Chapter 13. 6230* *Species-rich* Nardus *grasslands, on siliceous substrates in mountain areas* (S. Rūsiņa, A. Auniņš, V. Spuņģis)

13.1 Characteristics of the Habitat Type

13.1.1 Brief Description

Habitat type 6230* *Species-rich Nardus grasslands, on siliceous substrates in mountain areas* (referred to as *Nardus grasslands* in the text) consists of dry or mesic grasslands on acidic and very acidic sandy soils, very poor in nutrients. In Latvia they are rare throughout all of the country (Fig. 13.1.1) occupying 550 ha or 1.2% of all the semi-natural grasslands. They are mostly concentrated in sandy plains outside river valleys, less often in river valleys on sandy bedrocks, usually in plain terrain – Coastal Lowland, Ropaži Plain, and Madliena Tilted Plain, as well as in eastern Latvia in the Adzele Rise. Latvia only has 5.5% of the total area of *Nardus* grasslands in the EU boreal region (Rūsiņa 2013f).

Three variants of EU protected habitat type 6230* *Species-rich Nardus grasslands, on siliceous substrates in mountain areas* can be distinguished by vegetation and its determining environmental conditions. The first two are described in the Interpretation Manual of EU protected habitats in Latvia (Auniņš (ed.) 2013), while the third one is described for the first time, based on the latest habitat variant description in the EU (Galvánek, Janák 2008) (Table 13.1.1).

Sometimes typical species of *Nardus* grassland establish in new ex-arable land, however a single culm of *Nardus stricta* alone does not indicate that the grassland is EU protected habitat 6230* *Species-rich Nardus grasslands, on siliceous substrates in mountain areas*. To classify the grassland as an EU protected habitat:

- there must be habitat characteristic plant communities with typical dominant species;
- if the turf is very sparse and there are strong indications of ex-arable land or improved grassland, the grassland should contain at least five semi-natural grassland indicator species (Annex 4) that occur across the entire grassland and not in just some of its parts (for more details *see Chapter 1.2*).

Nardus grasslands occur in very small areas in Latvia and there are no protected nature territories where they could be observed in a larger area. They occur most frequently in "Lubāna Mitrājs" Nature Reserve (approximately 66 ha), the next largest area is "Salacas Ieleja" Nature Park (~ 12 ha) and Slītere National Park (~ 11 ha). In other protected nature territories the area of this grassland type is even smaller. (Fig. 13.1.2).

The key literature in the preparation of the guidelines were the guidelines for the management of this habitat type published by the European Commission (Galvánek, Janák 2008).

13.1.2 Vegetation, Plant and Animal Species

Plants and vegetation. Herb layer is very low (15–20 cm), but dense and with a very thick and dense turf ((Fig. 13.1.2, 13.1.3). The herb layer is dominated by one or more acid soil tolerant grass species – *Nardus stricta, Sieglingia decumbens, Festuca ovina*. The moss layer is usually dominated by *Rhytidiadelphys squarrosus*, but it may also be undeveloped. The determining soil factor is low fertility, while moisture conditions can fluctuate vastly, therefore the composition of accompanying species can be various – plant communities characteristic for dry soils (with *Antennaria dioica, Ca-*

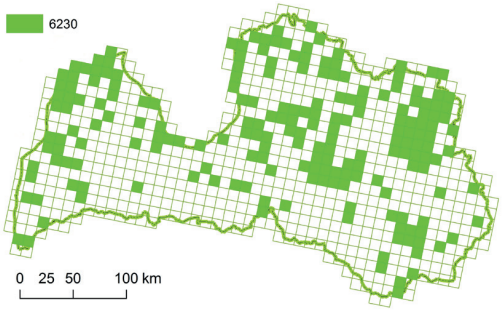

Fig. 13.1.1. Distribution of EU protected habitat type 6230* *Species-rich Nardus grasslands, on siliceous substrates in mountain areas* (Anon. 2013a).

Fig. 13.1.2. Nardus grasslands in "Oviši" Nature Reserve. Photo: S. Rūsiņa.

Table 13.1.1. Variants of habitat type 6230* *Species-rich Nardus grasslands, on siliceous substrates in mountain areas*. Photo: S. Rūsiņa, *Carex flava*– A. Priede).

Dry *Nardus* grasslands (6230*_1, dry variant)	**Moist *Nardus* grasslands (6230*_2, moist variant)**
In dry, very poor sandy acid soils. Dominated by *Nardus stricta, Festuca ovina* or *Sieglingia decumbens*. Many mesoxerophytes – *Festuca ovina, Vaccinium vitis-idaea, Trommsdorfia maculata, Calluna vulgaris, Campanula rotundifolia, Pilosella officinarum*. Hay yield lower than 0.5 t ha^{-1}.	In mesic and moist, very nutrient-poor and acid soils. Dominated by *Nardus stricta* or *Sieglingia decumbens*, *Deschampsia cespitosa* occurs frequently. Typical forbs are *Potentilla erecta, Viola canina, Succisa pratensis, Geum rivale*. Hay yield lower than 0.5 t ha^{-1}.


Antennaria dioica


Veronica officinalis


Succisa pratensis


Potentilla erecta

Wet *Nardus* grasslands (6230*_3, wet variant)

In wet areas with very nutrient-poor and acid soil (pH ~ 4) constantly affected by a high groundwater table. Often occurs on edges of fens or in mosaic with fen vegetation. Usually dominated by low sedges: *Carex nigra* and *Carex flava*, grasses *Agrostis canina* and *Deschampsia cespitosa*, forbs *Eriophorum polystachion, Viola palustris, Juncus* spp., *Pedicularis palustris, Festuca ovina, Comarum palustre, Equisetum palustre*, mosses *Aulacomnium palustre* and *Sphagnum* spp. Hay yield lower than 0.5 t ha^{-1}.


Carex nigra


Eriophorum polystachion


Carex flava


Pedicularis palustris

Fig. 13.1.3. Thick turf consists of *Nardus stricta*. Of all grasses found in Latvia, it forms the densest culms. Photo: S. Rūsiņa.

rex pilulifera, Veronica officinalis), as well as mesic (with *Carex pallescens, Viola canina, Agrostis tenuis*) and even wet soils (with *Succisa pratensis, Potentilla erecta, Carex nigra*) may develop. Paludification can occur, indicated by peat accumulation and *Sphagnum* establishment in the moss layer.

Birds. There are no bird species that are specifically associated with *Nardus* grasslands, but many grassland bird species may occur there. Meadow waders may occur in the moist and wet variants of these grasslands, but due to acidic soil and the low abundance of earthworms, the development of large breeding semi-colonies is unlikely. Most often, species of only two ecological groups are present – grassland passerines (most likely *Anthus pratensis, Motacilla flava, Emberiza citrinella, Carpodacus erythrina, Lanius collurio*) and birds that only feed in grasslands (*Ciconia ciconia, Buteo buteo, Aquila pomarina, Columba palumbus*).

Invertebrates. Soil fauna is species-poor, resulting in the poor decomposition of plant residues and the development of litter. Herb layer fauna varies depending on plant species composition. If vegetation is markedly low, a great diversity of Orthoptera species is observed, such as *Decticus verrucivorus* and *Myrmeleotettix maculatum*. Burrowing insects, such as spider wasps *Pompyliidae*, sand wasps *Sphecidae* (including *Bembix rostrata*), mining bees *Andrenidae*, burrowing bugs *Cydnidae* and ground bugs *Lygaeidae* are well represented. *Agelena labyrinthica* is related to low vegetation and can serve as the best indicator of habitat quality. There are few beetle species associated with herbaceous plants. There are no data on the presence of species listed in Appendix II to the Habitats Directive in this grassland habitat.

13.1.3 Important Processes and Structures

Soil acidity and nutrient deficiency, as well as grazing are the main factors that ensure the existence of the habitat (Galvánek, Janák 2008). *Nardus* grasslands develop only as a result of long-term grazing over several decades. Less commonly, this habitat can develop after mowing because the grassland yield is so low that they cannot be mown.

Soils have low pH (3–4) and they lack bioavailable plant nutrients (Galvánek, Janák 2008). They are mostly dry to moist mineral soils on sandy sediments, or on rarer occasions, moist peaty soils. In Latvia, the soils of this habitat have been studied in Vidzeme Upland. There, this habitat has developed in acidic and weakly acidic (pH 3.4–5.5) sandy or sandy loam soils (Matuko 2015).

The connectivity of habitats in the landscape is very important because plant species spread poorly – they may only disperse a few dozens of metres per year. If the grassland is surrounded by forests or arable fields, species die out gradually because they cannot move from one grassland to another and cannot sustain a healthy, genetically diverse population. It is easier for such grasslands to preserve in landscapes with a high occurrence of dry pine forests because plant species characteristic of *Nardus* grasslands can survive and move on edges, gaps and clearfellings of such forests.

13.1.4 Succession

It is possible that there still are *Nardus* grasslands in Latvia that have developed in forests through long-term grazing. They occur in very acidic and nutrient-poor soils, where arable fields were only created when absolutely necessary, but mainly the land was used for grazing. Long-term grazing in the forest or in the clearfelling could gradually create a wooded pasture first, followed by an open pasture landscape. In coastal areas, *Nardus* grasslands occur in Randu meadows, where they developed as a result of mowing and grazing, without the forest stage *Nardus* grasslands can also develop through long-term extensive grazing of coastal grey dunes.

Another type of development of these grasslands is the establishment of pastures or meadows in ex-arable land. In very dry and poor soils,

Nardus grasslands developed soon after arable land abandonment. In slightly more fertile soils, mesic species-rich pastures (EU protected habitat type 6270* *Fennoscandian lowland species-rich dry to mesic grasslands*) developed first, but continued long-term grazing or mowing without improvement resulted in the very slow (over several decades) depletion of soil and in the development of *Nardus* grasslands (Fig. 13.1.4).

With long-term extensive grazing, *Nardus* grasslands become increasingly poorer, and *Calluna vulgaris* establishes. It is not favoured by grazers and gradually spreads. With time, grassland

Fig. 13.1.5. Afforested species-rich *Nardus* grassland in Jaunpiebalga, Gauja valley.

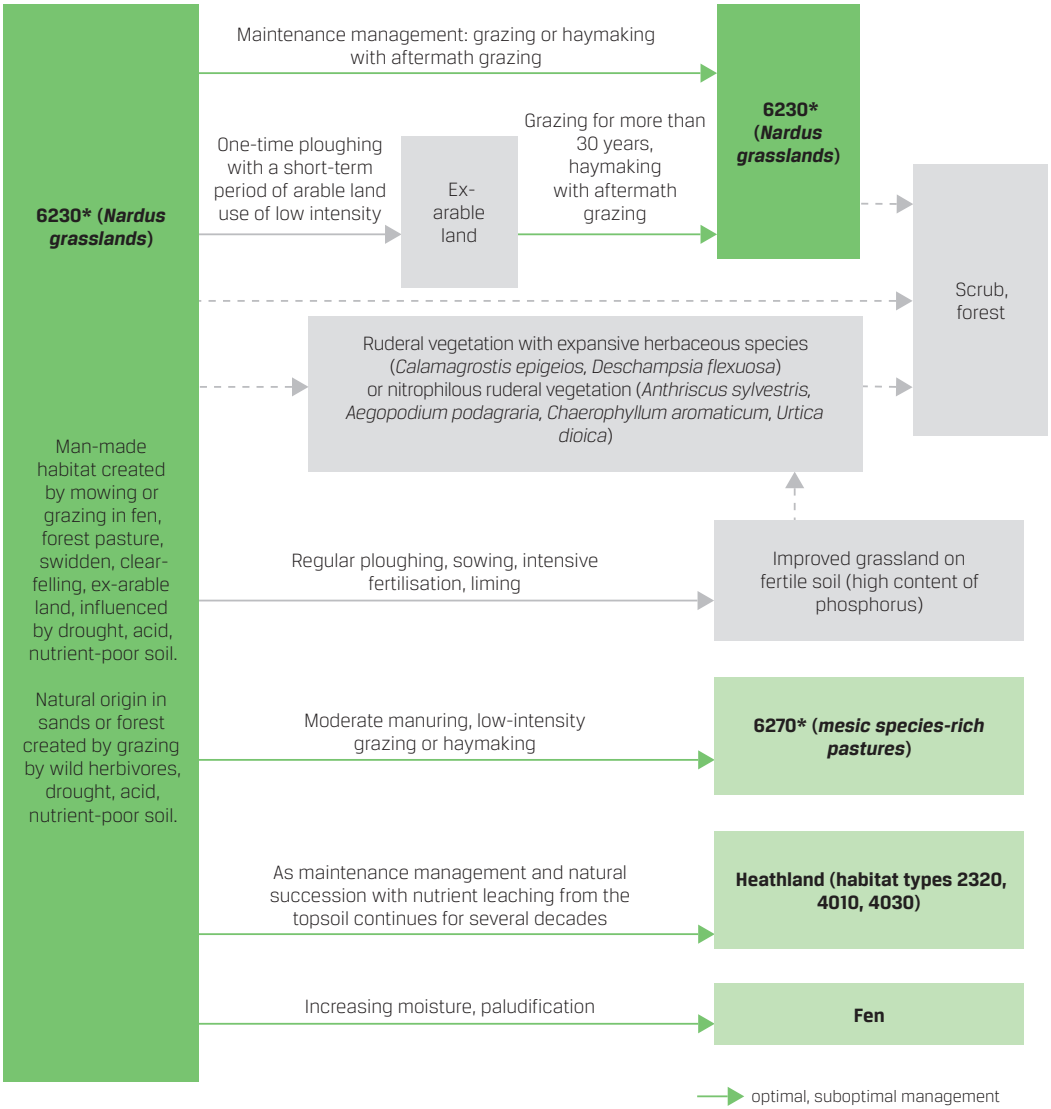

Fig. 13.1.4. Development of *Nardus* grassland vegetation under various management regimes.

Fig. 13.1.6. A pond excavated in *Nardus* grassland in Gauja National Park: (**a**) before the digging of the pond, (**b**) after digging. Maps: Orthophoto map at a scale of 1: 10,000 © Latvian Geospatial Information Agency (ORTHOPHOTO 2; ORTHOPHOTO 5).

can transform into a heath (habitat dominated by *Calluna vulgaris, Vaccinium vitis-idaea*, and other dwarf shrubs, rather than perennial grasses). Heaths are also EU protected habitats, so the management and conservation of both habitat types should be considered together. More on heath habitats and their management in Latvia: see Laime (ed.) 2017, Chapters 17, 18. Management cessation sometimes results in the establishment of *Calamagrostis epigeios* or *Deschampsia flexuosa* (in drier areas), in mesic areas – *Holcus mollis, Agrostis tenuis* or even grasses of more fertile soils: *Poa pratensis* and *Phleum pratense*. Expansive plant species spread if the soil is enriched due to airborne nitrogen deposition, as well as in recent ex-arable land. Most frequently though, overgrowth with shrubs (*Salix* spp., *Frangula alnus*) and trees *(Betula pendula, Populus tremula, Alnus incana, A. glutinosa*) occurs without the stage of expansive grasses.

13.1.5 Pressures and Threats

Habitat is adversely affected by all the factors listed and described in Chapter 3. The most significant factors have been abandonment, change of land use type (Fig. 13.1.5, 13.1.6) and inappropriate management, especially mulching. Eutrophication results in an increased proportion of grasses and disappearance of forb species. Negative changes occur if nitrogen deposits exceed 10–20 kg ha^{-1} (Bobbink et al. 2003).

In some Coastal Lowland areas, spreading of an invasive species *Aronia prunifolia* has been observed in abandoned *Nardus* grasslands.

13.2 Conservation and Management Objectives of *Nardus* Grasslands

- Ensuring the landscape connectivity and ecological processes characteristic for *Nardus* grasslands (vegetation structure diversity and nutrient cycling), creating preconditions so that the diversity and quality of the ecosystem services offered by this grassland habitat type does not decrease.
- Promoting the improvement in the number of localities and conservation status of typical, rare and vulnerable species and their populations by restoring suitable habitats in degraded *Nardus* grasslands.
- Restoring and maintaining the diversity of lichen, moss and higher plant species, communities and habitats: *Nardus* grasslands are the most important habitat for the protected plant species *Gentiana pneumonanthe* and *Platanthera chlorantha.*
- Restoring and maintaining the diversity of invertebrate species: dry *Nardus* grasslands with abundant *Thymus* spp. is suitable for protected butterfly species *Maculinea arion.* Ants *Myrmica sabuleti* are important in the lifecycle of this spe-

cies (Konvička et al. 2005). Moister *Nardus* grasslands, where the specially protected plant species *Gentiana pneumonanthe* occurs, are a suitable habitat for the butterfly *Maculinea alcon*, whose larvae consume this plant species.

13.3 Maintenance and Restoration of *Nardus* Grasslands

If a *Nardus* grassland is in a favourable condition, its restoration is not necessary and maintenance management is sufficient (*Chapter 13.3.1*). If any habitat features indicate the opposite (*see Chapter 13.3.3*), restoration is necessary. Before the habitat restoration, territory must be surveyed, nature values clarified, management plan developed (*see Chapter 7*), considering the legal framework of habitat management (*see Chapter 7.2*).

13.3.1 *Nardus* Grasslands Requiring Maintenance

Management is necessary for all *Nardus* grasslands in a favourable condition. *Nardus* grassland in a favourable conservation state is managed every year – by grazing or by mowing with haymaking; overgrowth with shrubs and the development of dense litter are prevented. The dominant plant species are *Nardus stricta, Sieglingia decumbens, Festuca ovina*, which develop a tussocky vegetation structure. The grassland is not significantly drained – ditches are absent or they are shallow, dug by hand in the first half of the 20th century. Some areas of *Nardus* grassland are covered with very low grass, some feature richly flowering herbs, where butterflies and other insects feed (Fig. 13.3.1–13.3.2, Table 13.3.1).

Fig. 13.3.1. Species diversity in well-managed *Nardus* grassland can be very high and protected plant species occur – *Gentiana pneumonanthe* blooming with blue flowers. Photo: S. Rūsiņa.

Favourable condition is indicated by the presence of *Nardus* grassland umbrella species *Bembix rostrata* and plant species *Nardus stricta, Polygala vulgaris, Sieglingia decumbens and Gentiana pneumonanthe*.

13.3.2 Optimal, Suboptimal and Inappropriate Management

Optimal, suboptimal and inappropriate management types are summarised in Table 1 and 5 of Annex 2.

The most recommended management is grazing by cattle or goats. Mowing with the removal of grass in late June and early July and one-time aftermath grazing are also appropriate. Grazing can also be performed in early spring until late May – mid-June,

Fig. 13.3.2. Well-managed *Nardus* grassland is dominated by (**a**) *Nardus* stricta or (**b**) other tussock-forming grasses, but many forb species also occur: *Succisa pratensis, Selinum carvifolia*. Photo: S. Rūsiņa.

Table 13.3.1. Indications of well-managed habitat 6230* *Species-rich Nardus grasslands, on siliceous substrates in mountain areas.*

Parameters	Meadow	Pasture
Litter	Litter covers more than 10% and less than 50% of the ground.	
Vegetation	High botanical diversity, rather than one or a few dominant species; characteristic tussocky vegetation structure is formed by *Nardus stricta, Sieglingia decumbens* or *Festuca ovina*; forbs: *Potentilla erecta, Viola canina, Veronica officinalis, Vaccinium vitis-idaea, Succisa pratensis, Geum rivale, Pilosella officinarum.*	
Vegetation structure	Vegetation is low – up to 20–30 cm (without inflorescences). When the meadow is in full bloom, several herb species flower. Low tussock-forming grasses dominate, but the number of forb species is also relatively high.	At least 20% of the area with grass lower than 7 cm and at least 20% of the area with grass higher than 20 cm. Plants in flower cover at least 20%.
Indicator species of semi-natural grasslands	Typical species: *Cardamine pratensis, Carex panicea, Galium boreale, Parnassia palustris, Ranunculus auricomus, Scorzonera humilis, Succisa pratensis, Trollius europaeus, Dianthus deltoides, Antennaria dioica, Polygala* spp.	
Bird species	Grassland has a diverse meadow passerine community (grassland smaller than 10 ha may have only one or a few species).	
Invertebrate species	Many xerothermophyle insects – plant bugs, beetles, Orthoptera, Hymenoptera, rich fauna of anthophylous insects, in pastures – also insect fauna related to animal excrement.	
Tussocks	Tussocks are present, but they are small or absent in some places.	
Expansive plant species	Absent or only up to 10% of the grassland area: *Calamagrostis epigeios, Deschampsia flexuosa, Anthriscus sylvestris, Elytrigia repens, Aegopodium podagraria, Filipendula ulmaria.*	Overgrazing indicators do not cover more than 30% of the sward, for example, *Agrostis tenuis, Trifolium repens, Plantago major, Polygonum arenastrum, Poa annua, Prunella vulgaris.*
Shrubs and trees	Large trees are preserved, small shrubs in at least 10% of the area, but no more than 30%.	

but then grassland can only be mown in late summer when seeds of most plants have ripened. If *Nardus stricta* in the grassland is abundant, it can decrease after spring grazing because then the plant is softer and animals eat it better.

Late mowing or mowing with leaving of grass are very unfavourable for *Nardus* grasslands because in both cases soil gets enriched in nitrogen. The amount of more nutrient-demanding grasses in the grassland increases, leading to vegetation change and disappearance of *Nardus* grassland.

Very specific management is needed in habitats of large blues *Maculinea* spp. One development stage of these butterflies needs *Myrmica* ants therefore grazing to a low sward (5 cm) where *Myrmica* ants can live is recommended. At the same time, ungrazed areas with flowering plants are also necessary to ensure feeding for butterflies. Research in Czechia suggests that cattle are not suitable for such grasslands because the vegetation structure created is not suitable for *Myrmica* ants. The most favourable management, according to this study, is extensive grazing with sheep or mixed sheep-cattle herd. The grazing period should be short. Early (mid-end-June) or, on the contrary, late (end-August) mowing and short grazing in autumn is suitable as well. Mowing should be performed in parts, up to 50% of the area in one year and the rest in the next year, and alternating mown and unmown areas every year.

To increase the diversity of passerines, shrubs and trees should be preserved in small amounts in a mosaic, but the increase of their number must be prevented. If there are many moist or wet areas in the grassland and is next to the water edge, its suitability for waders should be ensured by creating mosaic-type vegetation of varying height with free access to the water. This is best achieved by grazing.

13.3.3 *Nardus* Grasslands Requiring Ecological Restoration

Grassland restoration is necessary in the case if:

- it has not been managed for several years;
- it has been mown with mulching or leaving of

Table 13.4.1. Conflicting management priorities of 6230* *Species-rich* Nardus *grasslands, on siliceous substrates in mountain areas*

Question	Problem	Solution
Which habitat should be preserved – 6230* *Species-rich Nardus grasslands, on siliceous substrates in mountain areas* or 4030 *European dry heaths*	Long-term grazing gradually encourages the establishment of *Calluna vulgaris* and the transformation of habitat into a heath (EU protected habitat 4030 *European dry heaths*, in Coastal Lowland also 2320 *Dry sand heaths with Calluna and Empetrum nigrum).*	*Nardus* grasslands are priority protected habitats, which means they are threatened with extinction and are distributed mainly in the European Union, therefore priority should be given to the conservation of *Nardus* grassland, rather than the creation of heath.
Late flowering plants: *Gentiana pneumonanthe*	The plant blooms in August, therefore mowing before mid-August and intensive grazing has an adverse effect. However, annual late grazing also reduces the suitability of habitat for this species.	Areas, where the species is most prevalent should be left unmown. Grazing should be limited, allowing the plant to bloom and shed seeds.
Conservation of orchids (*Platantherea bifolia, P. chlorantha*) in pastures	Orchids do not tolerate trampling. If a newly grown leaf rosette is damaged, it will no longer regrow. Early mowing is also unsuitable because the species flowers in June and July.	The best solution is to leave unmown areas, where most specimens of the species occur.
Conservation of *Maculinea* spp. butterflies	One of the species of this genus lives on *Gentiana pneumonanthe*. In one of the development stages, larvae live in *Myrmica* anthills which can only develop if they are not mown or smoothed each year.	The most appropriate management is grazing. Mowing should be done by hand, sparing anthills. Part of the area should be left unmown for 2–3 years in a row, alternating the unmown part with other sites, where *Gentiana pneumonanthe* grows. If the grassland is very tussocky and needs to be smoothed due to management considerations, it should be done very gradually over several years.

grass for more than five years;
- it is very tussocky;
- overgrown with trees and shrubs;
- sward is dominated by expansive species, for example, *Calamagrostis epigeios, Deschampsia cespitosa, Urtica dioica, Pteridium aquilinium, Aegopodium podagraria, Anthriscus sylvestris, Elytrigia repens, Filipendula ulmaria*;
- invasive species dominate, for example, *Solidago canadensis, Aronia* spp., *Amelanchier spicata and Rosa rugosa;*
- there is a sparse herb layer and thick moss layer mainly composed of woodland mosses: *Hylocomium splendens* and *Pleurozium schreberii*;
- paludification occurs: vegetation is dominated by *Comarum palustre, Menyanthes trifoliata,* and *Sphagnum* spp. or *Aulacomnium palustre* in the moss layer.

13.3.4 Restoration Potential

Most *Nardus* grasslands nowadays are overgrowing with forest. Restoration is relatively easy in such sites. Grassland that is rather easy to restore resembles semi-natural grassland – there are various plant species, including grasses and forbs. In grasslands abandoned for a longer period grasses are more abundant than forbs. The number and abundance of forb species can be very low. In recently ploughed grasslands, turf is undeveloped, there are many ex-arable land species (dominated by *Agrostis tenuis*, sometimes *Anthoxanthum odoratum* or *Festuca rubra*). Young pine or birch stands may

***Nardus* grassland restoration success**
Nardus grassland (*Nardo–Galion*) was restored in a grassland that was fertilised for a long time, and where the initial yield of hay was 1.7 t ha^{-1} on average. By mowing once per year (in early July), a reduction of yield to 0.6 t ha^{-1} was achieved within 25 years. However, to completely restore the species composition, it should be reduced even more because the hay yield in well-developed *Nardus* grasslands is only 0.3–0.4 t ha^{-1} (Bakker et al. 2002).

have developed in long-abandoned grasslands and the herb layer may have disappeared due to shading.

If vegetation is dominated by habitat characteristic species, the restoration results will already be visible in the first restoration year. Restoration is also relatively easy in *Nardus* grasslands overgrown with forest (the grassland usually overgrows with *Pinus sylvestris, Populus tremula, Betula pendula*), as long as habitat characteristic species have been preserved in at least small abundance. It is sufficient to resume mowing and grazing after shrubs are cleared and grassland surface is smoothed (if necessary). If there are no other grasslands of the same habitat type closer than 1–5 km from the restored grassland, the introduction of habitat characteristic plant species using seed-containing hay may be necessary. *Nardus* grasslands characteristic species have weak spreading capacity and a transient seed bank (Bakker et al. 2002).

The potential for the restoration of *Nardus* grassland on improved grassland or intensively used arable land depends on how much the soil has been enriched and vegetation changed. Compared to more fertile semi-natural grassland habitats, the restoration of conditions required for *Nardus* grassland may take a longer time and more investment. In the case of topsoil removal and restoration grazing, the establishment of *Nardus* grassland may take up to 50 years (Bakker et al. 2002). Development of characteristic species composition may be very slow. To some extent, this is due to the high importance of soil processes for *Nardus* grasslands – specific composition of soil microorganisms, especially, fungi, is necessary. To accelerate the restoration, it is recommended in deturfed grassland to inoculate turf with arbuscular mycorrhizal fungi taken from grassland in a favourable conservation (Torrez et al. 2016).

If soil pH is increased during cultivation (pH 6 and more) and topsoil removal or deep ploughing fails to reduce soil pH (pH is also high in deeper layers), then soil acidification to at least pH 4 is necessary (Owen, Marrs 2000). The pH of *Nardus* grassland soils studied in Latvia is 3.4–4.0, but can also reach pH 5.5 (Rotkovska 2015). To acidify soil in ex-arable land, pine needles, woodchips, *Pteridium aquilinum* hay (if pH is 6, this material must be spread in at least a 10 cm thick layer and incorporated in the soil using a rotavator, to a depth of 10 cm) or sulphur (it is recommended to spread powdered sulphur 2 t ha^{-1}, using a rotavator to a depth of 5–10 cm) can be used (Owen, Marrs 2000).

13.3.5 Restoration Methods

Restoration methods are summarised in Table 20.1 of Chapter 20 and in Chapter 21. The creation of bare sand patches is described in Chapter 11.3.5. However, specific restoration aspects should be taken into account when restoring habitat type 6230* *Species-rich* Nardus *grasslands, on siliceous substrates in mountain areas.*

Rewetting: applies only to the moist and wet variant of *Nardus* grasslands. Until today, moist and wet *Nardus* grasslands with superficial drainage by shallow, hand-dug ditches remain. The filling of such ditches is not necessary, and the maintenance of such ditches is often necessary. However, draining with deep ditches destroys the habitat. If moist or wet *Nardus* grassland has been completely drained and improved, its restoration is almost impossible.

Restorative mowing or grazing: extensive grazing is best suited for restoration. If grazing is not possible, grassland must be mown with the removal of grass at least twice per season, to reduce the abundance of expansive plant species and decrease nutrients which accumulated excessively while the grassland was abandoned.

13.4 Conflicting Management Priorities of Nardus Grasslands

Managers of *Nardus* grasslands can experience conflicting management situations applicable to all types of grasslands (see Chapter 7.1.4). Specific conflicting priorities may be related to the natural succession of this habitat type and the conservation of habitat characteristic rare species (Table 13.4.1).