LIFE ADAPT BRDY

Co-funded by the European Union

NATURA 2000

Ministerstvo životního prostředí

LIFE ADAPT BRDY

# D2.3

# General management guidelines

Project 101074426 – LIFE21-CCA-CZ-LIFE Adapt Brdy

Climate Change Adaptation of Forests in the Brdy Highland

| Version | Date | Author/Organization |
|---|---|---|
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# Content

# 1. Introduction and assignment

One of important outputs of LIFE ADAPT BRDY are modified General management guidelines (RSH). According to agenda of the project, these are to contain prescriptions and principles for application of near-natural silvicultural approaches, which aim to adaptation of contemporary forest stands to climate change, i.e. a conversion of monocultures with dominant Norway spruce (NS) into stands manifesting diverse species, age and multistorey structures. This task directly follows the output of T2.1 and T2.2 task with outputs D2.1 and D2.2 – foundation of demonstration objects (DO) and operational Forest Inventory and it is a prerequisite for an elaboration of a guide for foresters (T4.2, D4.1).

The GMG emphasize a long-term basis of the prescribed measures. It is obvious that such change, i.e. a conversion towards the target condition, cannot be achieved over one rotation. To speed up the change, this project also emphasizes the need for a decrease of hoofed game density to stop the game damage, especially on natural regeneration.

# 2. Information source and methods

**The study area natural conditions taken into consideration**

Regarding differences in soils and stands (based on the forest site classification), the contemporary forests were differentiated as follows:

1. beech with oak on acidic and nutrient-medium soils (CHS 43 a 45)
2. fir with oak on nutrient-medium gleyic and acidic gleyic soils (CHS 47)
3. beech with fir and spruce on acidic, nutrient-poor and stony soils (CHS 51 a 53)
4. fir with beech and spruce, wet fir, wet nutrient-poor spruce with fir + ash with sycamore (CHS 57, 59, 79 a 29).

This differentiation represents the majority of forest type groups (SLT) present in the area of interest. The attributes of all DO and their affiliation to the groups of management guidelines are presented in table 1. Based on valid forest management plans (LHP), we included the dominant SLT (based on tree species domain in generalized soil and other conditions) with share of 10 % and more on DO. It is clear from the overview that there are often diverse environmental conditions at DOs. The most homogeneous (one group) in this direction are DO "Pod Slonovcem" and "Vosecká". On the contrary, the most varied (three groups) are the conditions at DO "Kudibal" and "Kreslovna". The other DOs represent two groups of conditions according to the above mentioned differentiation.

*Table 1: The demonstration objects affiliating to particular groups of general management guidelines (RSH).*

| Name of DO | Prevailing forest site group (SLT)[1] (% by area) | CHS[2] | PCHS[3] | Group of general management guidelines (RSH) |
|---|---|---|---|---|
| Pod Slonovcem | 3K+4K (91 %) | 43 | 43 a,b | 1 |
| V můrách | 3I+4I (57 %) | 43 | 43 a,b | 1 |
| | 3O+3P+4O+4P (42 %) | 47 | 47a,b | 2 |
| Brdce | 5K+5M (57 %) | 53 | 53 a,c | 3 |
| | 5N (25 %) | 51 | 51 a | 3 |
| | 6P (18 %) | 57 | 57e | 4 |
| Čihadla | 6K+6M (73 %) | 53 | 53 b,c | 3 |
| | 6Q (23 %) | 57 | 57e | 4 |
| Rafanda | 5K+5M (68 %) | 53 | 53 a,c | 3 |
| | 5P (19 %) | 57 | 57e | 4 |
| | 7T (12 %) | 79 | 79a | 4 |
| Vosecká | 6K+6M (51 %) | 53 | 53 b,c | 3 |
| | 6N (47 %) | 51 | 51b | 3 |
| Štítov | 4S (47 %) | 45 | 45 b | 1 |
| | 4O (47 %) | 47 | 47a | 2 |
| Kudibal | 4P (63 %) | 47 | 47b | 2 |
| | 4I (25 %) | 43 | 43b | 1 |
| | 5G (11 %) | 59 | 59b | 4 |
| Kreslovna | 4I+4K (42 %) | 43 | 43b | 1 |
| | 5O+5P (25 %) | 57 | 57 b,e | 4 |
| | 4O+4P (23 %) | 47 | 47a,b | 2 |
| Rokle | 4P (90 %) | 47 | 47b | 2 |
| | [3U (8 %)] | [29] | 29g | 4 |
| Horní muničák | 4P (55 %) | 47 | 47b | 2 |
| | 4I+4K (42 %) | 43 | 43b | 1 |

*Captions: [1]tree species domains: 3 beech-oak; 4 beech; 5 beech-fir; 6 beech-spruce; 7 spruce-fir; soil conditions: S nutrient-medium; K acidic; I compacted acidic; M nutrient-poor; N stony acidic; O nutrient-medium gleyic; P acidic gleyic; T nutrient-poor wet; G nutrient-medium wet; U valley); [2]target management unit; [3]target management subunit*

**Consideration of three forest development types (FDT)**

The three FDT (target – transitional – distant) were differentiated based on the three criteria such as share of spruce, % area covered with natural regeneration and stand storeys (table 2).

*Table 2: Forest development types according the attributes.*

| | Species composition (% share of NS) | Relative area (%) of natural regeneration | Height structure (number of storeys) |
|---|---|---|---|
| **A – target** | <50 | >50 | >2 |
| **B – transitional** | 50 – 75 | 5 - 50 | 2 |
| **C – distant** | >75 | <5 | 1 |

As for species composition, the distinguishing criterion is a share of Norway spruce (NS). Its share reflects different growing conditions generalized in target management units (CHS); it is expected generally that NS share will be less than 50%. On the other hand, more than 75% share of NS classifies the stands in the context of project strategy as distant ones. A transitional type covers all range between these two limits.

Regarding the presence of natural regeneration, the limits are between 5 and 50% of stand area, where 5% represent the distant type and more than 50% is a target type. Again, a transitional type covers all range between these two limits.

The last criterion is a height structure characterized by a number of storeys present. The target are multi-storey stands with mosaic of groups or even various trees. The boundary distinguishing the types of development are two storeys. One-storey stands are a distant type, two-storey stands are a transitional type and multi-storeyed stands reflect the satisfactory condition.

It is supposed that real conditions of forest stands will be often a combination of the criteria. Therefore, more weight is given to the share of NS, less important is % area of natural regeneration and the least one is the height structure. Every case ranking will be regarded according to the target needed including relevant forestry practice capacity and facility (D2.2). For example, a multi-storeyed, naturally-regenerated NS monoculture would be ranked as the target type. If it is on upper water-logged site with area less than 0.5 ha, one can accept that. However, if the NS monoculture is larger or at lower altitude, it is likely to be ranked as transitional or distant type.

Large clearcuts exceeding 1 ha of area and inappropriately thinned (high h/d ratio, short live crowns posing a risk of abiotic damage) stands are also the distant type.

As mentioned above, the shift on the way between distant→transitional or transitional→target cannot be accomplished over one rotation. More quick achievements are supposed in conversion of the distant type to the transitional one by mitigation the hoofed game pressure on natural regeneration and regeneration of other tree species (for example beech and fir) by underplanting or udersowing.

**Information sources**

The prescriptions, particularly for dominant spruce stands, are based on regional plans of forest development, long-term research and experience of practice. The sources are:

- Approved Regional plan of forest development (OPRL) for Natural forest area (PLO) 7 – Brdská vrchovina with validity 2023-2042. Download at: https://www.uhul.cz/wp-content/uploads/OPRL_PLO_7.zip.
- Certified methodology issued in edition Forestry guide (LP) focused on stabilisation and extending the life of existing spruce stands for the needs of their conversion, including silviculture recommendations for following stands:
    - LP 4/2007 - Thinning of forest stands of the main forest tree species. Download at: https://www.vulhm.cz/files/uploads/2019/03/lp_2007_04.pdf
    - LP 4/2008 – Guidelines for Norway spruce stand transformation on sites naturally dominated by mixed forest stands. Download at: https://www.vulhm.cz/files/uploads/2019/03/lp_2008_04.pdf

- LP 13/2016 - Methods of thinning for silvicultural, ecological and economic optimum of beech forest stands in forest management units 43 and 45. Download at: https://www.vulhm.cz/files/uploads/2019/03/LP_13_2016.pdf
- LP 14/2016 - Methods of thinning for silvicultural, ecological and economic optimum of spruce forest stands in forest management units 43 and 45. Download at: https://www.vulhm.cz/files/uploads/2019/03/LP_14_20161.pdf
- LP 7/2017 - Soil improving and stabilising functions of forest trees in site complexes of pine and spruce management. Download at: https://www.vulhm.cz/files/uploads/2019/03/LP_7_2017.pdf
- LP 10/2018 - Silviculture of declining spruce stands, a set of thinning measures for areas exhibiting die-off. Download at: https://www.vulhm.cz/files/uploads/2019/03/LP_10_2018_web.pdf
- LP 5/2020 - Silviculture measures in drought-endangered forest stands at sites dominated by non-native spruce. Download at: https://www.vulhm.cz/files/uploads/2021/02/LP_5_2020.pdf
- LP 10/2021 - Silviculture techniques in spruce and pine stands threatened by snow and wind. Download at: https://www.vulhm.cz/files/uploads/2022/02/LP_10_2021.pdf

- Management principles in forests managed by the project partner – State forests of Saxony (Sachsenforst). Citation: Richtlinie zu den Waldentwicklungstypen im Staatswald des Freistaates Sachsen. Teil 1 und 2. Graupa, Staatsbetrieb Sachsenforst 2013, 41 p. + annexes
- Conclusions from online meeting (27. 2. 2024) T3.2 (Innovation and upscaling of EU funded projects). A record of the meeting is available at https://www.youtube.com/watch?v=IfG1uNipXSI.

# 3. Elaborated General management guidelines (RSH)

RSH are elaborated that way – each group 1 – 4 contain prescribed measures for three types of forest development (A – target, B – transitional and C – distant). At present, the demonstration objects are composed of different stand types (PT), i.e. not only the spruce ones. Therefore the options were segmented as individual tables (see appendices). The document then contains:

- RSH 1 (43_45) **Acidic and nutrient-medium beech with oak** – four tables for PT: 431+451, 433, 435, 436
- RSH 2 (47) **Nutrient-medium gleyic fir with oak** – two tables for PT 471, 476
- RSH 3 (51_53) **Acidic, nutrient-poor and stony beech with fir and spruce** – one table for PT 511+531
- RSH 4 (57_59_79_29) **Acidic, nutrient-poor and nutrient-medium fir with beech and spruce, wet fir, wet nutrient-poor spruce with fir+ash with sycamore** – four tables for PT 571+591, 597, 791, 291

# 4. Conclusion

General management guidelines present a general approach of management measures elaborated from available information basis and present-day knowledge of forest management of stands with dominant spruce on sites of former mixed stands. Based on guideliness, the detailed procedures taking the present-day stand conditions into consideration (outputs D2.1 and D2.2) will be elaborated in the following activity and the guide for foresters (T4.2, D4.1).

# 5. List of acronyms

CDS – target species composition
CHS – target management unit
DO – demonstration object
HZ – silvicultural system (P – shelterwood, N – strip felling, H – clearcutting, V – selection cut)
LHP – forest management plan
LVS – forest vegetation zone
NT – sanitary (salvage) cut
OPRL – regional plan of forest development
PLO – natural forest area
PT – stand type
RSH – general management guidelines

**Tree species:**

| Czech | English* | Scientific name |
|---|---|---|
| BB – javor babyka | FM – field maple | *Acer campestre* L. |
| BK – buk lesní | BE – European beech | *Fagus sylvatica* L. |
| BO – borovice lesní | SP – Scots pine | *Pinus sylvestris* L. |
| BR – bříza bělokorá | SBI – siver birch | *Betula pendula* Roth |
| BRP – bříza pýřitá | BI – downy birch | *Betula pubescens* Ehrh. |
| DB – duby letní a zimní | OK – pedunculate + sessile oaks | *Quercus robur* L. + *Q. petraea* (Matt.) Liebl. |
| DG – douglaska tisolistá | DF – Douglas fir | *Pseudotsuga menziesii* (Mirb.) Franco |
| HB – habr obecný | HBM – hornbeam | *Carpinus betulus* L. |
| JD – jedle bělokorá | SF – silver fir | *Abies alba* Mill. |
| JDO – jedle obrovská | GF – grand fir | *Abies grandis* (Doug. ex D. Don) Lindl. |
| JL - jilmy | EM – elms | *Ulmus* sp. |
| JLH – jilm horský | WEM – wych elm | *Ulmus glabra* Hudson |
| JR – jeřáb ptačí | ROW – rowan | *Sorbus aucuparia* L. |
| JS – jasan ztepilý | AH – ash | *Fraxinus excelsior* L. |
| JV – javor mléč | NOM – Norway maple | *Acer platanoides* L. |
| KL – javor klen | SY – sycamore maple | *Acer pseudoplatanus* L. |
| LP – lípa srdčitá | SLI – small-leaved linden | *Tilia cordata* Mill. |
| MD – modřín opadavý | EL – European larch | *Larix decidua* Mill. |
| OL – olše lepkavá | CAR – common alder | *Alnus glutinosa* (L.) Gaertner |
| OLS – olše šedá | GAR – grey alder | *Alnus incana* (L.) Moench |
| OS – topol osika | ASP – aspen | *Populus tremula* L. |
| SM – smrk ztepilý | NS – Norway spruce | *Picea abies* (L.) Karst. |

**borrowed from Jenkins et al. 2011. Tree Species – Adocument listing the tree species included in the 2011 Production Forecast.*

# 6. Appendices

- RSH 1 (43_45)
- RSH 2 (47)
- RSH 3 (51_53)
- RSH 4 (57_59_79_29)