed, for example on or close to outcrops of rock, mounds of boulders etc. However, tree layer cover must always be <5%.

(3b) ‘Invasive vegetation’ means trees, shrubs (>1.5 m) and ground vegetation that have been able to establish themselves as a result of grazing having become insufficiently intensive to contribute to ensuring the occurrence of plant and animal communities and species favoured by grazing.

(4) >1 typical species must be found in >50% of the plots studied, however.

(5a) Negative indicator species = cow parsley (Anthriscus sylvestris), stinging nettle (Urtica dioica), creeping thistle (Cirsium arvense) and curled dock (Rumex crispus).

(5b) Large invasive indicator species = common reed (Phragmites australis), reed canary-grass (Phalaris arundinacea), sea club-rush (Bolboschoenus maritimus) or grey club-rush (Schoenoplectus tabernaemontani).

### Abbreviations used in matrix:

- BS – Baseline survey
- Mon. – Monitoring
- MPI – Meadows and Pastures Inventory
- NI – Negative indication
- Site – Natura 2000 site

- Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.
- Conservation objective to be monitored on all sites.
### 1650 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/IR/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extent</strong></td>
<td></td>
<td>ha</td>
<td>BS + mon. at all sites.</td>
<td>IR (M03 + G97)</td>
<td>IR (G97)</td>
<td>Every 24 years, + when exploited or new area added.</td>
</tr>
<tr>
<td>At &gt;90% of sites and in &gt;90% of the designated area, total nitrogen, total phosphorus and chlorophyll a should, as a minimum, meet the criteria for</td>
<td>Cover of floating filamentous algae should not increase or exceed 30% at any site.</td>
<td>Yes/no. P+Ntot =µmol/l, chlorophyll a=µg/l.</td>
<td>BS + mon. of indicator at all sites.</td>
<td>Aerial photo interpretation (M03).</td>
<td>Environmental monitoring handbook (NV 97), WFD handbook.</td>
<td>Every year at &gt;1 site per type area. All sites every 12 years. NI triggers monitoring of typical species.</td>
</tr>
<tr>
<td>The area of water not covered by helophytes (reeds etc.) should make up at least X% of the total area of the habitat within each WFD type area.</td>
<td>Cover of helophytes should not increase &gt;10X% at any site in each 6-year period.</td>
<td>Yes/no. Cover % + area (ha).</td>
<td>BS + mon. of indicator at all sites.</td>
<td>Aerial photo interpretation (A03).</td>
<td>Aerial photo interpretation (A03).</td>
<td>&gt;Every 6 years. NI triggers monitoring of typical species.</td>
</tr>
<tr>
<td>&gt;90% of sites and the designated area should meet site objectives regarding the Ecological Evaluation Index for macrophytes. At the biogeographical region level, the cover and depth distribution of vascular plants and algae should be maintained or increase.</td>
<td>Cover estimation + depth distribution along transects (NV in prep.).</td>
<td>BS at all + mon. at &gt;1 ref. site per type area, + sites with NI for filamentous algae or helophyte growth.</td>
<td>Cover estimation + depth distribution along transects (NV in prep.).</td>
<td>Survey of Breeding Coastal Birds (NV 98), supplemented.</td>
<td></td>
<td>Every year at reference sites. &gt;Every 6 years at sites with NI.</td>
</tr>
<tr>
<td>Populations of typical bird species should be maintained or increase in all type areas.</td>
<td>Number of breeding pairs of each species.</td>
<td>Mon. at sample of sites in each region.</td>
<td></td>
<td></td>
<td></td>
<td>&gt;50% every 6 years.</td>
</tr>
</tbody>
</table>

**Footnote**

(1) Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.

**Abbreviations used in matrix:**

- BS – Baseline survey
- IR – Infrared aerial photo interpretation
- Mon. – Monitoring
- NI – Negative indication, i.e. level defined for conservation objective or indicator not achieved
- Site – Natura 2000 site
- WFD – Water Framework Directive

**Objective to be monitored at sample of sites. If negative indication, to be monitored at all sites.**

**Conservation objective to be monitored at all sites.**
Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Min. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent and range of the habitats within the N2000 network should be maintained or increase.</td>
<td>Yes/no (ha). (1)</td>
<td>%-</td>
<td>BS + mon. on all sites.</td>
<td>As above.</td>
<td>As above.</td>
<td>50% every 6 years = regional changes.</td>
</tr>
<tr>
<td>95% of the designated area should meet site objectives of the extent of the different habitats, taking account of the variation arising from natural dune dynamics.</td>
<td>Yes/no (ha). (1)</td>
<td>%-</td>
<td>BS + mon. on all sites.</td>
<td>As above.</td>
<td>As above.</td>
<td>50% every 6 years = regional changes.</td>
</tr>
<tr>
<td>At least 70% of the area on all 90% of grazed sites should have well-grazed (2) vegetation at the end of each growing season (with the exception of 2120).</td>
<td>Yes/no (ha). (1)</td>
<td>%-</td>
<td>Mon. of habitats 2130, 2170 + 2190 on all grazed sites.</td>
<td>Pasture ruler in subjectively located plots (E96) random plots (B03).</td>
<td>Every 6 years + random plots every 12. NI triggers mon. of typical species.</td>
<td></td>
</tr>
<tr>
<td>In &gt;95% of the designated area, bare sand should make up &gt;55% and &lt;20% of the ground surface of habitats 2130 and 2140.</td>
<td>Yes/no (ha). (1)</td>
<td>%-</td>
<td>Mon. on all sites in conj. with BS in C region.</td>
<td>Tape measure along transects (F in prep.).</td>
<td>50% every 6 years.</td>
<td></td>
</tr>
<tr>
<td>Site objectives e.g. for Rosa rugosa and other exotic species, and for invasive vegetation, should be met. (2)</td>
<td>Yes/no (ha). (1)</td>
<td>%-</td>
<td>Mon. on all sites.</td>
<td>Plots along permanent transects (F in prep.).</td>
<td>50% every 6 years.</td>
<td></td>
</tr>
<tr>
<td>In humid habitats, the density of invasive woody vegetation should not exceed 10 stems &gt;1 m (2) cover.</td>
<td>Invasive vegetation: stems/ha.</td>
<td>Mon. on all sites.</td>
<td>100 m² circular plots in habitats where invasion most rapid (2170, 2190).</td>
<td>Nearest neighbour (A03:1), measurement in plots (B03).</td>
<td>Every 6 years. NI triggers mon. of typical species (if any).</td>
<td></td>
</tr>
<tr>
<td>Invasive woody vegetation &gt;1 m should not be present.</td>
<td>Yes/no (ha). (1)</td>
<td>%-</td>
<td>Mon. on all sites.</td>
<td>Plots along permanent transects (B03), Sea holly (O01).</td>
<td>50% every 6 years.</td>
<td></td>
</tr>
<tr>
<td>The abundance of typical species of vascular plants and bryophytes should be maintained or increase at the biogeographical region level, and at least 90% of the designated area should meet site objectives. (2)</td>
<td>Yes/no (ha). (2)</td>
<td>Frequency % of each species.</td>
<td>Mon. on all sites.</td>
<td>Plots along permanent transects (B03).</td>
<td>50% every 6 years.</td>
<td></td>
</tr>
<tr>
<td>The population of tawny pipit (Anthus campestris) on each site should increase or be maintained.</td>
<td>Number of pairs.</td>
<td>Mon. on all sites where species occurs.</td>
<td>Territory mapping (N78, two visits), existing species project.</td>
<td>As above.</td>
<td>Every 6 years.</td>
<td></td>
</tr>
</tbody>
</table>

Footnotes
(1) Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
(2) ‘Well-grazed’ means (A) that the average sward height is no more than 5X cm in habitats 2140-2170 and no more than 3X cm in habitat 2130, and (B) that no vegetation >1 m should exceed 10 stems >1 m
cover.
(3) ‘Trees and shrubs established in a well-managed landscape’ means trees and shrubs that served a function in earlier land use, and were shaped by that use, and those whose age, stem diameter and habitat clearly show that they could have become established in a well-managed landscape. The maximum cover of trees and shrubs will be determined by the habitat definition.
(4) A suggested minimum level is that >1 typical species should occur in >50% of the vegetated plots studied.

Abbreviations used in matrix:
B region – Boreal region
C region – Continental region
IR – Infrar red aerial photo interpretation
Mon. – Monitoring
BS – Baseline survey
NILS – Natura 2000 site

Objective to be monitored on sample sites. If negative indication, to be monitored on all sites.
Conservation objective to be monitored on all sites.

Typical species:
(Rosa rugosa), mountain pine (Pinus mugo), false oat (Molinia caerulea).

Invasive species:
Calamagrostis epigeios, Japanese rose (Rosa rugosa), mountain pine (Pinus mugo), and other introduced pines. These species should not occur within the habitats. Conservation plans should define a maximum cover of Japanese rose and other exotic species, and of invasive species. For example, it could be stated that exotic species and negative indicator species are to occur in <15% of the plots studied within each habitat.

Trees and shrubs established in a well-managed landscape’ means trees and shrubs that served a function in earlier land use, and were shaped by that use, and those whose age, stem diameter and habitat clearly show that they could have become established in a well-managed landscape. The maximum cover of trees and shrubs will be determined by the habitat definition.

A suggested minimum level is that >1 typical species should occur in >50% of the vegetated plots studied.

Conservation objectives:
The extent and range of the habitats within the N2000 network should be maintained or increase. The abundance of typical species of vascular plants and bryophytes should be maintained or increase at the biogeographical region level, and at least 90% of the designated area should meet site objectives. The population of tawny pipit (Anthus campestris) on each site should increase or be maintained.

Abbreviations used in matrix:
B region – Boreal region
C region – Continental region
IR – Infrar red aerial photo interpretation
Mon. – Monitoring
BS – Baseline survey
NILS – Natura 2000 site

Objective to be monitored on sample sites. If negative indication, to be monitored on all sites.
Conservation objective to be monitored on all sites.
### 3110 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator Measure</th>
<th>BS/Min.</th>
<th>BS methods</th>
<th>Min. methods</th>
<th>Min. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The extent and range of the habitat should be maintained or increase in all regions.</strong></td>
<td>Yes/no, Ha.</td>
<td>BS + mon. at all sites</td>
<td>IR (G97).</td>
<td>IR (G97).</td>
<td>Every 24 years, + when developed or new area added.</td>
</tr>
<tr>
<td><strong>&gt;90% of sites and the designated area should, as a minimum, meet the criteria for condition class 2 with respect to nutrients (total phosphorus), pH, absorbance and Secchi disk depth (according to N00).</strong></td>
<td>Yes/no (ha) (1)</td>
<td>BS at sites with nil for Secchi depth. Mon. at sample of sites, with 3130, + at all sites with Ni for helophytes + floating-leaved vegetation.</td>
<td>-</td>
<td>Environmental monitoring handbook (NV96). WFD handbook.</td>
<td>According to environmental monitoring handbook. Ni in WD habitat 3130 triggers mon. water quality at sites in WD.</td>
</tr>
<tr>
<td><strong>Lakes representing &gt;90% of sites and the designated area should have unimpeded migration routes in associated running waters.</strong></td>
<td>Secchi disk depth should be ≥5m</td>
<td>BS at all sites.</td>
<td>NV01, modified one measurement Aug.</td>
<td>-</td>
<td>Secchi depth &lt;5m triggers mon. water quality.</td>
</tr>
<tr>
<td><strong>Lakes representing &gt;90% of sites and the designated area should exhibit natural variations in water level.</strong></td>
<td>By 2030X, 90% of existing man-made barriers to migration from the lake to the nearest significant confluence or lake will be removed.</td>
<td>BS at all sites.</td>
<td>(N03a) + field checks (N03a) coordinated with WFD.</td>
<td>Field checks (N03a).</td>
<td>Monitoring following remedial action.</td>
</tr>
<tr>
<td><strong>The abundance of typical species of vascular plants should be maintained or increase at the biogeographical region level. &gt;90% of sites and the designated area should meet site objectives regarding cover and depth distribution.</strong></td>
<td>Yes/no (ha) (1), number of plants.</td>
<td>BS at all sites.</td>
<td>(N03a) + field checks (N03a) coordinated with WFD.</td>
<td>Field checks (N03a).</td>
<td>Monitoring following remedial action.</td>
</tr>
<tr>
<td><strong>The abundance of typical species of fish and noble crayfish should be maintained or increase at the biogeographical region level. &gt;90% of sites and the designated area should meet site objectives regarding population size and reproduction.</strong></td>
<td>Yes/no, + abundance and reproduction of each species.</td>
<td>Mon. &gt;5 sites/ WD with habitat 3130 (existing species) + all sites with Ni for helophytes + floating-leaved vegetation.</td>
<td>-</td>
<td>Sampling by multimesh gill-net (NV01;1) or electrofishing from boat (J03). Existing crayfish sampling (F57).</td>
<td>&gt;50% of lakes every 6 years. If Ni for structures, &gt;every 6 years.</td>
</tr>
<tr>
<td><strong>The abundance of typical species of breeding birds should be maintained or increase at the biogeographical region level.</strong></td>
<td>Yes/no. Number of breeding pairs of each species.</td>
<td>Mon. at sample of sites with bird fauna of conservation interest.</td>
<td>-</td>
<td>Breeding Bird Survey (S75) comb. with pair counts (NV98), + Species Gateway.</td>
<td>Every 6 years.</td>
</tr>
</tbody>
</table>

### Footnotes

1. Yes/no (ha) – in assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
2. If there is a natural water barrier associated with a man-made barrier, it should not be removed. This objective only applies to sites where this habitat is one of the primary reasons for designation. Variations in water level should meet the criteria for good ecological status, which are to be defined more precisely in 2004.
3. Total phosphorus: once a year for 3 years. To be measured in August. Absorbance and Secchi depth, monthly May-Oct for 1 year. pH >12 occasions in conjunction with other sampling, or once a quarter for 3 years.
4. Suggested minimum level: ≥2x of the typical species should occur on each transect.

### Abbreviations used in matrix:

- BS – Baseline survey
- IR – Infrared aerial photo interpretation
- Mon. – Monitoring
- NI – Negative indication
- WD – Water district
- WFD – Water Framework Directive

Objective to be monitored at sample of sites. If negative indication, to be monitored at all sites.

Conservation objective to be monitored at all sites.
### 3260 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Min. methods</th>
<th>Min. frequency</th>
<th>Footnotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent and range of the habitat should be maintained or increase in all regions.</td>
<td>Ha.</td>
<td>BS + mon. at all sites.</td>
<td>IR (G97).</td>
<td>IR (G97).</td>
<td>Every 24 yrs. + when developed/ new area exist.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In &gt;90% of stretches of rivers and streams within sites, the extent of the subgroup rivers and streams with aquatic mosses should be maintained or permitted to increase by a maximum of 200%.</td>
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</tr>
<tr>
<td>&gt;90% of stretches of rivers and streams within sites and &gt;80% outside sites should be identified as a management target (2).</td>
<td></td>
<td>BS at all sites, mon. in stratified sample of stretches with aquatic mosses.</td>
<td>IR (G97).</td>
<td>IR (A03).</td>
<td>&gt;50% every 6 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;90% of stretches of rivers and streams within sites should, as a minimum, meet the criteria for condition class 2X with respect to nutrients (total phosphorus) and pH (according to NV90).</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&gt;90% of stretches of rivers and streams within sites, the subgroup rivers and streams with floating-leaved plants should be maintained or increase in all biogeographical regions.</td>
<td></td>
<td>BS at all sites, mon. in stratified sample of stretches with aquatic mosses.</td>
<td>IR (G97).</td>
<td>IR (A03).</td>
<td>&gt;50% every 6 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In &gt;90% of stretches of rivers and streams within the subcatchments, the extent of the natural water barrier should be maintained.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>&gt;90% of stretches of rivers and streams within sites and &gt;80% outside sites should, as a minimum, meet the criteria for condition class 2X with respect to nutrients (total phosphorus) and pH (according to NV90).</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&gt;90% of stretches of rivers and streams within sites should, as a minimum, achieve condition class 2X with respect to benthic fauna (adjusted by comparator, NV90).</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In &gt;90% of stretches of rivers and streams within sites, the subgroup rivers and streams with floating-leaved plants should be maintained or increase in all biogeographical regions.</td>
<td></td>
<td>BS at all sites, mon. in stratified sample of stretches with aquatic mosses.</td>
<td>IR (G97).</td>
<td>IR (A03).</td>
<td>&gt;50% every 6 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In &gt;90% of stretches of rivers and streams within the N2000 network, aquatic organisms should have unobstructed migration routes.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The abundance of typical species of fish and bivalves should be maintained or increase at the level of the biogeographical region. &gt;90% of sites and the designated area should meet site objectives regarding population size and reproduction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The abundance of typical species of benthic fauna should be maintained or increase at the level of the biogeographical region.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Footnotes

1. Yes/no (ha). – In assessment at biogeographical region level, ‘ha’ means that entire area of a site (in hectares) is classified as unfavourable if objective is not met.

2. If there is a natural water barrier associated with a man-made barrier, it should not be removed. Variations in water level should meet the criteria for good ecological status, which are to be defined more precisely in 2004.

#### Abbreviations used in matrix:

- B reg. – Boreal region
- C reg. – Continental region
- DSFI – Danish stream fauna index
- IR – Infrared aerial photo interpretation
- NI – Negative indication
- Site – Natura 2000 site
- WD – Water district
- BS – Baseline survey
- WFD – Water Framework Directive
- NV00 – Norwegian Water Act
- NV96 – Norwegian Water Act 1996
- DSFI – Danish stream fauna index
- G97 – Government report 1997
- A03 – Administrative report 2003
- WFD – Water Framework Directive

#### Objective to be monitored at sample of sites. If negative indication, to be monitored at all sites.
<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase.</td>
<td>Ha.</td>
<td>BS + mon. on all sites.</td>
<td>MPI. Field visits (J02) to sites not covered.</td>
<td>Field checks (J02)</td>
<td>&gt;Every 12 years + when developed or area changes.</td>
<td></td>
</tr>
<tr>
<td>At least 95% of sites and the designated area should be well grazed at the end of each growing season. At least 95% of sites and the designated area should meet site objectives regarding the percentage of bare ground.</td>
<td>Yes/no (ha)</td>
<td>Sward height cm + % bare ground</td>
<td>BS + mon. on all sites.</td>
<td>Ruler in subjectively selected plots (E96) + random plots (B03).</td>
<td>&gt;Every 6 years + random plots every 12. NI triggers mon. of typical species.</td>
<td></td>
</tr>
<tr>
<td>At least 95% of sites and the designated area should meet site objectives regarding crown cover of trees and shrubs established in a well-managed landscape.</td>
<td>Yes/no (ha)</td>
<td>Cover %, and/or number of stems/ha, of invasive vegetation</td>
<td>BS + mon. on all sites.</td>
<td>Orthophotos (J02), + mon. method on sites not covered by MPI.</td>
<td>Subjective analysis &gt;every 6 years. Random plots: 50% of sites every 6 years. IR every 18 years.</td>
<td></td>
</tr>
<tr>
<td>Sites with a documented history of burning, and dominated by heather (Calluna vulgaris), should be burnt (the entire site) at least every 10 years.</td>
<td>Yes/no (ha)</td>
<td>BS + mon. on all sites.</td>
<td>Assessment of fire history in CP.</td>
<td>Mapping of burnt area.</td>
<td>After burning.</td>
<td></td>
</tr>
<tr>
<td>On &gt;90% of sites and in &gt;90% of the area where large and hollow deciduous trees have occurred in historical times, the number should be maintained or increase.</td>
<td>Yes/no (ha)</td>
<td>Number, species, dbh, condition class</td>
<td>BS on all sites + mon. throughout or in randomly selected part of each site.</td>
<td>UD1 on sites not covered by MPI, GPS, condition classification (L01:1).</td>
<td>33% of sites every 6 years or if NI obtained.</td>
<td></td>
</tr>
<tr>
<td>The abundance of typical species of vascular plants should be maintained or increase at the level of the biogeographical region. At least 90% of sites and the total area should meet site objectives regarding the abundance of typical species.</td>
<td>Yes/no (ha)</td>
<td>Frequency % of each species</td>
<td>Mon. on all sites.</td>
<td>Plots along permanent transects (B03) + (L01).</td>
<td>50% every 6 years. For Calluna heaths also 2 years after burning.</td>
<td></td>
</tr>
</tbody>
</table>

**Footnotes**

(1) Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.

(2) ‘Well grazed’ means that, at the end of the growing season, the average sward height on dry to mesic soil is no more than 3X cm.

(3a) ‘Trees and shrubs established in a well-managed landscape’ means trees and shrubs that served a function in earlier land use, and were shaped by that use, and those whose age, stem diameter and habit clearly show that they could have become established in a well-managed landscape. In earlier land use, areas of a pasture which, when well managed, were able to support grass were kept largely free of trees and shrubs. Shrubs and saplings were cleared at regular intervals to promote grass production. What trees and shrubs permitted in earlier land use had in common was that they grew, often in managed forms, in areas of the pasture that could not support grass, even when well managed, for example on or close to outcrops of rock, mounds of boulders etc.

(3b) ‘Invasive vegetation’ means trees, shrubs (>1.3 m) and ground vegetation that have been able to establish themselves as a result of grazing having become insufficiently intensive to contribute to ensuring the occurrence of plant and animal communities and species favoured by grazing.

(4) Positioning will be limited to <100 trees/site; beyond this limit, total number will be estimated. Within a reference plot on site, however, >50 trees will be positioned using the monitoring method.

(5) However, ≥1 typical species must be found in >50% of the plots studied.

**Abbreviations used in matrix:**

BS – Baseline survey  
IR – Infrared aerial photo interpretation  
MPI – Meadows and Pastures Inventory  
CP – Conservation plan  
Mon. – Monitoring  
NI – Negative indication  
Site – Natura 2000 site

Conservation objective to be monitored on all sites.
<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS method</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent of the habitat within N2000 sites should be maintained or increase in all regions. (2)</td>
<td>Ha.</td>
<td>BS on all sites + mon. on sample of sites.</td>
<td>A reg.: CORINE + comparisons with IR NILS. B reg.: Existing satellite image interpretation.</td>
<td>Sample: IR + NILS plots (A03, E03). Entire area: CORINE.</td>
<td>&gt;Every 5 years (NILS) + every 18 years CORINE + if encroachment by trees.</td>
<td></td>
</tr>
<tr>
<td>The average extent of the subgroup dry and extremely dry heaths, and of bare ground, should not increase by &gt;10X%, and their extent should not exceed X% in more than X% of 1x1 km squares.</td>
<td>Yes/no + % ground covered.</td>
<td>A reg.: BS on all sites. Mon. within NILS sample of sites. B reg.: &gt;10 sites.</td>
<td>Satellite images 1997 (N in press).</td>
<td>1x1km NILS squares. IR (A03+E03).</td>
<td>A reg.: &gt;Every 5 years (NILS) + if NI from satellite-based mon. in RRU. B reg.: 50% every 5 years.</td>
<td></td>
</tr>
<tr>
<td>In &gt;90% of sites and the designated area should meet site objectives regarding the subgroup dry and extremely dry heaths and bare ground.</td>
<td>Yes/no (ha) (1) + % ground covered.</td>
<td>A reg.: BS on all sites. Mon. within NILS sample of sites. B reg.: &gt;10 sites.</td>
<td>Satellite-based analysis + supplementary field analysis (N in press + F03).</td>
<td>If NI or &gt;every 18 years. NI triggers mon. of typical species on sites.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation should retain its structure and cover, and the extent of ground disturbance should be negligible. The cover of bare ground should be no more than 2%.</td>
<td>Yes/no, % change in cover/1x1 km square.</td>
<td>A reg.: Mon. within NILS sample of sites. If NI, mon. in RRU. B reg.: &gt;10 sites.</td>
<td>IR in 1x1 km squares, cover estimation (A03, E03).</td>
<td>A reg.: &gt;Every 5 years. NI in RRU triggers mon. of extent on sites. B reg.: 50% every 6 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The abundance of each of the typical bird species should be maintained or increase.</td>
<td>Change %, abundance of each species.</td>
<td>Mon. within NILS sample of sites.</td>
<td>Breeding Bird Survey (N78).</td>
<td>&gt;Every 5 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The frequency and cover of typical species of vascular plants should be maintained or increase at the level of the biogeographical region.</td>
<td>Change in cover + frequency % Site level: Yes/no (ha). (1)</td>
<td>A reg.: Mon. within NILS sample of sites. B reg.: &gt;10 sites.</td>
<td>NILS 0.28 m radius plots (E03). + search of 10 m radius plots.</td>
<td>A reg.: &gt;Every 5 years. B reg.: 50% every 6 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On extremely dry heaths, the cover and average biomass of typical lichen species should not decrease by &gt;10X% (+ minimum figure for cover).</td>
<td>Change % + kg/ha. Site level: Yes/no (ha). (1)</td>
<td>As above.</td>
<td>NILS 0.28 m radius plots (E03).</td>
<td>A reg.: &gt;Every 5 years. B reg.: 50% every 6 years.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.

(2) The tree layer should always have a cover of <10% and the shrub layer <20%.

Abbreviations used in matrix:
- A reg. – Alpine region
- B reg. – Boreal region
- BS – Baseline survey
- IR – Infrared aerial photo interpretation
- Mon. – Monitoring
- NI – Negative indication
- RRU – Regional reporting unit
- Site – Natura 2000 site

Footnotes:

- Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.
## 6270 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase.</td>
<td>Sward height cm.</td>
<td>Yes/no (ha). (1)</td>
<td>Mon. on all sites.</td>
<td>MPI + GPS, condition classification (L01:1),4(3)</td>
<td>GPS, condition classification (L01:2),4(3)</td>
<td>33% every 6 years.</td>
</tr>
<tr>
<td>The extent of grazed pasture land representing the habitat outside N2000 sites should be maintained or increase.</td>
<td></td>
<td>Ha.</td>
<td>BS + mon. on all sites.</td>
<td>MPI, Field visits (J02),2(4) + random plots (E96),2(4)</td>
<td>Swedish Board of Agriculture monitoring system.</td>
<td>Every 6 years (?).</td>
</tr>
<tr>
<td>At least 95% of sites and the designated area should be well grazed at the end of each growing season.</td>
<td>Cover %, and/or number of stems/shafts of invasive vegetation.</td>
<td>Yes/no (ha). (1)</td>
<td>Mon. on all sites.</td>
<td>MPI, Field visits (J02),2(4) + random plots (E96),2(4)</td>
<td>Swedish Board of Agriculture monitoring system.</td>
<td>Every 6 years (?).</td>
</tr>
<tr>
<td>At least 95% of sites and the designated area should meet site objectives regarding crown cover of trees and shrubs established in a well-managed landscape.</td>
<td></td>
<td>Yes/no (ha). (1)</td>
<td>Mon. on all sites.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On &gt;90% of sites and in &gt;90% of the area where pollard trees have occurred in historical times, the number of such trees should increase by 100% by 2010.</td>
<td>Frequency % of each species.</td>
<td>Yes/no (ha). (1)</td>
<td>Mon. on all sites.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On &gt;90% of sites and in &gt;90% of the area where large and hollow trees have occurred in historical times, the number should be maintained or increase.</td>
<td></td>
<td>Yes/no (ha). (1)</td>
<td>Mon. on all sites.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At the biogeographical region level, the abundance of typical species of vascular plants should be maintained or increase.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The abundance and range of typical species of butterflies and dung-feeding scarab beetles should be maintained or increase.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Footnotes

1. Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
2. ‘Well grazed’ means that, at the end of the growing season, the average sward height is no more than 3x cm on dry to meag soil, no more than 5x cm on moist soil and no more than 7x cm on wet soil.
3a. ‘Trees and shrubs established in a well-managed landscape’ means trees and shrubs that served a function in earlier land use, and were shaped by that use, and those whose age, stem diameter and habit clearly show that they could have become established in a well-managed landscape. In earlier land use, areas of a pasture which, when well managed, were able to support grass were kept largely free of trees and shrubs. Shrubs and saplings were cleared at regular intervals to promote grass production. What trees and shrubs permitted in earlier land use had in common was that they grew, often in managed forms, in areas of the pasture that could not support grass, even when well managed; for example on or close to outcrops of rock, mounds of boulders etc.
3b. Invasive vegetation means trees, shrubs (>1.3 m) and ground vegetation that have been able to establish themselves as a result of grazing having become insufficiently intensive to contribute to ensuring the occurrence of plant and animal communities and species favoured by grazing.
4. Positioning will be limited to <100 trees/site; beyond this limit, total number will be estimated. Within a reference plot on site, however, >50 trees will be positioned using the monitoring method.
5. In the case of sites where there is a risk of the estimated cover of trees and shrubs exceeding the habitat definition, new trees can be established in areas adjoining the site.
6. However, 21 typical species must be found in 95% of the plots studied.
7. Negative indicator species = cow parsley (Anthriscus sylvestris), stinging nettle (Urtica dioica), creeping thistle (Onopordum arvense), curled dock (Rumex crispus), bracken (Pteridium aquilinum) and flowering specimens of purple small-reed (Calamagrostis canescens), cockfoot (Dactylis glomerata) and wood millet (Milium effusum).

### Abbreviations used in matrix:

- **BS**: Baseline survey
- **MPI**: Meadows and Pastures Inventory
- **IR**: Infrared aerial photo interpretation
- **N**: Negative indication
- **MON**: Monitoring
- **NILS**: National Inventory of Landscape Structure in Sweden

- Objective to be monitored both within and outside designated sites.
- Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.
- Conservation objective to be monitored on all sites.
### 6530 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Min.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase.</td>
<td>Yes/no (ha).</td>
<td>Sward height</td>
<td>BS + mon. on all sites.</td>
<td>MPI, Field visits</td>
<td>Ruler (E96) + cover estimation (B03) in random plots (B03).</td>
<td>&gt;Every 6 years + when developed or area changes.</td>
</tr>
<tr>
<td>At least 95% of sites and the designated area should consist of well-managed (3a) grassland at the end of each growing season.</td>
<td>Negative indicator species (7) should have frequency of ≥5%.</td>
<td>Frequency %</td>
<td>Mon. on all sites.</td>
<td>-</td>
<td>-</td>
<td>Every 6 years.</td>
</tr>
<tr>
<td>At least 95% of sites and the designated area should meet site objectives regarding crown cover of trees and shrubs established in a well-managed landscape (3a).</td>
<td>Invasive woody vegetation should not be present. (3a)</td>
<td>Cover %, and/or number of stems/sha, of invasive vegetation.</td>
<td>BS + mon. on all sites.</td>
<td>Orthophotos (J02), GPS, condition classification (L01:1) (4)</td>
<td>IR (shrub layer: juniper + trees). Invasive vegetation - nearest neighbour (A03:1), subjectively selected + random plots.</td>
<td>Every 18 years. Invasive vegetation, subjective analysis: - every 6 years. Random plots: 50% of sites every 6 years.</td>
</tr>
<tr>
<td>On &gt;90% of sites and in &gt;90% of the area where pollard trees have occurred in historical times, the number of such trees should increase by 100% by 2010. (5)</td>
<td>Yes/no (ha). (3a) Number, species, dbh, condition class</td>
<td>BS on all sites + mon. throughout or in randomly selected part of each site.</td>
<td>(J02) on sites not covered by MPI.</td>
<td>GPS, condition classification (L01:1) (4)</td>
<td>33% of sites every 6 years, or if NI.</td>
<td></td>
</tr>
<tr>
<td>On &gt;90% of sites and in &gt;90% of the area where large and hollow trees have occurred in historical times, the number should be maintained or increase. (3a)</td>
<td>Yes/no (ha). (3a) Number, species, dbh, condition class</td>
<td>BS on all sites + mon. throughout or in randomly selected part of each site.</td>
<td>(J02) on sites not covered by MPI, GPS, condition classification (L01:1) (4)</td>
<td>GPS, condition classification (L01:1) (4)</td>
<td>33% of sites every 6 years, or if NI.</td>
<td></td>
</tr>
<tr>
<td>At the biogeographical region level, the abundance of typical species of vascular plants should be maintained or increase.</td>
<td>Frequency % of each species.</td>
<td>Mon. on all sites.</td>
<td>-</td>
<td>-</td>
<td>Plots along permanent transects (B03) + (L01:1).</td>
<td>Every 6 years.</td>
</tr>
<tr>
<td>The abundance and range of typical species of butterflies should be maintained or increase.</td>
<td>Frequency of each species.</td>
<td>Mon. on sample of sites.</td>
<td>-</td>
<td>Field methods (N03).</td>
<td>-</td>
<td>Every 6 years.</td>
</tr>
</tbody>
</table>

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**Footnotes**

1. Yes/no (ha) – In assessment at biogeographical region level, 'no' means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
2. 'Well managed' means that, at the end of the growing season, the average sward height is no more than 3 cm on dry to mesic soil and no more than 5 cm on moist soil, and that leaf litter never has a cover of >5%.
3a) 'Trees and shrubs established in a well-managed landscape' means trees and shrubs that served a function in earlier land use, and were shaped by that use, and whose stem diameter and habit clearly show that they could have become established in a well-managed landscape. In earlier land use, areas of a meadow which, when well managed, were able to support grass were kept largely free of trees and shrubs. Shrubs and saplings were cleared at regular intervals to promote grass production. What trees and shrubs permitted in earlier land use had in common was that they grew, often in managed forms, in areas of the meadow that could not support grass, even when well managed, for example on or close to outcrops of rock, mounds of boulders etc.
3b) 'Invasive vegetation' means trees, shrubs (>1.3 m) and ground vegetation that have been able to establish themselves as a result of mowing having become insufficiently intensive to contribute to ensuring the occurrence of plant and animal communities and species favoured by mowing.
4. Positioning will be limited to <100 trees/site; beyond this limit, total number will be estimated. Within a reference plot on site, however, >50 trees will be positioned using the monitoring method.
5. In the case of sites where there is a risk of the estimated cover of trees and shrubs exceeding the habitat definition, new trees can be established in areas adjoining the site. (5a) Within a radius of 4 m from the outer limit of tree crowns, there should be no invasive woody vegetation taller than 3X m.
6. However, ≥1 typical species must be found in >50% of the plots studied.

**Abbreviations used in matrix:**

- BS – Baseline survey
- Mon. – Monitoring
- BS/Mon. – Meadows and Pastures Inventory
- BS methods (N03) – Baseline survey, field methods (N03)
- Mon. methods (J02) – Monitoring, field methods (J02)

- Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.
- Conservation objective to be monitored on all sites.
- IR – Infrared aerial photo interpretation
### 7110 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Min. methods</th>
<th>Min. methods</th>
<th>Min. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent of the habitat within N2000 sites should be maintained or increase in all regional reporting units.</td>
<td>Yes/no</td>
<td>Ha.</td>
<td>BS all sites. Mon. all sites in C reg. + 20 sites in B reg. (incl. 10 in SW Sweden) + sites with ditches.</td>
<td>IR (A03), poss. satellite image interpretation.</td>
<td>Every 18 years + if NI for tree layer.</td>
</tr>
<tr>
<td>The extent of undrained active raised bogs outside N2000 sites should be maintained or increase.</td>
<td>Yes/no</td>
<td>Ha.</td>
<td>Environmental objective monitoring within + outside sites.</td>
<td>NLS + WI monitoring.</td>
<td>NLS: Every 5 years.</td>
</tr>
<tr>
<td>Vegetation should be naturally low-growing, which means that the maximum height of vascular plants on hummocks must not increase or decrease at the level of the biogeographical region.</td>
<td>Cover of tall negative indicator species should not exceed 1 m²/ha anywhere in the bog.</td>
<td>Yes/no, ha, %, average height cm, indicators yes/no.</td>
<td>Mon. all sites in C reg. + 20 sites in B reg. (incl. 10 in SW Sweden) + sites with ditches.</td>
<td>Circular plots (G03).</td>
<td>&gt;Every 6 years.</td>
</tr>
<tr>
<td>The stem density of trees &gt;0.5 m should remain unchanged or decrease at the level of the biogeographical region.</td>
<td>Yes/no, number of stems/ha.</td>
<td>Mon. all sites in C reg. + 20 sites in B reg. (incl. 10 in SW Sweden) + sites with ditches.</td>
<td>IR (A03).</td>
<td>&gt;Every 6 years.</td>
<td></td>
</tr>
<tr>
<td>The cover of the tree layer should remain unchanged or decrease at the level of the biogeographical region.</td>
<td>Yes/no, ha.</td>
<td>Mon. all sites in C reg. + 20 sites in B reg. (incl. 10 in SW Sweden) + sites with ditches.</td>
<td>IR (A03).</td>
<td>&gt;Every 6 years.</td>
<td></td>
</tr>
<tr>
<td>The extent of hollows and carpet vegetation should be maintained or increase, and they should cover &gt;X% of the total area in all reporting units.</td>
<td>Yes/no</td>
<td>Ha.</td>
<td>Ditches which lower the water table should not be present on the site.</td>
<td>BS + mon. of sites with ditches.</td>
<td>IR (A03) + fieldwork (E03).</td>
</tr>
<tr>
<td>&gt;90% of sites and the designated area should exhibit undisturbed hydrology.</td>
<td>Yes/no, ha.</td>
<td>BS + mon. of sites with ditches.</td>
<td>Topographical map.</td>
<td>Field inspection + photographic documentation + E03.</td>
<td>Following restoration measures.</td>
</tr>
<tr>
<td>Objectives at the biogeographical region level regarding structure and functions should be met in the habitat outside designated sites.</td>
<td>Yes/no.</td>
<td>Mon. of habitat within existing NLS network.</td>
<td>IR (A03) + fieldwork (E03).</td>
<td>Every 6 years.</td>
<td></td>
</tr>
<tr>
<td>At the biogeographical region level, the abundance of typical species of vascular plants and bryophytes on sites should be maintained or increase.</td>
<td>Yes/no, frequency % of each species.</td>
<td>Mon. all sites in C reg. + 20 sites in B reg. (incl. 10 in SW Sweden) + sites with ditches.</td>
<td>0.28 m radius plots (E03) if NLS network supplemented, modified.</td>
<td>&gt;Every 6 years.</td>
<td></td>
</tr>
<tr>
<td>The abundance of typical species of vascular plants and bryophytes should be maintained or increase in the habitat outside designated sites.</td>
<td>Yes/no, frequency % of each species.</td>
<td>Mon. in habitat within NLS squares.</td>
<td>0.28 m radius plots (E03).</td>
<td>Every 5 years.</td>
<td></td>
</tr>
<tr>
<td>The abundance of typical bird species should be maintained or increase within and outside sites, and &gt;90% of sites studied should meet site objectives for these species.</td>
<td>Number of breeding pairs + frequency (%) of each species.</td>
<td>Mon. on sites within NLS + additional sites with fauna interest/SPAs.</td>
<td>Breeding Bird Survey (N78) + point count transect survey (B02).</td>
<td>Every 6 years.</td>
<td></td>
</tr>
</tbody>
</table>

**Footnotes**

1. Tree layer cover should always be <30%.
2. Stem density should always be <3000X/ha on any site.

**Abbreviations used in matrix:**

- BS – Baseline survey
- C reg. – Continental biogeographical region
- FCS – Favourable conservation status
- IR – Infrared aerial photo interpretation
- Mon. – Monitoring
- NI – Negative indication
- NLS – Natura 2000 site
- WI – Wetlands Inventory

**Objective to be monitored both within and outside designated sites.**

**Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.**
### 7230 Conservation objectives, baseline survey and monitoring at biogeographical region level in Continental region, in S and C Swedish areas of Boreal region, and on managed sites

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent of the habitat and its subgroups within N2000 sites should be maintained or increase.</td>
<td>Ha of each subgroup</td>
<td>No/Yes (ha)</td>
<td>BS + mon. all sites</td>
<td>Existing WI supplemented if necessary with IR (N in prep.) + field GPS (N83).</td>
<td>Field WI + GPS (N83).</td>
<td>Every 18 years or if NI for stem density.</td>
</tr>
<tr>
<td>The extent of open and tree-covered alkaline fens without drainage ditches outside N2000 sites should be maintained or increase.</td>
<td>Ha of each subgroup</td>
<td>Yes/no (ha)</td>
<td>Environ. objective monitoring on outside sites</td>
<td>Existing WI (N83).</td>
<td>IR (NILS/N83).</td>
<td>?</td>
</tr>
<tr>
<td>&gt;90% of sites and the total area hosting the subgroup open alkaline fens should meet site objectives regarding hydromorphological structures.</td>
<td>Dense stands (&gt;50% cover) of negative indicator species (1) &gt;100X m²/ha should not be present.</td>
<td>Yes/no (ha)</td>
<td>BS + mon. all sites</td>
<td>IR (N in prep. + A03).</td>
<td>IR (A03) + semi-permanent plots stratified along transects (S03).</td>
<td>Managed + drained sites: &gt;50% every 6 years. Unmanaged sites: &gt;33% every 6X years.</td>
</tr>
<tr>
<td>Sites that are actively managed should be well managed at the end of the growing season, which means that at least 95% of sites and the designated area should meet site objectives defining ‘well managed’.</td>
<td>Dense stands (&gt;50% cover) of negative indicator species (1) &gt;20X m²/ha should not be present.</td>
<td>Yes/no (ha)</td>
<td>BS + mon. all sites</td>
<td>Helophytes: IR (A03).</td>
<td>Indicators: qualitative search. On sites with NI: plots (S03).</td>
<td>Indicators: &gt; every 6 years. NI triggers mon. of negative + typical species in plots.</td>
</tr>
<tr>
<td>At least 90% of sites should meet site objectives regarding the cover of trees and shrubs.</td>
<td>Invasive woody vegetation should not be present.</td>
<td>Yes/no (ha)</td>
<td>BS all sites. Mon. 30 sites in B reg. incl. NILS plots, + all in C reg.</td>
<td>Analysis of management history + current management regime.</td>
<td>IR (A03) + shrub layer field – nearest neighbour (A03:1) + photography.</td>
<td>&gt;Every 6 years. NI triggers mon. of negative + typical species in plots.</td>
</tr>
<tr>
<td>At least 95% of the designated area should exhibit undisturbed hydrology.</td>
<td>After 2030 ditches which lower the water table should not be present on X% of sites.</td>
<td>Yes/no (ha)</td>
<td>BS + mon. of sites with ditches.</td>
<td>IR/Topographical maps.</td>
<td>Field inspection of dammed/ blocked ditches.</td>
<td>Following restoration.</td>
</tr>
</tbody>
</table>

**Footnotes (Continental region, S and C Swedish areas of Boreal region, and managed sites)**

1. Yes/no (ha) – In assessment at biogeographical region level, “no” means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
2. ‘Well managed’ means as a rule that the average sward height is no more than 5X cm on moist soil and no more than 7X cm on wet soil.
3. Managed alkaline fens should as a rule be free from invasive woody vegetation. In open alkaline fens, tree and shrub layer cover should always be >30%.
4. Negative indicator species = purple moss-grass (Molinia caerulea), common reed (Phragmites australis) or meadowsweet (Filipendula ulmaria).
5. Objectives should be defined so as to ensure that hummock cover and sward height do not increase, and that the cover of lawn and carpet vegetation is maintained or increases.
## 7230 Conservation objectives, baseline survey and monitoring for unmanaged sites in Boreal region – N Sweden proper, and Alpine region

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent of the habitat and its subgroups within N2000 sites should be maintained or increase.</td>
<td>The extent of alkaline fen and its subgroups should be maintained in NILS plots, and the extent calculated for the Alpine region should not diverge &gt;10% from NILS values.</td>
<td>Ha of each subgroup</td>
<td>BS + mon. on sites covered by NILS</td>
<td>B reg.: Existing WI. If necessary IR (NILS/N03) + field GPS (N83).</td>
<td>A reg.: veg. + geological maps + comparisons with NILS.</td>
<td>NILS every 5 years. All sites every 24 years. If NI for indicator, BS in region. If NI for objectives, mon. in region.</td>
</tr>
<tr>
<td>The extent of open and tree-covered alkaline fens without drainage ditches outside N2000 sites should be maintained or increase.</td>
<td>The extent of alkaline fen and its subgroups should be maintained in NILS plots, and the extent calculated for the Alpine region should not diverge &gt;10% from NILS values.</td>
<td>Ha of each subgroup</td>
<td>Env. objective monitoring on + outside sites</td>
<td>Existing WI (N83).</td>
<td>NILS 0.28 m radius plots.</td>
<td>Every 5 years. NI triggers mon. at site level.</td>
</tr>
<tr>
<td>The cover of trees and shrubs should remain stable or decrease in the subgroup open alkaline fens.</td>
<td>The cover of hummocks must not increase.</td>
<td>Cover % + shrub stem density/ha.</td>
<td>Mon. in sample of habitat within and outside sites – NILS supplemented + all sites with ditches.</td>
<td>IR (A03) + permanent NILS plots (E03).</td>
<td>IR + field checks in permanent NILS plots (A03+E03). Site-level mon. (S03).</td>
<td>Every 5 years. NI triggers mon. at site level.</td>
</tr>
<tr>
<td>At least 95% of the designated area should exhibit undisturbed hydrology.</td>
<td>At least 95% of the designated area should exhibit undisturbed hydrology.</td>
<td>Yes/no (ha) (1)</td>
<td>Mon. in sample of habitat within and outside sites – NILS supplemented + all sites with ditches.</td>
<td>IR + field checks in permanent NILS plots (A03+E03). Site-level mon. (S03).</td>
<td>Field inspection of dammed/blocked ditches.</td>
<td>Following restoration measures. Presence of ditches triggers site-level mon.</td>
</tr>
</tbody>
</table>

### Footnotes (unmanaged sites in Boreal region – N Sweden proper, and Alpine region)

1. Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.

2. In the subgroup open alkaline fens, tree layer cover should be <30%.

### Abbreviations used in matrix

- A reg. – Alpine region
- B reg. – Boreal region
- BS – Baseline survey
- C reg. – Continental region
- IR – Infrared aerial photo interpretation
- Mon. – Monitoring
- NI – Negative indication
- Site – Natura 2000 site

- Objective to be monitored both within and outside designated sites.
- Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.
- Conservation objective to be monitored on all sites.
### 7310 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent of the habitat within N2000 sites should be maintained or increase.</td>
<td>Ha of each subgroup</td>
<td>BS + mon. on sample of sites.</td>
<td>Existing WI. If necessary IR (A03) + field GPS (N83). A reg.: existing veg. maps.</td>
<td>IR (A03).</td>
<td>NIFS: Every 5 years. If NI for extent and tree layer, mon. of extent on all sites.</td>
<td></td>
</tr>
<tr>
<td>The extent of the habitat outside N2000 sites should be maintained or increase.</td>
<td>Ha of each subgroup</td>
<td>NILS within and outside sites.</td>
<td>Existing WI (N83).</td>
<td>IR (A03).</td>
<td>Every 5 years.</td>
<td></td>
</tr>
<tr>
<td>The cover of the hydromorphological structures, mud-bottom flarks, floating carpets, flark pools and other pools within the habitat should be maintained or increase.</td>
<td>%</td>
<td>Mon. in sample of habitat within and outside sites (NILS). BS + mon. on sites with ditches.</td>
<td>IR (A03).</td>
<td>IR (A03) + permanent NILS plots (E03).</td>
<td>NIFS: &gt;Every 5 years.</td>
<td></td>
</tr>
<tr>
<td>The cover and average height of the tree and shrub layers should remain stable or decrease.(^\text{(2)})</td>
<td>Ditches which lower the water table and worn tracks deeper than 0.3 m should not be present on the site.</td>
<td>Mon. + BS of sites with ditches. Mon. of ground disturbance within NILS.</td>
<td>Existing WI, supplemented if necessary by IR/vegetation maps.</td>
<td>Line transect survey (E03). Field inspection of dammed/ blocked ditches.</td>
<td>Following restoration. Presence of ditches triggers mon. of veg. structure on site.</td>
<td></td>
</tr>
<tr>
<td>&gt;90% of sites and the designated area should exhibit undisturbed hydrology.</td>
<td>% of plots in which each species found + cover %.</td>
<td>Mon. in sample of habitat within and outside sites (NILS). BS + mon. on sites with Ni.</td>
<td>NIFS 0.28 m radius plots (E03).</td>
<td>-</td>
<td>&gt;Every 5 years.</td>
<td></td>
</tr>
<tr>
<td>At the biogeographical region level, the abundance of typical species of bryophytes and vascular plants should be maintained or increase for all ecological subgroups.</td>
<td>Number of pairs + frequency (%) of each species.</td>
<td>Mon. on sites within NIFS, supplemented - sites with fauna interest/SPAs.</td>
<td>Breeding Bird Survey (N78) + point count line transect survey (B02).</td>
<td>-</td>
<td>&gt;Every 6 years.</td>
<td></td>
</tr>
</tbody>
</table>

**Footnotes**

1. Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
2. Tree layer cover should be <30%.

**Abbreviations used in matrix**

- A reg. – Alpine region
- B reg. – Boreal region
- C reg. – Continental region
- IR – Infrared aerial photo interpretation
- BS – Baseline survey
- Mon. – Monitoring
- NIFS – Negative indication
- Site – Natura 2000 site

- Objective to be monitored both within and outside designated sites.
- Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.
### 8110 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extent</strong></td>
<td>The extent of the habitat within N2000 sites should be maintained or increase.</td>
<td>BS on all sites. B reg.: Mon. on all sites. A reg.: Mon. on random sample of sites in NILS 5x5 km squares.</td>
<td>B reg.: IR (M03). A reg.: Mountain veg. maps + altitude database and comparisons with IR (A03).</td>
<td>IR (A03/M03).</td>
<td>A reg.: NILS sample every 5 years. B reg.: &gt;Every 18 years.</td>
</tr>
<tr>
<td><strong>Proportion of the ground surface lacking vegetation</strong></td>
<td>Yes/no (ha).</td>
<td>%</td>
<td>A reg.: Mon. on sample of sites – NILS.</td>
<td>IR + field checks in permanent NILS plots (A03+E03).</td>
<td>&gt;Every 5 years.</td>
</tr>
<tr>
<td><strong>Cover of trees and shrubs</strong></td>
<td>Yes/no (ha).</td>
<td>% of cover</td>
<td>A reg.: Mon. on sample of sites – NILS. B reg.: BS + mon. on all sites.</td>
<td>IR + field checks in permanent NILS plots (A03+E03).</td>
<td>IR + field checks in permanent NILS plots (A03+E03).</td>
</tr>
<tr>
<td><strong>Proportion of trees made up of the deciduous species goat willow (Salix caprea), rowan (Sorbus aucuparia) and aspen (Populus tremula).</strong></td>
<td>Yes/no (ha).</td>
<td>% of cover</td>
<td>BS + mon. on all sites in B reg.</td>
<td>IR (A03).</td>
<td>IR (A03).</td>
</tr>
<tr>
<td><strong>Typical species</strong></td>
<td>At the level of the biogeographical region, the frequency and cover of typical species of lichens and vascular plants should be maintained or increase. At least 90% of sites and the total area should meet site objectives regarding the abundance of typical species.</td>
<td>A reg.: BS + mon. on sites, but Annex species &gt;1X/county + NILS sites lichens. B reg.: BS + mon. on sample of sites (&gt;1 per county).</td>
<td>Qualitative search/flora guardian methods (L01)/ permanent line transects.</td>
<td>Qualitative search/flora guardian methods (L01)/ permanent line transects.</td>
<td>Every 12 years. In NILS plots &gt;every 5 years.</td>
</tr>
</tbody>
</table>

**Footnote**

(1) Yes/no (ha) – In assessment at biogeographical region level, “no” means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.

**Abbreviations used in matrix:**

- A reg. – Alpine region
- B reg. – Boreal region
- BS – Baseline survey
- IR – Infrared aerial photo interpretation
- Mon. – Monitoring
- NI – Negative indication
- Site – Natura 2000 site

Objectives to be monitored on sample of sites. If negative indication, to be monitored on all sites.

Conservation objective to be monitored on all sites.
### 9010 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase.</td>
<td>Ha, m³ wood, number of trees &gt;X cm dbh</td>
<td>BS + mon. on all sites.</td>
<td>IR (Metria 2003)</td>
<td>Site level: Field methods (S03) or IR (Metria 2003).</td>
<td>Every 24 years + when developed or area changes.</td>
<td></td>
</tr>
<tr>
<td>The extent and range of deciduous-rich natural coniferous forest, young deciduous stands developed after fire and other deciduous-dominated taiga types within protected areas should be maintained or increase (2)</td>
<td>Ha, m³ wood, number of trees &gt;X cm dbh</td>
<td>BS + mon. in all protected areas and outside N2000 sites.</td>
<td>IR (Metria 2003)</td>
<td>Site level: Field methods (S03) or IR (Metria 2003).</td>
<td>NFI every 5 years, IR every 24 years.</td>
<td></td>
</tr>
<tr>
<td>The extent and range of pine forests (with Scots pine accounting for &gt;70% of the standing volume) within the network should be maintained or increase.</td>
<td>Ha, m³ wood, number of trees &gt;X cm dbh</td>
<td>BS + mon. on all sites.</td>
<td>IR (Metria 2003)</td>
<td>Site level: Field methods (S03).</td>
<td>&gt;Every 6 years. Burring/other management triggers site-level mon. acc. to CP (approx. every 18 years).</td>
<td></td>
</tr>
<tr>
<td>&gt;90% of sites and the designated area should meet site objectives regarding prescribed burning and other forms of management.</td>
<td>Yes/no (ha) (1)</td>
<td>Mon. according to site conservation plan.</td>
<td>-</td>
<td>Site level: Field methods (S03) or IR (Metria 2003).</td>
<td>Every 12 years.</td>
<td></td>
</tr>
<tr>
<td>Prescribed burning for nature conservation purposes or natural fires should occur in the landscape, within and outside N2000 sites, in at least X% of the forest area over a 12-year period.</td>
<td>Ha, m³ wood, number of trees &gt;X cm dbh</td>
<td>BS + mon. on all sites and in coniferous forest outside sites.</td>
<td>IR + regional recording system for fires.</td>
<td>Site level: Field methods (S03).</td>
<td>Every 5 years (NFI).</td>
<td></td>
</tr>
<tr>
<td>On &gt;90% of sites and in &gt;90% of the designated area, the ratio of dead to living hardwood should be &gt;1.5X.</td>
<td>Yes/no (ha) (1)</td>
<td>%</td>
<td>BS + mon. on all sites.</td>
<td>IR (Metria 2003) + if indication of UFCS, field visits (S03).</td>
<td>Every 5 years (NFI).</td>
<td></td>
</tr>
<tr>
<td>90% of sites and the designated area should have a tree species composition comprising native species, and a stable or increasing proportion of the deciduous species goat willow, rowan and aspen. The proportion of deciduous trees in spruce forests should be &gt;X%.</td>
<td>Non-native tree species (lodgepole pine Pinus contorta) should not be present on any site.</td>
<td>Yes/no (ha) (1)</td>
<td>%</td>
<td>IR (M03) + field visits (S03).</td>
<td>Every 5 years (NFI).</td>
<td></td>
</tr>
<tr>
<td>On &gt;90% of sites and in &gt;90% of the designated area, wet forests should exhibit unthreatened hydrology.</td>
<td>By 2030, all ditches which lower the water table will be blocked.</td>
<td>Number of stems/ha.</td>
<td>Mon. on sites with fires.</td>
<td>IR/Topographical maps (M03).</td>
<td>Every 5 years (NFI) + following restoration measures.</td>
<td></td>
</tr>
<tr>
<td>The frequency and cover of typical lichen species sensitive to air pollution should be maintained or increasing on at least 10% of sites.</td>
<td>Frequency % cover %</td>
<td>Mon. on sites with fires.</td>
<td>Site level: Field inspection of blockaded ditches + NFI (S03:1).</td>
<td>-</td>
<td>Every 5 years (NFI) + following restoration measures.</td>
<td></td>
</tr>
<tr>
<td>The frequency and cover of typical and Annex species of vascular plants in the habitat should be maintained or increase.</td>
<td>Frequency % cover % + for Annex species: number</td>
<td>Mon. on sites with fires.</td>
<td>Site level: Field inspection of blockaded ditches + NFI (S03:1).</td>
<td>-</td>
<td>Every 5 years (NFI) + following restoration measures.</td>
<td></td>
</tr>
<tr>
<td>There should be no decrease in the number of woodpecker signs recorded in the NFI.</td>
<td>Number of pairs/ha of each species</td>
<td>Mon. of sample (NILS) + additional surveys SPAs (+ in counties with NI woodpecker signs).</td>
<td>Site level: Field inspection of blockaded ditches + NFI (S03:1).</td>
<td>-</td>
<td>Every 5 years (NFI) + following restoration measures.</td>
<td></td>
</tr>
</tbody>
</table>

### Footnotes

1. Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
2. Deciduous-rich forest: deciduous trees make up at least 30%–50% of standing volume. Deciduous-dominated forest: deciduous trees make up at least 50% of standing volume.
3. Prescribed burning for nature conservation purposes means that at least X m³ of wood and at least X trees >X cm dbh are retained per ha.

### Abbreviations used in matrix:
- BS – Baseline survey
- IR – Infrared aerial photo interpretation
- NFI – Swedish National Forest Inventory
- NILS – National Inventory of Landscapes in Sweden
- CP – Conservation plan
- Mon. – Monitoring
- NI – Negative indication
- N2000 – Natura 2000 site
- UFCS – Unfavourable conservation status

### Conservation objective
- Objective to be monitored both within and outside designated sites.
- Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.

### Additional Notes
- County registers for fires. Every 18 years after fire.
- Field inspection of blocked ditches + NFI (S03:1).
### Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>Mon. methods</th>
<th>BS methods</th>
<th>BS/Mon. BS methods</th>
<th>Mon. frequency</th>
<th>Mon. method</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent and range of the habitat within the N2000 network should be maintained or increase.</td>
<td>Extent</td>
<td>Ha.</td>
<td>IR (Metria 2003)</td>
<td>BS + mon. on all sites.</td>
<td>Field visits (S03) to areas identified in CP.</td>
<td>Nearly 24 years + when developed or area changes.</td>
<td></td>
</tr>
<tr>
<td>At the biogeographical region level, the proportion of broadleaved deciduous trees and species represented by large trees should be maintained or increase. On &gt;90% of sites, deciduous species should form &gt;2 layers, the height of the lower layer being &gt;1/2 that of the upper one. In all layers, the proportion of deciduous trees should be &gt;50%.</td>
<td>At C reg. Norway spruce should not be present. In B reg. site objectives relating to spruce and sycamore in the different layers should be met.</td>
<td>Yes/no (ha),% of standing volume/layer + % large trees</td>
<td>IR (M03)</td>
<td>BS + mon. all sites.</td>
<td>Field searches where spruce regeneration can be suspected, + subjectively selected plots: relascope + calliper (S03).</td>
<td>&gt;50% every 6 years. NI triggers mon. of typical species. If nec., mon. of random plots.</td>
<td></td>
</tr>
<tr>
<td>In the area of south-west Sweden particularly affected by pollution, the abundance and range of typical species of vascular plants should be maintained or increase.</td>
<td>In the area of south-west Sweden particularly affected by pollution, the abundance and range of typical species of vascular plants should be maintained or increase.</td>
<td>Yes/no (ha),% of standing volume/layer + % large trees</td>
<td>IR (M03)</td>
<td>Subjectively selected plots: relascope (S03).</td>
<td>Subjectively selected plots (S03)</td>
<td>6 every 6 years.</td>
<td></td>
</tr>
</tbody>
</table>

### Structure and composition

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>Mon. methods</th>
<th>BS methods</th>
<th>BS/Mon. BS methods</th>
<th>Mon. frequency</th>
<th>Mon. method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In C reg. Norway spruce should not be present. In B reg. site objectives relating to spruce and sycamore in the different layers should be met.</td>
<td>Yes/no (ha),% of standing volume/layer + % large trees</td>
<td>BS + mon. all sites.</td>
<td>IR (M03), + field searches where spruce regeneration can be suspected, + subjectively selected plots: relascope (S03).</td>
<td>Subjectively selected plots (S03)</td>
<td>&gt;50% every 6 years.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within the designated area, the ratio of dead to living wood should increase or be maintained. At the site level, the ratio of dead to living wood should be &gt;1:5X.</td>
<td>Yes/no (ha),% of standing volume.</td>
<td>BS + mon. all sites.</td>
<td>KHI (S02)</td>
<td>Subjectively selected plots: relascope (S03).</td>
<td>&gt;50% every 6 years. If NI, mon. of typical species.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The abundance of typical species of bryophytes, lichens and wood-inhabiting fungi should be maintained or increase. At least 90% of sites and the total area should meet site objectives regarding the abundance of typical species.</td>
<td>Yes/no (ha),% of standing volume.</td>
<td>BS + mon. all sites.</td>
<td>KHI (S02), + sample tree survey using mon. method.</td>
<td>Field method permanent sample trees, cover estimation (NV99a).</td>
<td>33% every 6 years. In areas with UFCS, every 6 years.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In the area of south-west Sweden particularly affected by pollution, the abundance and range of typical species of vascular plants should be maintained or increase.</td>
<td>Yes/no (ha),% of standing volume.</td>
<td>BS + mon. all sites.</td>
<td>KHI (S02).</td>
<td>Field method permanent plots (E03).</td>
<td>Every 6 years.</td>
<td></td>
</tr>
</tbody>
</table>

### Footnotes

1. Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.
2. Typical species

### Abbreviations used in matrix

- B reg. – Boreal region
- C reg. – Continental region
- BS – Baseline survey
- CP – Conservation plan
- IR – Infrared aerial photo interpretation
- KHI – Key habitat inventory
- Mon. – Monitoring
- NFI – Swedish National Forest Inventory
- NI – Negative indication
- NILS – National Inventory of Landscapes in Sweden
- Site – Natura 2000 site
- UFCS – Unfavourable conservation status
### 9040 Conservation objectives, baseline survey and monitoring at biogeographical region level

<table>
<thead>
<tr>
<th>Conservation objective</th>
<th>Indicator</th>
<th>Measure</th>
<th>BS/Mon.</th>
<th>BS methods</th>
<th>Mon. methods</th>
<th>Mon. Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extent</strong></td>
<td><strong>The extent of the habitat within N2000 sites should be maintained or increase in all regions.</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Extent</td>
<td>Ha.</td>
<td>BS + mon. NILS on all sites.</td>
<td>Mon. sites: IR + NILS plots (A03, E03). Entire area: CORINE.</td>
<td>&gt;Every 5 years (NILS), B reg.: every 18 years. Nil for % encroachment by conifers.</td>
</tr>
<tr>
<td>Lodgepole pine (Pinus contorta) should not be present and Norway spruce or Scots pine should make up &lt;30% of the standing volume.</td>
<td>Lodgepole pine should increase or be maintained and should be &gt;1.5X.</td>
<td>Lodgepole pine (Pinus contorta)</td>
<td>m&lt;sup&gt;3&lt;/sup&gt;/ha of each species</td>
<td>BS + mon. NILS on all sites.</td>
<td>NILS 0.28 m radius plots (E03).</td>
<td>&gt;Every 5 years. B reg.: every 6 years.</td>
</tr>
<tr>
<td><strong>Species composition</strong></td>
<td><strong>The habitat should exhibit a species composition comprising native species of trees.</strong> The standing volume of aspen, rowan and goat willow must not decrease by &gt;10X% and the standing volume of mountain birch must not increase or decrease by &gt;20X%.</td>
<td>Species composition</td>
<td>A reg.: Mon. within NILS sample of sites. B reg.: &gt;10 sites.</td>
<td>A reg.: &gt;Every 5 years (NILS). B reg.: 50% every 6 years. Nil for % conifers triggers mon. of extent in RRU.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Standing volume</strong></td>
<td></td>
<td>Standing volume</td>
<td></td>
<td>A reg.: &gt;Every 5 years (NILS). B reg.: 50% every 6 years. Nil for % conifers triggers mon. of extent in RRU.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dead to living wood</strong></td>
<td></td>
<td>Dead to living wood</td>
<td></td>
<td>A reg.: &gt;Every 5 years. B reg.: 50% every 6 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetation should retain its structure and cover, and the extent of ground disturbance should be no more than 1X%.</td>
<td>Vegetation should retain its structure and cover, and the extent of ground disturbance should be no more than 1X%.</td>
<td>Vegetation</td>
<td>A reg.: Mon. within NILS sample of sites.</td>
<td>NILS 0.28 m radius plots (E03).</td>
<td>&gt;Every 5 years. Nil in RRU triggers mon. of typical species on sites.</td>
<td></td>
</tr>
<tr>
<td><strong>Structure and functions</strong></td>
<td></td>
<td>Structure and functions</td>
<td></td>
<td>Breeding Bird Survey (N78).</td>
<td>&gt;Every 5 years.</td>
<td></td>
</tr>
<tr>
<td>In lichen-type mountain birch forests, the cover and average biomass of typical lichen species should not decrease by &gt;10X% (+ minimum figure for cover).</td>
<td>In lichen-type mountain birch forests, the cover and average biomass of typical lichen species should not decrease by &gt;10X% (+ minimum figure for cover).</td>
<td>Lichen</td>
<td>Change % + kg/ha. Site level: Yes/no (ha)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>A reg.: &gt;Every 5 years (NILS). B reg.: every 6 years.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Footnotes**

<sup>1</sup> Yes/no (ha) – In assessment at biogeographical region level, ‘no’ means that entire area of a site (in hectares) is classed as unfavourable if objective is not met.

<sup>2</sup> Tree layer cover should always be >10%, with birch, aspen, goat willow or rowan accounting for >70X%.

**Abbreviations used in matrix:**

- A reg. – Alpine region
- B reg. – Boreal region
- BS – Baseline survey
- IR – Infrared aerial photo interpretation
- Mon. – Monitoring
- NI – Negative indication
- RRU – Regional reporting unit
- Site – Natura 2000 site

Objective to be monitored on sample of sites. If negative indication, to be monitored on all sites.

Conservation objective to be monitored on all sites.