AGENTURA OCHRANY PŘÍRODY A KRAJINY ČESKÉ REPUBLIKY

PŘÍRODOVĚDECKÁ FAKULTA Univerzita Karlova

STANDARDS OF NATURE AND LANDSCAPE MANAGEMENT		
MANAGEMENT OF SELECTED TERRESTRIAL BIOTOPES	DISTURBANCE MANAGEMENT ON NON-FOREST AREAS	SPPK D02 006: 2018
SERIES D		

Disturbanční management na nelesních plochách / Disturbance management on non-forest areas

Störungsmanagement in nicht bewaldeten Gebieten

This standard contains definitions of technical and technological procedures of management of non-forest areas using disturbances.

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Decree No. 294/2005 on the conditions of depositing waste in landfills and its use on the surface of the ground, as amended.
Decree No. 257/2009 on the use of sediments in farming soil, as amended.

Standard development:
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1. Standard purpose and content

The standard “Disturbance management on non-forested areas” defines procedures for disturbance management with the aim of creating a mosaic of non-forest biotopes, return to early successional stages of non-forest biotopes, creating specific types of biotopes and conservation and increasing in biodiversity in general.

Disturbance can be generally defined as a mechanical intervention (be it natural or man-driven) into an ecosystem resulting in a temporary change of the current conditions, a disruption of an ecosystem, its composition, its development and structure. It creates new conditions which are more likely not to match current species requirements and provides opportunity for new colonisation or as the case may be helps current species retreating because of a present late successional stage.

Disturbance procedures have character of targeted measures. They substitute natural disturbances (eg. windfallen trees, floods, wildfires, influence of large mammals) suppressed or eradicated in nature by man though. At the same time they create biotopes common in traditional farming landscape of past centuries that would develop as consequence of human activities (eg. extensive grazing, burning off etc.). Competitively weaker species bound to early successional stages cannot find suitable conditions in current landscape and they rank among the most quickly dwindling organisms in the Czech Republic (and many has already died off in our territory).

This Standard is primarily intended for performing special management in non-forest areas in protected areas. It can also be used for management in valuable biotopes beyond protected areas including secondary and anthropogenic biotopes (eg. quarries, sandpits, sludge lagoons, disposal site of fly ash, slag heaps etc.).

This Standard contains commonly used methods of disturbance management in nature conservation. Apart from these, many other procedures can be marginally used such as disturbance of soil surface or creation of wetlands using explosives, removing vegetation and humus layer from rocky outcrops, removing humus layer and clay alluvia from gravel benches and sand benches along watercourses, disturbances in field wetlands, salt marshes etc. This Standard general instructions are intended also for these. (art. 3) although they are not mentioned in this Standard due to their scarce use. A method commonly used abroad but only experimentaly used in the Czech Republic is vegetation controlled burning off. In the conditions of the Czech Republic nature conservationists struggle for the possibility of using burning off in selected biotopes (eg. when restorating heathlands on large areas), therefore a legislative amendment is being prepared that would allow it in the future. After that burning off will be added to the methods of disturbance in this Standard.

2. Legal framework

Act No. 114/1992 Coll., On Nature and Landscape Protection, as amended, deals (inter alia) with the general protection of species of wild fauna and flora and special protection of those species that are rare or endangered by positively influencing their development in nature and ensuring the conditions for their preservation, possibly using special cultivation and rearing facilities, restoration and creation of new naturally valuable ecosystems. The law also deals with the protection of woody plant species growing outside forest which may be affected by the disturbance management, protection of important landscape features and landscape character and basic protective conditions of specially protected areas.

Act No. 334/1992 Coll., On the Protection of the Agricultural Land Fund, as amended, lays down general principles for the protection of agricultural land (§ 3) against pollution, erosion and limits non-agricultural use.

Act No. 254/2001 Coll., On Waters and Amendments to Certain Acts (the Water Act), as amended, is a regulation restricting the entry of hazardous and other harmful substances into waters and further addresses the protection of water resources or the protection of water quality against harmful substances listed in the annex to the Act. The Act regulates legal relations to surface and groundwater, relations individuals and legal entities to the use of surface and groundwater, as well as relations to land and constructions directly related to the occurrence of these waters, in order to ensure sustainable use of these waters.

Another legal regulation related to this issue is Act No. 449/2001 Coll., On Hunting, as amended. In section 11, on the obligations of hunting users, states in paragraph 3: "*Hunting users are obliged to take available and proportionate measures to rescue game in times of emergency, in particular in connection with floods, forest fires and extremely high snow cover."*

Act No. 201/2012 Coll., On Air Protection, as amended, deals with the prevention of air pollution and the reduction of the level of pollution so as to limit the risks to human health caused by air pollution, reducing the burden on the environment by substances introduced into the air and to create conditions for the regeneration of environmental components affected by air pollution (§ 1 (1)).

The Standard "SPPK D02 006 Disturbance Management on Non-Forest Areas" is not primarily intended for use in the territory of existing military areas, or as the case may be it can be used appropriately there, to the extent that the military training is not restricted.

3. General instructions for disturbance management

3.1 Conducting surveys

3.1.1 If possible, it is very suitable to trace the history of farming in the locality of interest. Prior to the commencement of the disturbance measures, an orientation inventory survey of the locality is carried out, that means detection of organisms, especially plants and invertebrates, and depending on the characteristic of the locality also groups of vertebrates or other groups of organisms are taken into account. Monitoring of alien invasive, native invasive plant and animal species that can respond to disturbances by rapid spread is important.

3.1.2 Monitoring must be repeated after the intervention, preferably a long-term follow-up of interventions.

3.1.3 As part of the survey, it is necessary to take into account any prohibitions and restrictions arising from legal regulations (eg. basic protective conditions of specially protected areas and specially protected plants and animals and protection of woody plant species growing outside forest pursuant to Act No. 114/1992 Coll.) and for the intended activity to obtain in advance an exemption, permit or other permitting act from the competent state authority. In case of doubt, it is possible to consult the procedure with competent state authority in advance**.**

3.2 The aim of disturbance management

3.2.1 Primarily biotopes ensuring the existence of target species are protected or restored and not vice versa. A well-defined setting of conservation objectives is crucial.

3.2.2 As with other types of interventions, it is possible that individuals die in favor of populations.

3.3 Patch size

The smaller the area of interest of the habitat, the more cautious the procedure must be.

3.3.1 In large areas (approx. over 30 ha), there is no need to significantly reduce spatial and time constraints. However, the assumption is that no more than about 1/3 of the area shall be affected by the disturbance at once.

3.3.2 In small areas (up to approx. 30 ha), disturbance planning and risk assessment must be more careful.

3.3.3 This definition is, by no means, absolute and approach to the locality should be derived from the ecology and spatial requirements of the main target groups of organisms.

3.4 Preventing risks

3.4.1 If disturbance management is introduced at a given site, caution should be exercised, i. e. to test the method first in smaller areas of the habitat and where the risks are low. Further procedures should be selected based on the evaluation of these experimental measures.

3.4.2 It is necessary to combine different types of disturbances described and always make sure that at least half of the area (but preferably more) remains intact in that year. It is advisable not to carry out disturbances always in the same term.

3.4.3 The competent state authorities and bodies concerned (stakeholders) must always be informed in advance. Interventions should be planned well in advance (about half a year) to resolve all complications in a timely manner.

3.4.5 The progress and results of controlled disturbances should be documented (including photographs).

3.4.5 Interventions need to be explained prior to the start of implementation and repeatedly in the course of data collection (good examples, effects and results).

4. Disturbance methods

4.1 Soil scarification and removal of grass turf

4.1.1 Soil scarification and removal of grass turf using (heavy) technique

4.1.1.1 Application of the method

4.1.1.1.1 Turf disturbance using (heavy) technique is an important type of intervention that supports competitively weak species, thereby maintaining or increasing local biodiversity.

4.1.1.1.2 This disturbance management is usually planned in various terrestrial non-forest habitats, especially in moist grasslands and wetland meadows, peat bogs, heaths, sandy lands, steppe grasslands, salt marshes, mesophilic meadows and pastures. Further use is at anthropogenic stands - tailings ponds, dumps, sand pits, quarries, etc.

4.1.1.2. Method description

4.1.1.2.1 Removal of grass turf exposes soil surface and disrupts continuous vegetation cover. If heavy technique is used, soil surface is severely damaged, and vegetation cover can be completely eliminated even in large areas. In case of minor interventions, removed grass turf can remain on the site. In case of extensive interventions, it is necessary to deposit the soil away from valuable areas or to remove it from the site (see chapter 4.1.4).

4.1.1.2.2 Larger interventions should take place out of the growing season, from October to February (lower altitudes) or from October to March (middle and higher altitudes). If the objective is to promote catching of diaspores or fragmentation of vegetative parts of plant species of interest, interventions should take place during the ripening of their seeds or spores. On condition that populations of other endangered organisms at the place of intervention are not threatened.

4.1.1.3. Technology and material

4.1.1.3.1 Agricultural and non-agricultural machinery and vehicles can be used. From the classic agricultural equipment a wheeled or tracked tractor (traveling alone or with a harnessed rail or heavy harrow), a cultivator, a tedder, a tractor with plow or harrows and a soil cutter can be used. Also suitable are off-roads, quads, off-road motorcycles, excavators, mini excavators, and various tracked vehicles. The weight, power and working width of the machine will be chosen according to the size and vulnerability of the site and the planned intervention. Military vehicles maneuvering is dealt with in separate chapter 4.4.

4.1.1.4. Intensity, scale, periodicity

4.1.1.4.1 The extent of intervention in one year shall not exceed about 1/3 of the area of the biotope of interest in the given locality. In justified cases (eg. in overgrown habitats) the intervention can be carried out over a larger area of the habitat of interest.

4.1.1.4.2 Creation of a habitat mosaic and annual disturbance of a smaller area, typically 10% of the area on a different site every year is appropriate. This ensures continuity of the early

successional stages and at the same time vegetation variability in places of interventions of different ages. This method is crucial for many organisms that cannot exist without permanent presence of exposed soil. Repetition of major interventions in a previously disturbed area may be carried out in the range from 3 to 6 (10) years.

4.1.1.5. Aftercare

Mowing, grazing and cutting scrubs are recommended as aftercare. If the site is not subject to intensive overgrowth, it is advisable to omit aftercare in the first two years and only monitor the effect of disturbance.

4.1.1.6. Risks and limitations

4.1.1.6.1 For this type of disturbance, detailed knowledge of species occurring at the site of interest is essential in order to prevent inappropriate interventions in places with disturbance-sensitive organisms (eg. many lichens, anthills).

4.1.1.6.2 Interventions should not be carried out near populations of invasive and expansive plants to prevent their spread.

4.1.1.6.3 In case of use of off-road and motorcycle maneuvering, it is important to agree on changes in the route for repeated maneuvering.

4.1.2 Manual soil scarification

4.1.2.1 Application of the method

Small work with hand tools is suitable for small-scale interventions in various types of habitats, especially in case of caring of specific individuals or populations of endangered vascular and non-vascular plants and animals. Manual turf disturbance is performed in cases where it is impossible to use the technique, eg. in the immediate vicinity of rare plant specimens or in inaccessible places.

4.1.2.2 Method description

4.1.2.2.1 In case of manual soil scarification, disturbance of the vegetation cover is small and limited. Soil surface can be exposed either directly by removing turf, or only by disrupting the vegetation cover (creating gaps of size of few dm^2 and different shapes) or raking out biomass without separating grass turf from the soil. Grass turf remains on the site of intervention whereas the biomass extracted by scarification and raking out is removed from the site of interest.

4.1.2.2.2 For Hymenoptera mosaic removal of the grass turf causing several centimeters large overgrown patches alternating with gaps of exposed soil is also an effective management. Butterfly caterpillars often need lonely sods or bunches of plants surrounded by bare ground.

4.1.2.2.3 In case the aim of the intervention is to support germination of seeds or spores of a target specie, the intervention should be timed to the time this species produces diaspores. In case the aim is to remove undesirable species or biomass, it is possible to carry out the

intervention almost at any time. In case of other specific interventions when the goal is to fragment tubers or other underground and above-ground vegetative parts of a plant, it is advisable to time the intervention until the peak of the growing season (depending on the case).

4.1.2.3. Technique and materials

For turf disruption it is possible to use common hand tools such as spade, pick, shovel and hoe. Positive effects can be obtained with a brush cutter (3 teeth blade or string trimer) neverthless only after the removal (mowing and raking) of most of the above-ground biomass. For biomass removal rakes and pitchfork is usually used. When transporting a larger amount of biomass from a locality it is common to use a canvas or a trailer pulled by an off-road vehicle or a quad bike.

4.1.2.4. Intensity, scale, periodicity

4.1.2.4.1 The extent of intervention in one year does not exceed about 1/3 of the area of the biotope of interest in the given locality (except for justified cases). The intervention extent is given by the number of people working and amount of time spent working in the locality and usually is only small scale. Manual removal of grass turf is only surface intervention (into a depth of cca 5 to 10 cm)

4.1.2.4.2 Periodicity of disturbance repetition is usually 1 to 5 years. Raking out biomass can be carried out each year.

4.1.2.5. Aftercare

Manual scarification can be combined with mowing, grazing or shrubbing.

4.1.2.6. Risks and limitations

Manual scarification is usualy targeted on a specific species and there is assumption of a detailed knowledge of the species´ distribution at the site of interest and knowledge of the most suitable date of the planned intervention.

4.1.3 Minor surface treatment (removal of litter layer)

4.1.3.1 Application of the method

4.1.3.1.1 A thick layer of litter may hinder the development of vegetation or the use of land by species bound to the exposed substrate, such as Hymenoptera, butterflies and other insects living on the soil surface. Litter is also an undesirable source of nutrients. A specific case is removal of old biomass layer in littoral stands (eg. in reeds).

4.1.3.1.2 The aim of the treatment is to create a mosaic of small patches (m^2 units) with litter, without litter and, to a lesser extent, patches with partially exposed soil.

4.1.3.2 Method description

4.1.3.2.1 When removing the litter layer (needles, leaves or accumulated biomass from herbs) in places without vegetation, the surface is exposed or slightly disturbed. The raked out biomass is removed outside the area of interest.

4.1.3.2.2 The primary aim of the intervention is to create a mosaic of differently sized patches and patches differently exposed to sun situated under solitary trees, small groups of trees or shrubs. The tickest litter layer is directly under trees. Therefore it is desirable to cut lower tree branches (eg. in pines), so that sun shines into the target patches. In case of litoral stands biomass and dead biomass of the dominant species (usually reed or bulrush) preventing other species from growing is removed. At the same time, this reduces accumulation of nutrients and accumulation of humus layer, which then causes gradual drying and decreasing of the size of litoral stands. Intervention takes place at any time of the year, but if it is directed to the peak vegetation season, it is necessary to critically assess the possible negative impact on target and other species occurring on the site.

4.1.3.3 Technique and materials

In particular, different types of rakes for raking out litter and biomass can be used. To remove biomass in littoral stands, a tracked or walking excavator is used.

4.1.3.4 Intensity, scale, periodicity

Due to time and labor intensity of manual work and the relatively low occurrence of these habitats, it is not necessary to limit the intensity and scope of the intervention. Disturbance is realized only on the soil surface. The intervention can be carried out annually.

4.1.3.5 Aftercare

Unnecessary.

4.1.3.6 Risks and limitations

It is undesirable to leave the removed biomass near the place of intervention.

4.1.4 Removal of grass turf with material removal

4.1.4.1 Application of the method

The aim of the intervention is complete removal of undesirable plant species (usually alien invasive or native invasive) including underground organs and upper eutrophic soil layer. It is possible to apply this method also for enlargement of a biotope of interest for example on the site after shrubbing. The side effect of turf removal is creation of a habitat with exposed soil, the possibility of restoring the original plant communities from the soil seed bank or improving the availability of groundwater (wetland restoration). The intervention is carried out on the same habitats as in the case of grass turf disturbance, as well as in littoral stands (eg. reeds).

4.1.4.2. Method description

4.1.4.2.1 The upper soil layer including grass turf (ie. aboveground and most of the underground plant biomass) is removed and transported away from a selected locality. The depth of the soil layer removed depends on the depth of the root system of the plant species being removed. The minimum effective depth for most species is 20 cm. For example, in bushgrass (*Calamagrostis epigejos*), this depth is usually sufficient for the restoration of the original community, although its roots are likely to reach a greater depth.

4.1.4.2.2 The optimal date is from October to February (lower altitudes) or March (middle and higher altitudes).

4.1.4.3 Technique and materials

A suitable technique is an excavator or a bulldozer and a truck to transport the material. In most cases, it is necessary to use a tracked excavator that can also work in waterlogged ground or on sloping terrain. In heavily waterlogged localities it is necessary to use a walking excavator. Smaller types of excavators (weight of 3 tons) are suitable for interventions in smaller areas (up to about 0.25 ha), on larger areas bigger excavators (eg. 6 tons) are more effective. Bigger excavators are also more suitable on stony land.

4.1.4.4 Intensity, scale, periodicity

4.1.4.4.1 Scale of the disturbance depends on the area covered by undesirable vegetation, usually unvaluable so that there is no need to limit the area for intervention.

4.1.4.4.2 In case of a well-executed intervention and application of aftercare on the site, repetition of the intervention is unnecessary. Otherwise, the intervention can be repeated after three or more years.

4.1.4.5 Aftercare

Aftercare consist in mowing, grazing or soil scarification. In the first two years (sometimes even longer) after the intervention there is no need of aftercare. In some cases (especially in the vicinity of ruderal vegetation) though undesirable species may colonise the site rapidly. In those cases aftercare should be applied in the next vegetation season.

4.1.4.6 Risks and limitation

4.1.4.6.1 For soil storage it is advisable to select a heavily degraded area (eg. nettle stands, bushgrass, invasive plants, ruderal stands) in the proximity of the locality. Another possibility is to store the soil in pre-dug deposits on the locality and to overlay it with clean soil taken from lower layers.

4.1.4.6.2 From sloping and waterlogged sites it is advisable to remove the soil at the time of frost or by using a track loader.

4.1.4.6.3 This intervention should not be applied in the vicinity of populations of alien invasive or native invasive plants, which spread primarily by seeds.

4.1.5 Cutting slopes of sandpits and clay slopes

4.1.5.1 Application of the method

This specific intervention is mainly used in sandpits, but can be carried out on virtually any sand, clay or loess slope. The target groups of organisms are mainly birds (bank swallow, kingfisher, bee-eater) and Hymenoptera (solitary bees, hunting wasps). Regular bank exposure mimics material extraction or natural processes such as landslides or bank erosion due to floods, etc.

4.1.5.2 Method description

4.1.5.2.1 When cutting sand and clay banks, a surface layer at least 10 cm thick is removed mechanically, ideally over the entire height of the bank. It is essential to remove material mainly from the upper part of the bank, which is most attractive for nesting birds due to less predation, slower clogging of the air vents due to landslides and usually finer sediment in these places. Another requirement for the intervention is the perpendicularity of the resulting bank.

4.1.5.2.2 For interventions targeted at the bank swallow, the minimum wall height is 2 to 3 meters, or slightly less for the kingfisher. If the walls are low, birds can nest here, but are more likely to be threatened by predators. Occupied burrows near the surface are digged up over the overlay layer by foxes, through the entrance corridor by rats, otters, weasels, badgers and minks.

4.1.5.2.3 For Hymenoptera, it is sufficient to create a bank 50 cm high.

4.1.5.2.4 The extracted material should be spread around the bank, creating an early succession stage that is very attractive to insects and some species of plants, bryophytes and lichens.

4.1.5.2.5 Suitable term for application is October to February (until March in higher altitudes).

4.1.5.3 Technique and materials

An excavator, a truck. Smaller interventions can also be carried out with hand tools (spade, etc.)

4.1.5.4 Intensity, scale, periodicity

With the exception of specific cases (see chapter Risks and limitations) it is not necessary to limit the scope of interventions and it is possible to apply it on the whole locality. Regular repetition of the intervention after 3 to 6 years is appropriate.

4.1.5.5 Aftercare

The banks themselves remain without subsequent care. In the place of deposited material, it is advisable to maintain exposed areas by regularly disturbing the soil surface (see previous chapters).

4.1.5.6 Risks and limitation

4.1.5.6.1 For the vast majority of target species, exposed surface is essential, while for some non-moving species conservation of the source populations is also crucial, so that the diaspores will subsequently be able to colonize the newly formed bank.

4.1.5.6.2 On sloping terrain the risk of erosion should be considered in advance.

4.2 Sheet mulching

4.2.1 Application of the method

4.2.1.1 Sheet mulching consists of overlapping the vegetation with opaque sheets and dying of the overlapped plants after some time. The principle of the method is to make the light unavailable to plants, which is manifested by fading of tissues or organs, extension of the stem (etiolization) and subsequent dying.

4.2.1.2 Sheet mulching is used on spatially limited deposits of undesirable plant species or vegetation types, as well as to create exposed soil patches and to open up new space for competitively weak plant species and to initiate new succession or to create areas of sparse vegetation for invertebrate animals requiring these microbiotopes.

4.2.1.3 It is a non-destructive method, ie. only plants are reduced without further impact on soil cover. The exact localization of the intervention is suitable for the care of localities with simultaneous and mosaic occurrence of important species of plants (eg. butterfly foodplants), vegetation formations and expansive or undesirable species.

4.2.1.4 Combination with other methods of disturbance management and use in sites with a clearly defined subject of conservation, eg. one plant species or monophagous insects, is suitable.

4.2.2 Method description

4.2.2.1 The first step is to carefully map the site in order to clearly locate the intervention so as to minimize or rather eliminate negative effects (eg. overlapping rare and endangered plant species).

4.2.2.2 For the preparation it is necessary to mow the vegetation in the place of the planned laying of the sheets as low as possible above the ground. All mowed biomass must be removed from the area, including raking out the remains of dead biomass.

4.2.2.3 The actual sheet mulching consists in temporarily covering surface with a light-impermeable fabric. The fabric should be anchored at its perimeter with pins, nails with pads and / or loaded with stones, logs, etc.

4.2.2.4 Sheet mulching is performed during the vegetation season, it is especially effective in spring and summer. Interventions can be made in winter, but sheets must be exposed at least during a part of the growing season.

4.2.2.5 The length of covering may vary depending on the nature of the locality and vegetation, about 2 months can be considered as a sufficient time.

4.2.2.6 This method is effective in rather sunny habitats, in a wide range of habitats from steppes to waterlogged meadows.

4.2.3 Intensity, scale, periodicity

4.2.3.1 This method is effective on areas of tens to hundreds of square meters. Sheet mulching is performed in mosaic, especially in places with local occurrence of undesirable vegetation. Covering larger areas with sheets is less time-effective and less cost-effective than alternative methods.

4.2.3.2 After the time necessary for the biomass to die under the sheet, it is advisable to move the sheet to other locations in the site.

4.2.3.3 It is possible and desirable to repeat sheet mulching at the same or adjacent sites after several years, depending on the nature and quality of the newly developed vegetation or the need to (re) create microbiotopes of bare soil and sparse vegetation.

4.2.4 Technique and materials

4.2.4.1 Mowing is carried out by conventional machinery described in standard the SPPK D02 004 Mowing of grasslands (brush cutter, hand guided drum or bar mower, scythe, etc.).

4.2.4.2 Removal of biomass is carried out in accordance with the procedures described in the standard SPPK D02 004 Mowing of grasslands (most often rakes, pitchforks, biomass removal). Mulching is excluded.

4.2.4.3 Black foil or black fabric is used to cover the surface to prevent weeds from growing in gardens, ornamental beds (eg. under mulch) or forest nurseries. These textiles prevent the passage of sunlight, but are permeable to water, thus avoiding negative drying or altering the soil structure under the fabric. Textiles have different widths (usually 1,5-3 m), they are available on the market as one-piece pieces of several meters or in rolls of up to 100 m and with limited relocation. Unwoven fabrics are lighter and cheaper but also less durable, their life-time is about one or two seasons. Woven fabrics are more durable (up to 10 years) and movable.

4.2.5 After-care

4.2.5.1 After uncovering the sheet, it is necessary to remove the remains of dead vegetation and to disrupt and level the soil surface with rakes or other mechanization means.

4.2.5.2 In the next step it is possible to leave the area to spontaneous succession of the grass cover (regeneration from the seed bank). It is also appropriate to choose this procedure if you want to keep the bare soil as long as possible.

4.2.5.3 It is possible to sow target plant species, but always from plants growing on the site. Sowing should take place immediately after uncovering the sheet, i. e. most often in autumn. It is also possible to use the method of so-called green hay, ie. to mow a place with the target type of vegetation in the surrounding area and immediately transfer the biomass to the place after sheet mulching, where the matter will dry out and seeds will be shed (in accordance with the standard SPPK D02 001 Restoration of grasslands using regional seed mixtures).

4.2.6 Risks and limitation

4.2.6.1 Risks of using this method are small thanks to precise aiming. Using this method does not cause any direct death of animals.

4.2.6.2 In some locations, particularly in connection with urbanized areas, sheets may be stolen or destroyed. An explanatory placard can be placed on the sheet, or it can be pointed out by spraying on the fabric that it is a deliberate intervention.

4.2.6.3 One disadvantage of this method is the limited size of the treated area, the advantage is low laboriousness. Another disadvantage is the zero effect on reducing the amount of organic matter and nutrients in the soil.

4.3 Trampling

4.3.1 Application of the method

4.3.1.1 Trampling consists of directing direct influence of humans or other larger mammals, especially ungulates, on vegetation and plant cover while browsing. The result of trampling is damage to the herbaceous vegetation lying in breaking stems, its drying and thinning, and furthermore exposing bare soil along with damage to the root system. On waterlogged soils small soil depressions often flooded with water are caused. More intensive trampling is accompanied by the removal of top soil layers including reduction of organic matter, reduced soil porosity, increased runoff and soil erosion.

4.3.1.2 The aim of the disturbance is to create lower and sparse vegetation or even bare surfaces and to give space to competitively weak species of plants, bryophytes, lichens and plants requiring germination and seedlings´ growing on patches of bare soil caused by hooves (eg. gentians). These disturbances also create areas covered in sparse vegetation for invertebrates requiring these microbiotopes (eg. Hymenoptera, butterflies).

4.3.1.3 Trampling ranks among less destructive and localized methods. Often it is of a linear nature, to some extent it is possible to regulate the intensity by both the number of people / ungulates and their distribution on the site due to the location of resources and the attractiveness of microbiotopes (eg. near a mountain hut, mineral lick or waterhole).

4.3.1.4 A specific type of trampling is periodic disturbance of pools or ponds. The action of ungulates on the pool can be both positive and negative. Positive phenomena include blocking the succession of the pool, negative phenomena are too intense turbulence and turbidity of water in case of larger ungulates and eutrophication by dung. The target group of organisms in the pool is important, eg. disturbances are generally suitable for crustaceans linked to rapidly disappearing habitats of puddles, while less suitable for amphibians and aquatic plants.

4.3.1.5 Trampling is suitable for creating and maintaining places where ungulates and birds like to “dust bathe”. Usually, on a larger pasture such places are chosen by the animals themselves, most often in dry places with loose substrate structure, often in places that serve or have served to burn branches, etc. These sites are used by many insects for sunbathing and larval development. Their edges are populated by specific species of bryophytes or vascular plants.

4.3.2 Application of the method

4.3.2.1 Human trampling

4.3.2.1.1 In case of human influence by trampling, it is about regulation or management of the long-term effect of groups visiting the locality (mostly tourists, sportsmen), who influence the vegetation character by their regular movement. The influence is on vegetation morphology as well as on its physiognomy and species composition.

4.3.2.1.2 Trampling can be controlled and targeted eg. by placing geocaches, benches, information signs, etc. or, on the other hand, completely eliminated in undesirable places. Hiking paths can be moved (using railings and other barriers). One-time intense pedal disturbance can be influenced eg. by organizing events in which a large number of people are acting in a certain area.

4.3.2.2 Ungulate trampling

4.3.2.2.1 Ungulate trampling can be regulated mostly by concentrating the activity of the animals in selected places in the pasture, or on the other hand by completely eliminating trampling on undesirable places. Gathering of animals can be influenced mainly by suitable placement of objects - shelters, watering places, mineral lick, entrance to the enclosure. Exclusion of trampling can then be accomplished by fencing or relocating the above-mentioned structures.

4.3.2.2.2 As in case of grazing, the characteristics of each species of grazing animals must be taken into account. A cow or a horse is a heavy animal, with large hooves or cloven hooves, and disrupts the soil more intensively. With larger flocks of sheep and goats, similar effects can be achieved. All kinds of animals create a network of paths on the site, where they move more often and where trampling is intensive. These paths can also be moved, especially by using simple natural obstacles (a felled tree, branches, etc.).

4.3.2.2.3 A special type of trampling is disruption of pools. It always depends on the number and kind of animals, the size and morphology of the pool. Goats and sheep basically do not enter the pool, they have a positive effect on the gently sloping banks of the pool, avoiding steeper slopes. In contrast, cattle and horses enter directly into the pools and they can also graze the aquatic vegetation. Ideal is a moderate disturbance rate limited in spring.

4.3.2.2.4 The use of wild animals may also be a special type of intervention. Their movement can be directed to well-liked places such as watering places or places with an attractive type of food (eg. wild pigs). Salt can be used as an attraction - finely salted vegetation attracts animals and can be deliberately grazed and disturbed.

4.3.3 Intensity, scale, periodicity

4.3.3.1 A suitable term for trampling is out of the main growing season, ie. from autumn to spring, but can be carried out at any time. Year-round trampling is important at periodic pools.

4.3.3.2 Trampled areas are left fallow for a certain time. Depending on the nature of the locality and vegetation, the period without trampling ranges from weeks to months in the growing season.

4.3.3.3 Trampling is one of space-limited interventions on the level of units up to hundreds of m^2. Trampling over larger areas is less advantageous in terms of time and money than alternative methods.

4.3.3.4 This is usually a long-term intervention in a longer time scale (except for one-time events, such as a music festival). That is why it is necessary to plan trampling management in time and space accordingly to the character of weather, type of subsoil, humidity, vegetation and achieved effects.

4.3.4 Technique and materials

The most important indicators of the impact of trampling on target habitats and species are its spatial distribution and intensity, which is based primarily on number of people / animals and concentration of their activities. This is more or less the same for all kinds of participants in trampling.

- Human - the advantage is easier possibility of localization of activities, the disadvantage is the linear character.
- Sheep and goat – the advantages are easier work with them, ability of trampling steep slopes and rocks. The disadvantage is their small weight and thus low intensity of trampling and insufficient formation of patches of bare soil. In addition grazing is often seasonal.
- Horse – the advantage is its heavier weight and its hooves cause suitable bare soil patches. Horses, especially Exmoor ponnies, are usable also on wet localities. They graze also reeds and can move in litoral stands.
- Cattle – the same as in horse is valid. Suitable also in wet localities.
- European bison - its activity is year-round and locally intensive. In addition to trampling in pools it also creates so-called dust baths. It gradually leaves them and small areas of early succession stages are created.
- Wild boar - the advantage is that the wild boar is actively digging in the soil, it is probably the main original disturber in wetter locations. The disadvantage is that the localization of its activities cannot be influenced much and in some cases it can destroy underground organs of target plant species.
- Deer and Roe Deer - these are rather only marginally usable animals, for example by attraction to feed stations, shifting trails, etc.

4.3.5 Aftercare

The areas are usually left without subsequent care. After one-time trampling it is advisable to dig up and remove vegetation remains. Long-term trampling on the site must be controlled, ie. gradually moved, extensive trampling can be left without regulation.

4.3.6 Risks and limitations

4.3.6.1 Risks of this method are rather small, as trampling can be planned and managed outside valuable areas with the target groups of organisms. There is no direct death of animals during trampling. However, in places where small populations of rare species occur, it is always necessary to monitor the intensity of trampling.

4.3.6.2 One of the risks is eutrophication, a long-term supply of nutrients in form of excrements in one place. Droppings or manure can be collected and transported, sometimes with the top layer of soil. Eutrophication can be prevented by moving objects where animals are gahtered (shelter, mineral lick, watering place) and rotational grazing.

4.3.6.3 It is advisable to alternate places with and without trampling and avoid intensive and long-term influence of trampling in the same places.

4.3.6.4 Especially intensive trampling can have accompanying negative effects, soil compaction and exposing, erosion and flushing or other removal (mechanically, by wind) of organic matter. Particular care should be taken in sloping terrain. However, in some cases this effect may be desirable, eg. in rocky or steppe habitats where accumulation of organic matter and nutrients takes place.

4.3.6.5 Heavy clay soils are not very suitable for this type of disturbance, where the soil surface is mainly compressed.

4.3.6.5 The disadvantage is that trampling is not located precisely - whether by the nature of less controllable movement of ungulates or the discipline of tourists, athletes, etc. The advantage is that it is a cheap and effective method.

4.4. Military and other vehicles maneuvering

4.4.1 Application of the method

4.4.1.1 During maneuvering off-road and other vehicles, the surface is differentiated into a fine-grained mosaic and depressions are formed. Depending on the type of soil surface (eg. clay, sand), depressions and structures of different character are created. Places with fully or partially exposed surfaces, varying roughness of soil and periodic puddles and pools are created. New pools are created in wetland habitats or pools already filled with sediment are being restored.

4.4.1.2 Maneuvering removes or severely reduces continuous growth of expansive plant species (eg. *Calamagrostis epigejos*, *Brachypodium pinnatum*) cover. There is a change in the character of vegetation in favor of less competitive species (sundew, heather, etc.) and consequently greater involvement of vegetation and gradual grounding to smooth out disturbance.

4.4.2 Method description

4.4.2.1 Difference between military and amateur maneuvering

4.4.2.1.1 Military maneuvering - in training number of vehicles moving in space is determined based on size of the area. The aim of the training is to teach soldiers the ability to improvise, so that they can cope with any situation that may occur on the battlefields. It follows that although there are major routes to move from the base to the training ground, on the actual training ground, soldiers use the entire area to generally "extensive" and at the same time very heterogeneous maneuvering. As a result there are places that are rutted very intensively, ie. to the subsoil, where almost nothing grows, neverthless most of the area is rutted partially and a smaller part of patches remain intact.

4.4.2.1.2 Amateur maneuvering - there is no limit on the number of vehicles per location, amateurs prefer routes that are of interest to them (elevation and terrain division, passage through water, etc.). The rest of the area is mostly neglected. Due to some specific features of the maneuvering, it is important that participants are organized groups with management, with whom maneuvering conditions can be fixed.

4.4.2.2 Differences between maneuvering on large and small areas

In terms of methodology, there is a significant difference in maneuvering planning between large (hundreds of ha) and small (tens or units of ha) areas to be rutted (up to 50 ha). The distribution according to the area is approximate and always depends on local conditions.

4.4.2.2.1 Areas of approximately 50 ha or more with large sites of homogeneous character, i. e. mainly former military areas (eg. Milovice, Ralsko). It is not necessary to regulate maneuvering, the only necessity is to set aside sites important to some more sensitive species, especially those whose populations are low or on the verge of existence.

4.4.2.2.2 Areas of about 50 ha and less. Military or other off-road vehicles should not travel across the entire area. It is important that some areas remain intact in order to compare the travel effect and as a "back-up" for regeneration of residual and often last populations in the

region. These are species that have specific requirements or do not tolerate significant disturbances (many plant species, anthills of *Myrmica* ants etc.) or even species associated with early succession stages however, with so small populations on the site that they require finer care methods (eg. shallow nesting Hymenoptera - larvae are in the soil and "plowing" of the soil could destroy the population). Also, most of the target phenomena are not supported by maneuvering at the highest intensity, ie. when spots of bare surface are permanently disturbed. This must also be taken into account.

4.4.2.3 Route design

4.4.2.3.1 Route design in large areas

4.4.2.3.1.1 Generally, on large surfaces it is possible to experiment with maneuvering more than on small ones. The route and time need not be carefully selected and, apart from potential slight limitations, it is basically possible to travel anytime and anyhow.

4.4.2.3.1.2 If it is known that there are places with occurrence of exceptional species, whose populations are low or on the verge of existence (whether plants or animals), it is necessary to prevent their crossings by simple restrictions.

4.4.2.3.1.3 If there is the effect of amateur maneuvering, when only a small area is rutted very intensively, it is advisable to create new routes and let the old ones gradually overgrow. Coordination is aimed at increasing heterogeneity in the locality.

4.4.2.3.2 Route design in small areas

4.4.2.3.2.1 Before commencing maneuvering in small areas, it is necessary to go through the locality and assess the course of the route so that the maneuvering creates the most varied spectrum of habitats possible and consider the desirable goal when designing the route (eg. disruption of the surface, removal of a young forest, renewal of pools).

4.4.2.3.2.2 When planning a route, it is important to consider whether soil enrichment by organic nutrients pushed by tanks into the soil is desirable. Where undesirable, it is advisable to remove woody plants in advance or to cut and rake grass cover.

4.4.2.3.2.3 It is important to avoid places that are unique in the locality and in the given season represent refuge for animals. For example, in a dry year it is not advisable to go through the only remaining pool in the locality where aquatic species have been withdrawn.

4.4.2.4 Adjustment of the route

It is necessary to take into account the capabilities of military vehicles:

4.4.2.4.1 Tanks do not overcome too steep slopes and banks.

4.4.2.4.2 Tanks do not pass over low stumps that get into their caterpillar tracks, and the belts fall. It is therefore not possible to use them for restoration of an area after felling a forest, orchard, etc. However, it is possible to prepare the route for the tanks and remove the stumps before maneuvering.

4.4.2.4.3 Tanks pass through cover of young woody plants up to approximately 15 cm in diameter. It depends on the species of woody plant (wood hardness) and the substrate (sand, clay, etc.). In case of young woody plants, the route for tanks can be prepared by cutting them to higher stumps (about 1m), which are uprooted by moving tanks.

4.4.2.4.4 Disturbance effect in removal or scarification of the turf and creation of bare surfaces occurs mainly when cornering and turning vehicles. Therefore, it is necessary to support these activities in selected suitable places.

4.4.2.4.5 Before organizing a military maneuvering, it is essential to ensure that the public is kept informed of the event and to place announcements of military maneuvering training on all access roads.

4.4.2.4.6 When preparing maneuvering for the first time, it may be helpful to ask someone with practical experience to get a better idea of the maneuvering possibilities, advantages or disadvantages in advance.

4.4.2.4.7 During maneuvering large amount of oil is used. In order to prevent oil pollution, it is recommended to provide an emergency oil spill kit.

4.4.2.5 Marking out route

4.4.2.5.1 Large areas

In large areas, there is usually no need to mark out the route and it is possible to drive without coordination. Also, no time restriction is required. Marking is desirable in two cases:

4.4.2.5.1.1 It is necessary to mark out places where rare species are known to occur, whose populations are scarce or on the verge of existence, and which could be harmed by the travels.

4.4.2.5.1.2 Maneuvering has long been focused on steady routes and there is no wider spectrum of disturbances of varying intensity in the area - it is advisable to close the existing routes and leave the next maneuvering again without regulation or to mark new routes.

4.4.2.5.2 Small or heterogeneous areas

4.4.2.5.2.1 It is advisable to mark the entire route to make it clear to the drivers where to drive. Flagging tape can be used.

4.4.2.5.2.2 Before the start of the event, it is desirable to show the route of the first vehicle to other drivers in order to avoid misunderstandings or confusion in the marking.

4.4.2.5.2.3 Maneuvering can be even several days long. During the event, it is essential to ensure a supervisor, who monitors especially critical points that could be damaged by inappropriate intervention. It is also necessary to specify the time of day, from when to when it is possible to drive on the site.

4.4.3 Technique and materials

For significant disturbances caused by maneuvering, it is possible to use military and other off-road vehicles - tanks, tracked transporters, trucks, smaller off-road vehicles, quads, fire trucks, etc.

4.4.4 Intensity, scale, periodicity

Currently, large proportion of species occurs in landscape in small populations, which can be strongly negatively affected by relatively weak intervention. Therefore, it is important to consider intensity and term of the maneuvering. Maneuvering time and intensity are also dependent on the size of the area where the intervention is planned.

4.4.4.1 Date of maneuvering

4.4.4.1.1 In large localities (hundreds of hectars) it is possible to drive all year round.

4.4.4.1.2 In smaller areas (tens and units of hectars) it is appropriate to consider the term according to local conditions and target phenomena. In case of uncertainty, maneuvering should be directed to a period when animals or plants show the lowest activity. Especially suitable are the autumn months (October, November) and possibly the winter months.

4.4.4.1.3 Usually, however, it is possible to approach the term more freely and to drive in another period or more times during the year.

4.4.4.1.4 Locations that are used by animals at the time of the event (eg. amphibian and reptile wintering sites, amphibian breeding sites) or with concentration of flowering target plant species and vegetation are excluded from maneuvering.

4.4.4.2 Intensity of maneuvering

Maneuvering intensity depends not only on frequency of repetitions, but also on other aspects. Account must be taken of the subject of protection (habitat, plant or animal species) and its needs for restoration, conservation or improvement, accessibility, slope and other site conditions. It is essential that maneuvering does not result in only two extremes, ie. very intensely disturbed and undisturbed surfaces. The aim of the intervention is to create a mosaic of surfaces disturbed with variable intensity.

4.4.4.3 Dependence of intensity on target phenomenon

4.4.4.3.1 Gentle maneuvering, for example one pass through a meadow causing scarification of turf only. The result is similar to eg. harrowing. This is suitable for plants that do not take in continuous turf (eg. dandelions of the section Palustria, orchids, louseworts) for example.

4.4.4.3.2 Medium intensive maneuvering - significant surface disturbance occurs, but there is residual vegetation on the disturbed surface left.

4.4.4.3.3 Intensive maneuvering is used when removing continuous vegetation (eg. bushgrass cover, self-seeding woody plants) or when renewing or creating pools where repeated maneuvering of multiple vehicles is required. The result is bare soil, vegetation-free surface with depressions of different sizes.

4.4.4.4 Dependence of intensity on local conditions

4.4.4.4.1 Soil type - clay soils are more compacted by maneuvering, sandy ones remain longer fluffy after maneuvering.
4.4.4.4.2 Soil moisture - affects the possibilities of disturbing surface. Damp soil gets easily rutted and rapidly compacted.
4.4.4.4.3 In places where maximum rutting is not desired, it is important to check the route and adjust the route if necessary.

4.4.4.5 Periodicity

4.4.4.5.1 Range in which the intervention is repeated depends on the target phenomenon, local conditions and area size.

4.4.4.5.2 In places where the total area is of hundreds of hectars and large parts are homogeneous, it is possible to drive virtually anytime during season. Maneuvering frequency need not be too rectified. However, it is not beneficial to drive along the same routes, where appear bare, permanently disturbed, places without possibility of succession.

4.4.4.5.3 At locations of tens of hectares or less, it is advisable to repeat maneuvering annually, but on modified routes (part of the route may be the same).

4.4.4.5.4 Especially in case of homogeneous areas (eg. large cover of bushgrass, large areas of self-seeding woody plants) and attempts to start different phases of succession or to create more disturbed places, it is possible and possibly also appropriate, to repeat maneuvering several times a year.

4.4.4.5.1.5 It is desirable to alternate maneuvering routes between the individual events at least partially so that areas rutted with variable intensity as well as areas with different degrees of succession (eg. pools or sandy areas at different stages of development).

4.4.4.5.1.6 Due to different intensity of disturbance and selected frequency, a wide range of micro-habitats will be created at the site.

4.4.5 Aftercare

4.5.5.1 In renewed pools or at oligotrophic sites (eg. sandy areas), aftercare is not necessary. Further intervention is dependent on the succession rate on which the travel frequency depends.

4.5.5.2 Alien invasive plant species may spread on disturbed eutrophic habitats. It is important to reduce them, for example, by mowing before or during their flowering (see the standard SPPK D02 007 Management of selected alien plant species).

4.5.5.3 Maneuvering can easily be combined with any other type of site management, including (semi) natural grazing.

4.4.6 Risks and limitations

4.4.6.1 For the use of maneuvering knowledge of species occurring in the locality is important in order to avoid unsuitable interventions in places with occurrence of species rare and at the same time susceptible to disturbances or to prevent intervention being directed into an unsuitable period.

4.4.6.2 In areas with eutrophic landfills or otherwise eutrophic habitats, invasive plant species such as *Solidago canadensis* may spread on freshly disturbed areas. Alien invasive or native invasive species that spread by rhizomes, such as *Reynoutria sp.* may be boosted.

4.4.6.3 The disadvantage is negative public perception of obviously drastic interventions in a protected area. Freshly rutted areas look dreadful and unaesthetic, and sometimes part of traditionally used (not official) roads is also rutted. Strongly negatively is also perceived

felling of self-seeding woody plants in connection with tanks. There takes place a significant one-time change in appearance of the site.

4.4.6.4 Possible killing of animals by using military technique - the influence of maneuvering on individual specimens is undetectable, but it is likely that some individuals are killed. While maneuvering, as well as mowing, individuals are lost, but the resulting habitat effect in terms of population is more significant.

5. Conclusion

The aim of this standard is to give basic and rather free guidance on how to support critically endangered species and communities tied to early succession stages in Central Europe today (at least in part of their life cycle). The standard cannot be understood as a universal methodological tool, but rather anchors previously unthinkable practices in nature conservation. It should give erudite conservationists enough freedom and ample opportunities to support the goal of protection quickly and efficiently. Basically, the standard encourages reasonable experimentation, observation, documenting and evaluation of the effects of different types of disturbances, of varying intensity and scope. Unfortunately, current legislation does not allow use of full spectrum of effective types of disturbances (eg. controlled fires) that are commonly used elsewhere in the world. However, even those described in the standard open up new possibilities.

Appendix 1 List of disturbance methods and their application

Method	Advantages	Disadvantages	Optimum term	Target phenomena
Turf scarification using (heavy) technique	Fast effect with return to an early succession stages	Increased probability of spread of invasive plants	Usually October to March; while supporting taking of diaspores of target species direct to the period of seed or spores production	Waterlogged meadows, peat bogs, reeds, heathlands, sandy lands, steppe meadows, salt marshes, mesophilic meadows, pastures, but also anthropogenic stands (sandpits, dumps, sludge lagoons, quarries etc.).
	Possibility of using on areas of different size			Vascular plants, invertebrates
Manual turf scarification	Possibility of creating fine-grained mosaic	High physical and time demands	According to target aimed, removal of competing plants – all season as needed	Competitively weak species linked to early succession stages
	Care focused on specific individuals or populations	Only minor interventions (of the order of tens of m2)	Fragmentation of vegetative parts – July, August	Vascular plants, insects
	Work on places inaccessible to technique		Support of germination – period of target species seeds ripening	
Removal of grass turf	Fast effect with return to an early succession stages	Increased probability of spread of invasive plants	October - March	Waterlogged meadows, peat bogs, heathlands, sandy lands, steppe meadows, salt marshes, mesophilic meadows, pastures and antropogenic stands.
	Possibility to select a mosaic of smaller areas or large areas as needed	Ensure appropriate disposal of removed material		
	Removal and fragmentation of compact covers such as bushgrass, reeds	Problematic removal of material from waterlogged localities		Mosses, vascular plants, insects
	Possibility of restoration of former plant communities from soil seed bank			

Removing litter layer	Creation of patches of bare soil.		October - April	Micro-habitats for insects, plants, mosses
Sheet mulching	Possibility of precise targeting of intervention.	Intervention limited to small areas.	During whole vegetation season	Competitively weak species
		Demanding preparation, i. e. to preparation of the area before intervention, finishing after intervention.		Animals (especially insects) prefer sparse vegetation.
	Effective elimination of undesirable species.	Risk of overlapping target plant species in early stages.		
Human trampling	Possibility to plan suitable routes for continuous activities (hiking trails).	For mass actions, the resulting impact is difficult to estimate.	Depending on local conditions and target phenomena.	Competitively weak species
	Possibility to plan suitable routes for mass events (cross-country and cycling races, raves).	Eutrophication caused by huge number of people.		Areas with sparse vegetation for invertebrates (e. g. Chazara briseis)
	Minimal cost	Intensive trampling leads to soil compaction.		
Trampling by grazing animals	Directing grazing to suitable places using fences or attractive places (watering places, licks ...).	For grazing livestock often inappropriate period.	Extensive grazing suitable year-round	Competitively weak species
	Uneven turf scarification	In livestock grazing usually missing winter grazing. In (semi) natural grazing of large ungulates limited controllability, but disturbances arise in	Short-term intensive grazing according to local. conditions and target phenomena.	Areas with sparse vegetation for invertebrates (e. g. *Hymenoptera*, *Chazara briseis*).

		natural mosaic.		
		Eutrophication caused by supplemental feeding or huge number of animals.		
		Trampling cannot be located precisely.		
Military vehicles maneuvering	Vegetation is destroyed with varying intensity, resulting in fully or partially exposed surface.	Increased probability of spread of invasive plants.	October - February	Animals linked to temporary pools (e. g. fairy shrimps and tadpole shrimps).
	Rutting of soil surface and creation of various roughness on land and in water.	Negative perception of interventions by public.		Pools for amphibians and insects linked to water environment.
	Formation of various types of puddles and pools in wetland habitats.			Organisms linked to early succession stages.

Appendix 2 List of processed Standards of nature and landscape management (Series D -Management of selected terrestrial biotopes)

00 General

00 001 Terminology

02 Technological procedures

02 001 Restoration of grasslands communities using regional seed mixture

02 002 Restoration of long-term unmanaged grassland communities (including removal of natural seeding woods)

02 003 Grazing

02 004 Mowing of grasslands

02 005 Disturbance management on non-forest areas

02 006 Measures to improve the structure of forest stands

02 007 Management of selected alien plant species

03 Occupational safety and health protection

SPPK D02 001

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2018