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FORRISK

Cross-border forest risk management

© Thomas Kirisits

BOKU

Mendel University in Brno

Federal Institute of Agricultural Economics, Rural and Mountain Research

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Introduction

This brochure gives a brief orientation on the project “Cross-border risk management in forestry” (FORRISK) and its outputs, covering risk identification, potential current and future risks, and brief recommendations how to deal with the occurring problems according to site conditions, forest stand types and structure, and size of owned forest land, specifically in the neighbouring regions of Austria and Czech Republic (Figure 1). Integrated management of bark beetles, which have been a major risk factor in recent years in the project area, is also outlined.

Due to:

- recent approaches to afforestation, reforestation (planting) and/or natural regeneration (i.e. tree species and site selection, tree density and planting methods);
- inappropriate tending and rejuvenation of forest stands (e.g. clear-cuts with artificial forest stands establishment as predominant silvicultural method, thinning at a too late stage, if at all, and/or at low intensity);
- maintaining labile forest structures (even-aged coniferous monocultures);
- changing and extremely varying environmental conditions (climate change: temperature increase, precipitation decrease and variability, more extreme climatic events such as droughts, floods, wind-storm occurrences; major disturbances caused e.g. by wind, ice, fire, bark beetles; high/persistent deposition of air pollutants and nitrogen depositions);
- high population densities of wild game, particularly roe deer and red deer, and locally also introduced mouflon, sika deer and fallow deer, leading to strong negative impacts on natural and artificial regeneration (browsing and rubbing) and young pole stands (bark peeling) and selective elimination of more rarely represented tree species such as silver fir and hardwoods);
- mass outbreaks of insect pests, particularly bark beetles, and severe epidemics of (mainly fungal) pathogens

forests, particularly those consisting of tree species at inappropriate sites, are under pressure and at high risk to disturbance wordwide and also in the project area. Therefore, forestry has to cope with these risks as best as possible.

No borders exist regarding these actual and potential risks among countries. Rising problems can easily and rapidly expand in area and overcome national borders. In the project area this has in recent years been experienced in the form of a severe and long-lasting drought and an unprecedented mass outbreak of bark beetles. **Therefore, in the Interreg project FORRISK a cross-border cooperation in risk management has been started.**

Figure 1: FORRISK project region on the border between Austria and Czech Republic

Overview on main project outputs

1. The **first output** of FORRISK focuses on the **comparison of the two countries, i.e. Austria and Czech Republic,** especially in their border regions, regarding forests, forest practices, risks, legal situation and future recommendations.

2. The **second output** of FORRISK is a **manual for future crisis and risk management in forestry.** It includes a comprehensive overview of recommendations how to solve the presently occurring and expected problems according to forest stand type, site conditions and size of owned forest land.

3. The **third output** is a **web site functioning as an early warning and recommendation system** including possible management responses and keeping information up-to-date as much as possible, to avoid or mitigate the occurrence of such huge problems experienced in recent years and to minimize economic and ecological losses as well as constraints in ecosystem services.

More details see
www.at-cz.eu/cz/ibox/po-4-udrzitelne-site-a-institucionalni-spoluprace/atcz251_forrisk/dokumenty

www.at-cz.eu/at/ibox/pa-4-nachhaltige-netzwerke-und-institutionelle-kooperation/atcz251_forrisk/dokumente

What is risk and how to deal with it

In forestry, risk is often associated with disturbances and natural disasters causing damage to forests. In a broader sense, risk refers to uncertainty of future events or outcomes. A structured risk management can be visualized as a circular process comprising the phases of risk identification, assessment, control and monitoring (Figure 2).

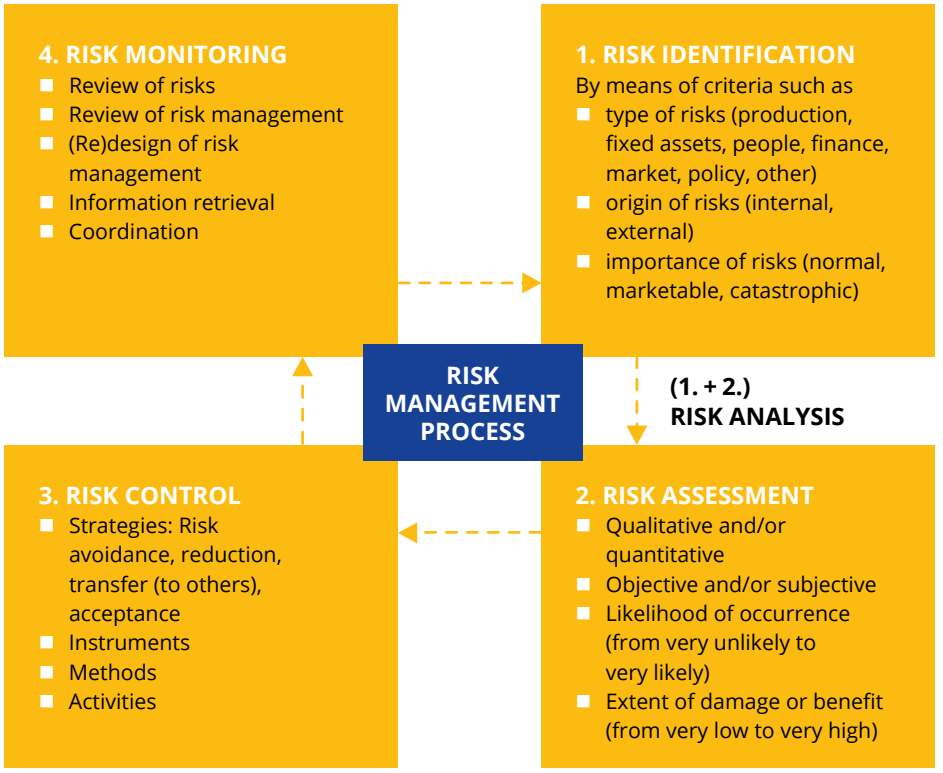


Figure 2.: Example for a circular structured risk management process.

Risks in forestry

After huge forest exploitation in the course of history and due to the shortage of wood on the market, afforestations and reforestation of abandoned agricultural land and pastures have been done since the 19th century. These efforts have been strongly focusing on timber production as main management goal to achieve the maximum economic benefit from the forest. Therefore, forest owners planted tree species with high increment, best processing characteristics, usability and highest marketability with high return rates, namely Norway spruce and Scots pine, even on inappropriate sites far outside of their natural ranges and/or not matching with their potential ecological niches. At the same time, seed material was used regardless of its origin. For efficient and simple management, these forests were established as homogeneous, even-aged forest stands and managed with clear-cutting and artificial regeneration as the prevailing silvicultural system. In recent decades and nowadays accelerated and more and more driven by global change, these forests, and particularly conifer stands on inappropriate sites, have been subjected to high disturbance risks. To minimize these risks, unpredicted response, disintegration or collapse of forests, foresters must put more attention to create resistant and resilient forests and should focus more on preparedness and prevention measures.

Current problems

The current problems of forest management are connected to:

- Forest exploitation in history
- Common use of the clear-cut system
- Artificial regeneration as main regeneration method
- Establishment of unstable even-aged homogeneous stands of conifers (Norway spruce and Scots pine)
- Neglected tending (too late, if any, thicket-sized treatments and thinnings and/or at low intensity)
- Reduction of habitat value and biodiversity
- High population densities of wild game
- Change of chemical composition of air and soil
- Global climate change generally stressing forests and leading to a change in disturbance regimes
- Increasing attack of insects and (mainly fungal) pathogens
- Introduction of invasive alien plants, insect pests and tree pathogens
- Lack or shortage of appropriate reproductive material of many tree species
- Ownership structure with many small forest owners, often lacking expertise and infrastructure to appropriately manage forests.

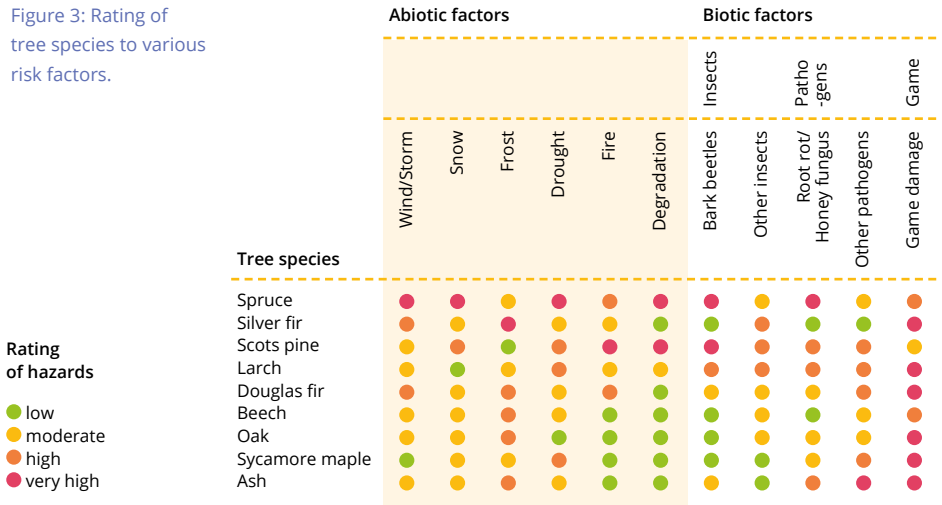
Tree species selection – a key element to avoid risks

Selecting tree species to appropriate sites according to the species's ecological characteristics is a key element reducing risks in forestry. This has largely been neglected in the past, resulting in monocultures of conifers at inappropriate sites, forming unstable forest stands in the project area. Moreover, different tree species vary in their susceptibility to various risk factors, and this has to be considered for their use in forestry. A rating of the main tree species to the major risk factors in the project area is presented in Figure 3.

Preparedness

To be well prepared for risky situations, it is necessary to have actual information from monitoring systems and educational material. Therefore, further readings, information on tree species and their damaging factors, and the diverse assemblage of forest insects and tree diseases as well as data from different monitoring systems are available under the links presented on the right side.

Figure 3: Rating of tree species to various risk factors.



Austria

- Federal Research and Training Centre for Forests, Natural Hazards and Landscape
  www.bfw.gv.at
- Austrian bark beetle-monitoring
  bfw.ac.at/rz/bfwcms2.web?dok=5312
- Institute of Forest Entomology, Forest Pathology and Forest Protection
  ifff-server.boku.ac.at
- Tree species selection in the Mühlviertel – recommendations for the growth-areas of Mühlviertel and Sauwald
  www.land-oberoesterreich.gv.at/files/publikationen/lfw_baumartenwahl_muehlviertel.pdf
- Climate adapted forest
  www.klimafitterwald.at
- Silvicultural recommendations for forestry in Lower Austria
  www.noe.gv.at/noe/Forstwirtschaft/Wb-Empfehlugen-17-11-2015.pdf
- Austrian forest-fire database
  fire.boku.ac.at/firedb/de
- Central Institution for Meteorology and Geodynamics
  www.zamg.ac.at
- Austrian Forest Fund – the package for our forests in the future
  www.waldfonds.at
- Information- and communication-platform waldwissen.net – informations for forestry in practice
  www.waldwissen.net

Czech Republic

- Weather actual and historical info
  www.chmi.cz/aktualni-situace/aktualni-stav-pocasi/ceska-republika/pocasi-a-kurovec
- Current drought situation
  www.intersucho.cz
- Fire potential risk
  www.firerisk.cz
- Agricultural risks
  www.agrorisk.cz
- Information about forest status
  www.vulhm.cz/monitoring-stavu-lesa
- Current monitoring of tree stem increment (similarly to tree talker)
  www.emsbrno.cz/p.axd/en/DendroNETWORK.DendroNET
  future dendronet.cz
- Current bark beetle information
  www.kurovcoveinfo.cz and/or
  www.kurovcovamapa.cz

Integrated bark beetle management

From 2015 to 2020 a very damaging outbreak of the European spruce bark beetle *(Ips typographus)* on Norway spruce, triggered by drought (leading to stress and weakening of standing trees) and influenced to some extend also by fallen and broken trees (due to storm, snow and ice), which facilitated the build-up of high population levels of the insect, occurred in the project area. Bark beetle outbreaks are favored by climate change (higher temperature accelerate the insects' development and promote more generations per year; likewise, extreme climatic events such as drought weaken Norway spruce host trees and thus make them more susceptible to attack: moreover, extreme climatic events, particularly storms, lead increasingly to fallen and broken trees, on which bark beetles can build up high population densities) and have been increasing in importance in recent decades. Consequently, bark beetle management, for which forest owners are responsible according to the respective laws in Austria and Czech Republic, will remain important in the future, in areas where mature spruce stands occur.

Figure 4: Elements of integrated management of bark beetles *(Ips typographus)* recommended/ practiced in Austria and Czech Republic.

CONSERVATION BIOLOGICAL CONTROL
Conservation biological control
→ promotion of natural enemies

SALVAGE AND TIMBER LOGISTICS
→ timely removal or treatment (e.g. de-barking, chopping, wet storage) of suitable breeding material

SILVICULTURE, FOREST MANAGEMENT
→ stable stands, tree species composition, accessibility

EARLY DETECTION OF INFESTED TREES
→ mainly ground surveys

DOCUMENTATION OF INFESTED AREAS

SANITATION
→ removal and treatment (e.g. debarking, insecticides, Storanet®, wet storage) of infested material

TIMBER STORAGE
→ wet and dry storage (to preserve timber quality, prevent infestation, respectively avoid emergence of beetles)

MONITORING
→ pheromone traps, trap trees, PHENIPS plus, ...

CATCHING OF BEETLES
→ trap trees (timing of measures!), pheromone traps, Trinet®, ...

Figure 4 illustrates elements of integrated bark beetle management. An important preventive future strategy in areas at high risk is the establishment of mixed species stands with a low share of Norway spruce. Futhermore, stands should be established and tended (early, frequently, with moderate to high intensity) in a way that they show stability towards wind and snow, so that the provision of large quantities of breeding material for bark beetles is avoided.

In the case wind and snow damage occurs, potential breeding material needs to be removed or treated (e.g. debarking, chopping) timely or appropriately stored (e.g. wet storage). If bark beetle infestations on living trees are increasing (e.g. after an extreme drought as experienced since 2015 in the project area), a regular monitoring of forest stands (ground surveys) at short intervals is essential, in order to detect infested trees and sanitate (remove and treat) them as soon as possible. The documentation of infested areas facilitates follow-up surveys to locate bark beetle-attacked trees. Monitoring (with pheromone traps or trap trees or by using online models such as PHENIPS pus in Austria), catching of beetles and timber storage complement the integrated management of bark beetles. Finally, the promotion of natural enemies of bark beetles is desirable, by diversifying forests in terms of tree species and forest structure (which favors biodiversity including bark beetle predators and parasitoids).

Forest recovery after a calamity

Important recommendations for regeneration

- Consider the changing site and climatic conditions for risk assessement for tree species choice;
- Prefer natural regeneration (of tree species appropriate for the site) with integrating pioneer trees or two-phase regeneration using pioneer tree species as shelters for late-successional tree species (nurse crop system);
- Use plants of high quality and appropriate provenance for planting measures, manipulate plants carefully and use appropriate planting methods (according to plant size and site characteristics);
- Use vigorous, site-adapted wild seedlings for regeneration, particularly if appropriate provenances of tree species are not available in forest nurseries;
- Choose the appropriate planting design according to the growth performance and competitive behaviour of the tree species;
- Reduce game population in areas with high negative game impact substantially (at least temporarily) with priority and/or protect plants from game damage (fence, tree shelters);
- Reduce wind movement in calamity areas of large size (e.g. by leaving standing dead trees, creating piles from brush).

For recommendations in Austria see www.land-oberoesterreich.gv.at/files/publikationen/Forst_Laubholz.pdf

For recommendations in Czech Republic see www.uhul.cz/ke-stazeni/generel-obnovy

Possibility of recovery

Natural regeneration (secondary succession)

Combination of natural and artificial regeneration

Artificial regeneration by planting or seeding

Prevention – application of adaptation strategies

Main recommendations

- Keep more or less permanent forest cover (size of gaps according to the light-ecological requirements of the tree species; from 0.05 to 0.5 (0.8) hectares) to avoid climatic extremes;
- Promote and/or maintain tree species mixture integrating also pioneer tree species, in order to utilize their different ecological demands and tolerance to various stress and disturbance factors; if site conditions allow, three or more tree species in a stand are desirable;
- Keep, respectively establish diversified forests, not only in tree species and their genetic composition and diversity, but also in their size and age, and in their vertical (two- or multi-layered) and horizontal structure (small-scale distribution of different stand elements); support particularly also regeneration;
- Consider micro-site conditions in silviculture;
- Manage and tend a forest in order to facilitate its resistance and resilience to disturbances (tend early, frequently and with moderate to high intensity; maintain diversity and species mixtures);
- Transform or restore very unstable forest stands into stable stands with high urgency;
- Keep the various abiotic and biotic disturbance and risk factors carefully in mind, and consequently, monitor forest stands regularly for important damaging factors (e.g. game, bark beetles, pine weevil, damage due to wind and snow) in order to be able to react as timely as possible.

For detail see Catalogue of Forest Adaptive Measures www.frameadapt.cz/vystupy-a-data

Treatment of presently occurring even-aged, monospecific coniferous forest stands

- Transform or restore Norway spruce and Scots pine monocultures into stable forest stands by using adequate high thinning methods or structural thinning;
- Support the natural regeneration of other tree species including especially also ameliorative ones;
- Underplant and use advance planting of suitable tree species to gradual convert monocultures to mixed species stands and diversify forest structure (both vertically and horizontally).

Tending of regenerations, young and pole-sized stands

- Facilitate the occurrence and (at least minimal but permanent) representation of pioneer tree species;
- Support rich mixtured and well-structured stands;
- Tend and thin early, frequently and with moderate to high intensity.

Good practice examples

Czech Republic

- All forest types: ProSilva Bohemica
  prosilvabohemica.cz
- Pine (pure) forest types (lowlands):
  www.mestske-lesy.cz
- Oak – Beech – mixed forest types (uplands):
  www.slpkrtiny.cz
- Spruce – Beech – mixed forest types
  (uplands –mountains):
  www.mlvolary.cz
  www.npsumava.cz

Austria

- Recommendations for tree species selection on all site types in the Mühlviertel (characterised by altitude, terrain, soil depth and water balance)
  https://www.land-oberoesterreich.gv.at/files/publikationen/lfw_baumartenwahl_muehlviertel.pdf
- Silvicultural recommendations for Lower Austria, including Waldviertel
  www.noe.gv.at/noe/Forstwirtschaft/Wb-Empfehlugen-17-11-2015.pdf

Imprint

Editors

University of Natural Resources and Life Sciences, Vienna (BOKU, Lead Partner):
Peter Baier, Elisabeth Gerhardt, Eduard Hochbichler, Markus Immitzer, Thomas Kirisits, Sigrid Netherer, Zoran Trailovic

Mendel University in Brno (MENDELU):
Petr Čermák, Petr Martinek, Antonín Martiník Jitka Meňházová, Radek Pokorný, Dalibor Šafařík, Alena Šamonilová, Tomáš Žid

Federal Institute of Agricultural Economics, Rural and Mountain Research (BAB):
Gerhard Gahleitner, Karin Heinschink, Thomas Resl

Layout

Barbara Veit

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