

Nordic alvar and precambrian calcareous flatrocks* (6280) – Estonia



Conservation status	E28: Not assessed EE: U1 (-)
Protection status	HD: Annex I (priority habitat)
Area (2007-12)	EU: 296 km ² EE: 100 km ²
MS with genuine improvement	Sub-reporting level improvement in EE
Other MS	SE, FI

Photo © Annely Esko

Summary: The Nordic alvar and Precambrian calcareous flatrocks habitat is found around the Baltic Sea. The priority habitat has an unfavourable-bad status with declining trend in the boreal biogeographic region, primarily because of abandonment of traditional low intensity grazing. Estonia, where the alvar is considered to be a different subtype, also reported the trend in status as declining in the 2007 to 2012 period, although most of the habitat is protected in Natura 2000 sites. In 2012 less than 30% of the 9,800 ha of Estonian alvar grasslands were being managed appropriately, but since 2015 a substantial improvement in the area of habitat under active management has been achieved. This large scale restoration has been achieved primarily through a LIFE project and State Forest Management Centre land management agreements. Key factors of success were the efficient and fast large-scale mechanical restoration technique, the improved communication of the local people with the state organisation and with each other (which has facilitated restoration and grazing arrangements), availability of targeted agri-environment support, and the project team's efforts to enable local livestock owners to sign restoration agreements and agri-environment contracts. The habitat improvement has been enabled by the development of integrated coastal zone management, and also by the local population's enhanced awareness of sustainable development and the benefits of nature conservation in the Biosphere Reserve. As the Estonian Nature Conservation Development Plan has set the target of a minimum of 7,500 ha of Nordic alvar grassland habitat area to be under annual grazing by 2020, and funding has been allocated in the Operational Programme for Cohesion Policy Funds, Rural Development Programme, and national funds to 2020, the future prospects of the habitat are improved.

Background

Status and EU occurrence

The habitat is found around the coastlines of the Baltic Sea in the boreal biogeographic region (in Sweden, Estonia and Finland) and the continental biogeographic region (in Sweden only). The range is naturally limited by the occurrence of the typical landscape structure and rocks, and is reported as favourable in all Member States and overall. One third of the currently existing habitat in the boreal range is in Estonia (100 km² reported)(ETC-BD, 2018). Sweden has the largest area overall with 100 km² in the boreal region and 135.1 km² in the continental region, primarily on the islands of Öland and Gotland. There is a small boreal area in southwest Finland (0.5 km²).

The EU conservation status of Nordic alvar and precambrian calcareous flatrocks in the boreal biogeographic region was assessed as unfavourable-bad with a declining trend in the 2007-2012 period, with range assessed as favourable, and distribution, structure and functions, and future prospects as unfavourable-bad (Annex 1).

In Estonia (boreal biogeographic region) the conservation status was assessed as unfavourable-inadequate with a favourable distribution but unfavourable structure and function and future prospects in the 2007 to 2012 period. Although the overall trend in status was reported as declining, information subsequently provided by the Member State authorities for the European Commission Drivers of Success study indicated that a sub-reporting unit level improvement in the habitat's status has occurred, although primarily since 2015 when a substantial increase in the area of habitat under active management has been achieved.

Ecological requirements

Nordic alvar and precambrian calcareous flatrocks are open flat habitats with an ecological character strongly influenced by winter climatic conditions and exposure to wind (European Commission, 2013). The flat rocks are covered with a thin layer of soil (0-30 cm), which is the product of weathering of the underlying rock, with bare patches of rock amongst the vegetation. Depressions in the rock fill with water in spring but then dry up partially or completely in summer. The soil layer is frozen to ice and/or covered with snow in winter, and annual freezing and thawing give rise to movements at the soil surface which create small patches of bare soil each summer. These patches are occupied by characteristic and very diverse vegetation, including a number of regionally rare vascular plants, bryophytes and lichens and correspondingly species rich invertebrate communities, characterised by adaptations to the harsh conditions linked to dry summers, frosty winters and windy conditions (Eriksson, 2008).

The habitat requires grazing for the long-term maintenance of nature conservation values over large areas, corresponding to the very long history of human use. Regular clearing of vegetation may also be a necessary complementary measure (Eriksson, 2008). Calcareous flatrocks mostly occur in a mosaic with related habitats, such as semi-natural dry grasslands (6210), rupicolous calcareous or basophilic grasslands (*6110) and limestone pavements (*8240), and a holistic management approach for these habitats is advisable (Eriksson, 2008).

The Estonian alvar is considered to be a different subtype from the Nordic alvar in Sweden. In Estonia, the habitat is classified as including three types: a "dry thin soil layer type" (*Festucetum alvarense* type, soil layer <5 cm), a "dry deeper soil layer type" (*Avenetum alvarense* type, soil layer 5-30 cm) and a "wet alvar type" (*Molinietum alvarense* type) (Eriksson, 2008, Paul, 2007).

Typical plant species include: *Acinos arvensis*, *Arabis hirsuta*, *Artemisia rupestris*, *Asperula tinctoria*, *Galium verum*, *Helianthemum nummularium*, *Helictotrichon pratense*, *Linum catharticum*, *Thymus serpyllum*, *Veronica spicata*.

Habitats Directive Annex II plant species characteristic of the habitat in the boreal biogeographic region include: *Sisymbrium supinum*, *Senecio jacobea* ssp. *gotlandicus*, *Thesium ebracteatum*, *Pulsatilla patens*, *Cypripedium calceolus*, *Liparis loeselii*, and the moss species *Tortella rigens* and *Encalypta mutica*.

Characteristic Habitats Directive Annex II animal species include the Large Blue butterfly (*Maculinea arion*) (Environment Board, 2017). For some bird species listed in Annex I of the EU Birds Directive (79/409/CEE), calcareous flatrocks are important though not exclusive habitats (Eriksson, 2008), including Eurasian Golden Plover (*Pluvialis apricaria*), Montagu's Harrier (*Circus pygargus*), Barred Warbler (*Sylvia nisoria*), and Red-backed Shrike (*Lanius collurio*). They are also nesting habitat for birds typical of open grassland, and the wetland depressions are frequently used as breeding sites by waders.

Pressures and threats in Estonia

The major cause for the unfavourable status is the lack of grazing. Unmanaged sites become invaded by generalist species from surrounding landscapes, and once three quarters of a site is overgrown with shrubs and trees, the loss of characteristic plant species is rapid (Environment Board, 2017). During the Soviet period, large areas were lost to afforestation, and some areas have been destroyed by quarrying of limestone rock.

Estonia reported the pressures on Nordic alvar in 2007-2012 (mainly based on expert judgement and other data) as: abandonment of pastoral systems and lack of grazing, urbanised areas/ human habitation (high importance pressures), and open cast mining, species composition change (succession) (medium importance)¹. In 2012, most of the approximately 9,800 ha of alvar grasslands were heavily overgrown with shrubs (mostly juniper *Juniperus communis*) and trees (mostly pine *Pinus sylvestris*), and only around 2,000 ha were managed and in a

¹ Estonia's Article 17 report

http://cdr.eionet.europa.eu/Converters/run_conversion?file=/ee/eu/art17/envuc0mhq/EE_habitats_reports-13917-125328.xml&conv=350&source=remote#6280BOR

satisfactory or only slightly unfavourable condition (Environment Board, 2017). This is not enough to maintain the ecological connectivity and biodiversity of the alvar grassland habitat type in Estonia.

The major reported threats in Estonia are the same as the pressures, except for the absence of succession pressure.

Drivers of improvements: actors, actions and their implementation approaches

Organisers, partners, supporters and other stakeholders

Organisers:

- Estonian Environment Board (under Estonian Ministry of the Environment) is responsible for Natura 2000 legislation and governance.
- State Forest Management Centre (RMK) is responsible for Natura 2000 site restoration and management on state owned land.

Partners:

- Private landowners in and around Natura 2000 sites with alvar grassland.
- University of Tartu and Estonian Life Science University provide expert ecological advice and monitoring of the wildlife response to restoration.
- Estonian Seminatural Community Conservation Association (ESCCA) offers farmer training.
- Environment Board biosphere programme area adviser.

Supporters:

- Livestock owners and breeders.
- Local entrepreneurs with machinery suitable for restoration work.

Other stakeholders:

- Discussion groups in communities around the Natura 2000 sites funded by the LIFE for Alvars project.

During the last decade, Estonian scientists and nature conservation associations have highlighted the necessity for large-scale restoration of alvar grasslands through many articles in the popular press and scientific publications, official complaints to the government, and other awareness raising actions (Environment Board, 2017).

Contributions / relevance of strategic plans

During the 2007 to 2012 reporting period, Estonia made progress with designating Natura 2000 sites.

The Estonian Nature Conservation Development Plan (2012-2020) sets targets for improving the conservation status of habitats and species of European importance, including the target of a minimum of 7,500 ha of Nordic alvar grassland habitat area to be under annual grazing by 2020, in order to maintain the ecological connectivity and biodiversity of the alvar grassland habitat type in Estonia (Estonian Ministry of Environment, 2012).

Wider progress on integrated coastal zone management in Estonia has been achieved through international cooperative programmes:

- Action Plan of the Strategy for the Baltic Sea Region (under the Strategy for the Baltic Sea Region).
- Visions and Strategies Around the Baltic Sea 2010 (VASAB) programme, which promoted sustainable development in the region through interregional joint projects and planning initiatives, and produced *Common Recommendations for Spatial Planning of the Coastal Zone in the BSR* consolidating common objectives of coastal zone spatial planning.

A large proportion of the Nordic alvar grasslands lie within the West Estonian Archipelago Biosphere Reserve, which was established in 1990. The Environment Board has included one staff member as biosphere programme area adviser since 2009. The Estonian UNESCO-funded MAB Programme has turned the Biosphere area into a leading area for green economy innovation and pilot projects in respect of sustainable use of natural resources, raised the regional awareness of sustainable development principles, and created a supportive attitude in the local population (Keskonnaamet 2014).

Measures taken and their effectiveness

The conservation measure reported by Estonia for the conservation of the habitat in 2008-2012 was the establishment of protected sites (ranked as high importance, to maintain and enhance long-term).

In response to the survey of Member State authorities carried out in the scope of this project, the Estonian authorities reported two additional conservation measures:

Measure	Type	Ranking	Inside / outside N2k	Broad evaluation
2.1 Maintaining grasslands and other open habitats	recurrent contractual	High	inside	enhance
2.0 Other agriculture-related measures		High	inside	enhance

Source: Estonia's Article 17 report available at https://bd.eionet.europa.eu/activities/Reporting/Article_17/Reports_2013

Estonia has designated 81 Natura 2000 sites for habitat 6280 with a total of 9,950 ha of habitat, i.e. most of the existing habitat (EEA, 2017). The Natura 2000 network covers a substantial part of the coastline and near-shore islets, and without this protection there would very probably have been much more housing development and loss of habitat.

The restoration of alvar started with the LIFE Silmar project (2003-2006) and LIFE Coastal Meadows project (2001-2004), but these were mainly targeted boreal coastal meadow habitat and only restored some small areas of alvar (Annex 2; Riiklik Looduskaitsekeskus, 2007).

In 2012 less than 30% of Estonian alvar grasslands were under the annual management necessary for long-term persistence of this habitat type (Environment Board, 2017). A National Audit Office report published in 2015 identified problems with semi-natural grassland management in protected areas due to landowners' lack of interest linked to modest support rates, lack of inspection and also due to lack of clarity in responsibilities between the authorities (European Commission, 2017).

Two activities have been crucial in recently improving the conservation status of alvar grasslands: the LIFE to Alvars project and State Forest Management Centre land management agreements.

The LIFE Alvars project launched in 2014 aimed to carry out restoration on a sufficiently large scale to allow grazing to be resumed on 2,500 ha of the abandoned area, around a quarter of the total habitat (Environment Board, 2017). The project is restoring 23 different areas on the islands of Saaremaa, Muhu and Hiiumaa and two areas on the mainland of Estonia.

The LIFE to Alvars project between 2014 and 2017 has (Environment Board, 2017):

- introduced effective large-scale restoration methods;
- created the necessary infrastructure for continuous management of the restored sites;
- directly involved private land owners;
- raised awareness among the local community and the general public on the value of alvar areas and of the importance of managing them effectively; and
- initiated an added value products working group to seek opportunities for the farmers to market their products.

Restoration measures have included (Environment Board, 2017):

- large-scale removal of shrubs and trees using communal and forestry machinery;
- collection of seeds of characteristic alvar grassland species from nearby sites and sowing to the restored sites that were very heavily overgrown, to enable quicker recovery of grassland vegetation; and
- establishment of grazing facilities at each restored site (fences, electric fences with batteries and generators, cattle grids, freshwater access facilities, livestock shelters, livestock collection pens, and access gates);

Local entrepreneurs and farmers were contracted to carry out many of the activities including cutting trees and bushes, building fences and gates, and bringing their cattle to graze in restored areas. The LIFE project team's intensive personal communications and public meetings resulted in a large number of private landowners signing agreements to have their land restored in the project. Habitat restoration agreements were signed between the Environment Board and 57 farmers (as well as 800 ha of publicly owned land) by the start of 2017, and involving more than 500 landowners.

Prior to the restoration, the farmer signs a 10 year grazing obligation agreement with the Environment Board to ensure long-term management. The farmers attended two-day training courses on the theoretical background regarding habitats and their biodiversity as well as all practical issues regarding restoration activities. The landowner is required by the contract to inform the Environment Board when the first hectare is restored, at which point a project expert carries out a field inspection and gives direct feedback to the contractor on site. This inspection has assured a high quality of restoration from the start, for example in cases where the contractor misunderstood the terms of the contract or did not apply the proper restoration operations. This was followed up with regular on-site meetings with restoration workers or entrepreneurs and land owners focused on issues such as improving the efficiency of tree or bush removal, proper electrical fence establishment, and optimising grazing pressure.

The State Forest Management Centre (RMK) has entered into land use agreements with 349 natural and legal persons to maintain semi-natural habitats on state land (RMK 2017). The agreements cover 22,462 ha of land, including 21,354 ha of semi-natural habitats of which 1,500 ha are Nordic alvar. Since 2016 everyone interested can get information about vacant and rented semi-natural biotic communities in the areas maintained by RMK through a web application, showing a large interest in land rentals. This is a significant improvement in communication and networking.

Funding sources (current and long-term) and costs (one-off and ongoing)

Alvar restoration and investments in the infrastructure for their management have been financed by the EU Regional Development Fund and Cohesion Fund 2007-2013 and 2014-2020, and national funds in the environmental programme. Management is financed through Estonia's Rural Development Programme (RDP) under the European Agricultural Fund for Rural Development (EAFRD).

ERDF & Cohesion funding: The Estonian operational programme 2007-2014 under the European Regional Development Fund (ERDF) (Keskkonnaministeerium, 2014) included an investment programme (budget €12.1 m) for the Estonian Environment Board and the State Forest Management Centre (RMK) to restore threatened habitats, reconstruct infrastructure needed for the management of semi-natural habitats (roads, bridges, culverts), restore protected landscapes and protected parks, manage invasive alien species (invasive hogweeds), and restore recreational infrastructure (log fire sites, boardwalks etc) (RMK 2014).

The Estonian ERDF operational programme 2007-2014 also included an open call (budget €4.4 m) for NGOs and local municipalities to restore habitats in protected landscapes and protected parks, to restore recreational infrastructure and to buy livestock for the management of semi-natural habitats, including alvars.

The Estonian Operational Programme for Cohesion Policy Funds 2014 – 2020 (combined ERDF, Cohesion and Social Fund) (Rahandusministeerium, 2018) has budgeted €54 m for preservation and restoration of protected species and habitats, from which €24.7 m is foreseen for restoration of protected habitats (including alvars) and €14 m for investments in infrastructure necessary for maintaining valuable semi-natural grasslands (incl alvars). It includes a support programme for the State Forest Management Centre and Environmental Board, and an open call fund for NGOs and local municipalities.

National funds: National public finances of €47 m have been used for the improvement and implementation of the Natura 2000 network (incl. inventories, monitoring, protection and management planning, data management, restoration and ongoing management, land purchase, environmental education and awareness raising, restoration of infrastructure, incl infrastructure for public access) (Keskkonnaministeerium, 2014). Funding for alvars was administered through the Environmental Board, Environmental Agency, Land Board, State Forest Management Centre, and the national environmental programme of the Environmental Investment Centre.

LIFE: The LIFE for Alvars project (2014-2017) had a total budget of €3,725,865, of which €934,560 was funded by Estonia (Keskkonnaministeerium, 2017).

EAFRD: The Estonian RDP 2007-2013 introduced an agri-environment option for grazing or mowing of semi-natural habitats (including alvars), with a total budget for 2007-2013 of €25.6 m. This is being continued under the 2014-2020 RDP with a budget of €40 m. The payment for alvars is higher than grazing on other habitat types (Esko pes comm 2018). Areas restored in the LIFE to alvars project are eligible for this option and the project made an effort to increase farmers' interest in applying for an agri-environment contract (Esko pes comm 2018).

Future actions

The Estonia PAF 2012-2020 (Keskkonnaministeerium, 2014) identified the conservation priority for habitats 6280 and 8240 as maintaining the currently managed area and restoring additional areas, with the expected outcome in 2020 that the managed area is increased from 2,850 ha to 7,350 ha. The PAF identified the following funding needs and sources for the habitat in 2014-2020:

- subsidies for the management of semi-natural habitats - EAFRD;
- restoration of semi-natural habitats - national public, ERDF/CF, LIFE;
- restoration of infrastructure needed for the management of semi-natural habitats - ERDF/CF, LIFE, national public; and
- providing cattle and specific machineries for the management of semi-natural habitats - ERDF/CF, LIFE, national public.

Achievements

Impacts on the target habitat

Some restoration of alvar started with the LIFE Coastal Meadows project (2001-2004), which succeeded in getting 1,675 ha of coastal meadows under management², and the LIFE Silmar project (2003-2006) which restored and managed 1,100 ha of coastal meadows³, but only a small part of the restored areas comprised alvar grassland (Riiklik Looduskaitsekeskus, 2007). Subsequently, much more extensive restoration of alvar grassland has been undertaken, so that by 2017, 1,720 ha had been restored by the removal of woody biomass – 1,000 ha on state owned land and 700 ha on privately owned land (Environment Board, 2017). On around 930 ha of this area, there has already been a second vegetation clearance after the end of the first grazing season and the areas have entered long-term grazing agreements. Restoration has been started on another 220 ha of privately owned land and 300 ha of public land.

Habitat restoration agreements were signed between the Environment Board and 57 private landowners, and agreements also included 300 ha of publicly owned land, so in total 1,350 ha were included in restoration agreements at the start of 2017 (Environment Board, 2017). In the summer of 2017, 1,413 ha of restored alvars were grazed under agri-environment contracts (Esko pes comm 2018).

In the 2016 grazing season (following the LIFE-funded restoration in 2014-2015), the restored area was already covered with species rich grassland vegetation, indicating that the seedbank of the typical grassland community is still present on the overgrown areas (Keskkonnaministeerium, 2017). This countered initial doubts that the sites would not recover quickly after the large-scale mechanical clearance of the woody vegetation and would fail to provide sufficient forage for livestock to graze. The changed light conditions triggered mass flowerings of protected orchid species in several project areas which made the restoration activities more acceptable for visitors to the Natura 2000 areas. The biodiversity monitoring of alvars has discovered several new plant species for Estonia.

Other impacts (e.g. other habitats and species, ecosystem services, economic and social)

The restored alvars are all inside Estonia's Western Archipelago Biosphere Reserve on the three main islands Saaremaa, Hiiumaa and Muhu, which all have an economy heavily dependent on public subsidies and seasonal tourism, with most of the remaining cattle farmers producing meat for their own consumption. The funded restoration work is an important source of local employment during the winter season in which other work opportunities are scarce (Esko and Holm, 2017). The restoration programme has stimulated local micro-enterprises to hire more workers and invest in machinery. Some locals are now developing markets for their beef, and are setting up a farmer cooperative and constructing a slaughterhouse on Muhu island. However, there is still no commercial use for the wool. Residues from the vegetation clearance have been used for production of heating energy (Esko and Holm, 2017).

The LIFE project funding has fostered the communication of the local people with the state and with each other (Esko and Holm, 2017). The cattle owners and the landowners started to contact one another, the entrepreneurs and cattle owners started to communicate more actively, and local residents started to communicate with the

² http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=1720

³ http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=2490

local entrepreneurs and cattle owners to get information or work. The cattle owners started to actively seek information on lease conditions and availability of state owned alvar grasslands from the State Forest Management Centre. This dynamic bodes well for the sustainability of alvar management after the end of LIFE funding.

The traditional appearance of the Estonian island landscape is very open due to grazing and mowing. The older local residents have a strong emotional attachment to that type of landscape, and some locals tried to restore parts of the habitats manually, but were limited by their low efficiency and small scale organisations (Esko and Holm, 2017). Most residents have a positive attitude to the restoration or have become more positive in their attitude during the restoration work. In contrast, newcomers who have bought holiday property prefer the closed landscape. The restoration is revealing aspects of the cultural heritage of the islands and is also providing opportunities for tourism by increasing the appeal for walkers and horse riders.

Conclusions and lessons learnt

The key targeted conservation measures that led to the improvements

- The mechanical restoration technique restored more areas faster and with smaller costs than manual restoration. Because the overgrowth was removed quickly, grazing could be reintroduced in the following summer and the subsequent regrowth of trees and bushes was more easily suppressed. Mechanical restoration also has an ecological benefit as the heavy ground disturbance initiates the emergence of seedlings of characteristic open grassland species from the seed bank. Without such disturbance, the thick needle and litter layer under the shrubs and pine trees would have hindered the development of characteristic vegetation after restoration. Due to the mechanical disturbance, quick establishment of characteristic vegetation was observed.
- Agri-environment support in Estonia has been targeted at semi-natural grasslands (including Nordic alvar) for the last two decades and has resulted in an increase in 1,400 ha managed by farmers from 2014 to 2017.
- The LIFE project funding has fostered the communication of the local people with the state and with each other, facilitating restoration and grazing arrangements. The cattle owners started to actively seek information on lease conditions and the availability of state owned alvar grasslands from the State Forest Management Centre. Effective dissemination and communication with landowners resulted in larger pasture plots than initially anticipated. This meant that not all borders required fencing and on the larger plots the grassland plant species recovered faster through a better dispersal of seeds and plant material.

Conservation measures that have not been sufficiently effective

- The project encountered some delays in the planned construction or repair of the access roads to the Natura 2000 sites on the Estonian islands, and with the contract for installation of public information at the sites, but these have been resolved.

Factors that supported the conservation measures

- The LIFE project team's intensive personal communications and public meetings resulted in a large number of private landowners signing agreements to have their land restored in the project, and the subsequent support and inspections assured a high quality of restoration from the start.
- The LIFE project communication and publicity activities significantly raised the level of media coverage, which was essential to convince the private land owners and to explain the values of restored and grazed alvar grassland.
- Biodiversity monitoring is being carried out on permanent plots established on each restored site, measuring vascular plant diversity, butterfly diversity, management, disturbance regimes, environmental indicators and soil chemistry.

Factors that constrained conservation measures

- On one site (Hanila) the restoration could not be started because it was not possible to obtain the landowners agreement, even though the local municipality was supportive (Environment Board, 2017). Most of the landowners of that area use the land only in summer for their holiday cottage and value the overgrown vegetation as it creates privacy for their property. As grazing has completely ceased in

the area, the landowners have a cautious and sceptical attitude towards its re-establishment. Some landowners are opposed to the existence of the Natura 2000 area because it limits their rights to establish new buildings next to the sea, and are therefore also resistant to conservation measures.

Quick wins that could be applied elsewhere for the habitat

- The mechanical restoration technique is key to the successful habitat restoration, as it allows faster and larger scale restoration with smaller costs and within a reasonable time frame. State Forest Management Centre subcontractors and private landowners applying for national funding for protected grassland restoration have started to use mechanical restoration. The project team plans to facilitate its use in future by recommending changes to the Ministry of Environment's legislative act which describes the method and subsidy for restoration of semi-natural habitats.
- Seed collecting via brush harvester is a viable and effective method of introducing seeds of characteristic species to restored sites. It can be recommended on sites that are heavily degraded and where the seed-bank is depleted (green-hay transfer was also tested, but as the herb layer of alvars is very short – less than 20 cm - it is hard and inefficient to collect sufficient green hay).
- Cattle grids proved to be effective in terms of both keeping the livestock in pasture plots and improving the accessibility for visitors to the Natura 2000 sites.
- Small plots of trees growing inside the pastures next to the borders of the restored areas were left to provide natural shade for the livestock, which replaced the need for construction of livestock shelters.

Examples of good practice, which could be applied to other habitats

- The mechanical restoration technique and implementation is highly relevant for the restoration of other semi-natural habitats that need shrub, tree or reed removal.
- The training of farmers and contractors for restoration proved to be very successful and considerably increased the knowledge about the value of alvar grasslands and significantly improved the quality of restoration works carried out by farmers.
- The first hectare check-up procedure (see supporting factors above) results in good-quality restoration activities from the beginning, as project coordinators can give feedback and suggestions to contractor and landowner.
- Knowledge gained in the seed collection and sowing technique (see quick wins) can be transferred to restoration of other habitat types such as wooded meadows.

References

EEA (2017) EUNIS database – Nordic alvar and Precambrian flatrocks. Available at: <http://eunis.eea.europa.eu/habitats/10127> (accessed 12/2/2018)

Environment Board (2017) Life for Alvars project midterm report covering the project activities from 01/09/2014 to 31/01/2017. Available at: http://life.envir.ee/sites/default/files/pictures/midterm_report_lifetoalvars.pdf (accessed 11/2/2018)

Eriksson, M O G and Rosén, E (2008) *Management of Natura 2000 Habitats: 6280 Nordic alvar and precambrian calcareous flatrocks*. Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, Technical Report 2008 16/24, European Commission, Brussels.

Esko, A (2018) Personal communication 2 April 2018. Annely Esko, Keskkonnaamet/Environmental Board of Estonia, LIFE to alvars projektikoordinaator/ LIFE to alvars project coordinator

Esko, A and Holm, B (2017) *Working group for promotion of added-value products from alvar grasslands*. LIFE to Alvars project Report of Action E.8, LIFE to Alvars project.

Estonian Ministry of Environment (2012) *Nature Conservation Development Plan until 2020*. Ministry of Environment, Estonia, Tallinn.

ETC-BD (2018) Member State Article 17 reports on 6280 Nordic Alvar, as compiled by ETC-BD on EIONET. <https://bd.eionet.europa.eu/article17/reports2012/habitat/summary/?period=3&group=Grasslands&subject=6280®ion=>

European Commission (2013) *Interpretation Manual of European Union Habitats - EUR28*. European Commission, Brussels.

European Commission (2017) The EU Environmental Implementation Review Country Report – Estonia. Commission Staff Working Document Accompanying the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. The EU Environmental Implementation Review: Common Challenges and how to combine efforts to deliver better results. SWD(2017) 40 final. European Commission, Brussels.

Keskkonnamisteerium (2014) Prioritised Action Framework (PAF) for Natura 2000 for the EU Multiannual Financing Period 2014-2020. Ministry of Environment, Estonia. Available at: https://www.envir.ee/sites/default/files/elfinder/article_files/paf_est.pdf

Keskkonnamisteerium (2017) LIFE for Alvars project website. Ministry of Environment, Estonia. Available at: <http://life.envir.ee/english-project-life-alvars> (accessed 11/2/2018)

Keskkonnaamet (2014) Sustainable Development Programme for West Estonian Archipelago Biosphere Programme Area 2014-2020. Available at: https://www.keskkonnaamet.ee/sites/default/files/laane-estli_saarte_biosfaari_programmiala_saastliku_arengu_programm_0.pdf (accessed 20/4/2018)

Linder, M (ed) (2017) Estonian Nature Conservation in 2015. Keskkonnaagentuur (Estonian Environment Agency), Tallinn. Available at: http://www.keskkonnaagentuur.ee/sites/default/files/elk2015_eng.pdf

Paal, J. (2007) Loodusdirektiivi elupaigatüüpide käsiraamat (Habitats Directive habitat types manual). Eesti Keskkonnamisteerium, Tallinn, Estonia. Available at: <http://dspace.ut.ee/handle/10062/18477> (accessed 12/2/2018)

Rahandusministeerium (2018) STRUKTUURITOETUSTEST Perioodi 2014–2020 rakendamine. Available at http://www.struktuurifondid.ee/et/rakendamine_14_20 (accessed 13/4/2018)

Riiklik Looduskaitsekeskus (2007) Restoration of Habitats of Endangered Species in Silma Nature Reserve. Project No LIFE2003NAT/EE/000181 Laymans report. State Nature Conservation Centre, Estonia.

RMK (2014) Ühtekuuluvusfond (ÜF) [Cohesion Funding]. State Forest Management Centre (RMK), Estonia. Available at: <http://rmk.ee/organisatsioon/el-fondid-1/uhtekuuluvusfond> (accessed 12/2/2018).

RMK (2017) RMK Annual Report 2016. Available at: http://media.rmk.ee/files/RMK_Aastaraamat_2016_eng.pdf (accessed 12/2/2018)

State Forest Management Centre (2014) Preserving Nature's Diversity (Investment Plan). Estonia. Available at: <http://rmk.ee/organisatsioon/el-fondid-1/looduse-mitmekesisuse-sailitamine> (accessed 12/2/2018)

Authorship

Prepared by Evelyn Underwood of IEEP, as part of the European Commission study on identifying the drivers of successful implementation of the Birds and Habitats Directives (under contract ENV.F.1/FRA/2014/0063), carried out by the Institute for European Environmental Policy, BirdLife International, Deloitte, Denkstatt, Ecologic, ICF Consulting Services and PBL Netherlands Environmental Assessment Agency.

The information and views set out in this case study are those of the authors and do not necessarily represent the official views of the Commission.

Acknowledgements

The case study was informed by information from Annely Esko, Environmental Board of Estonia, March and April 2018.

Annex 1 Status of Nordic alvar and precambrian calcareous flatrocks* (6280) at Member State and biogeographic levels

Favourable	FV	Unknown	XX	Unfavourable - inadequate	U1	Unfavourable - bad	U2
------------	-----------	---------	----	---------------------------	-----------	--------------------	-----------

Qualifier (+) improving (-) deteriorating (=) stable (x) unknown (n/a) not reported

	2001-06	2007-12				
	Overall	Range	Area	Structure	Future	Overall
EE (BOR)	U1 (-)	FV	FV	U1	U1	U1 (-)
FI (BOR)	U2 (-)	FV	U2	U2	U2	U2 (-)
SE (BOR)	U2 (-)	FV	U2 (-)	U2	U2	U2 (-)
EU overall (BOR)	U2	FV	U2 (-)	U2	U2	U2 (-)
SE (CON)	FV	FV	FV	FV	FV	FV
EU overall (CON)	FV	FV	FV	FV	FV	FV (=)

Source: Member State Article 17 reports as compiled by the ETC-BD on EIONET <https://bd.eionet.europa.eu/article17/reports2012/>

Annex 2. LIFE Nature Projects in Estonia that aimed to help conserve Nordic alvar and precambrian calcareous flatrocks

Project Title	Project N°	MS	Type Of Beneficiary	Time period
LIFE to alvars - Restoration of Estonian alvar grasslands	LIFE13 NAT/EE/000082	EE	National authority	2014-2019
Silma - Restoration of habitats of endangered species in Silma Nature Reserve	LIFE03 NAT/EE/000181	EE	Park-Reserve authority	2003-2006
EE Coastal Meadows - boreal Baltic Coastal Meadow Preservation in Estonia	LIFE00 NAT/EE/007083	EE	National authority	2001-2004

Source: Life Programme database, projects with *Nordic alvar and precambrian calcareous flatrocks* listed as a key word