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„Biodiversity conservation of the native forest in the border region and fostering their ability against the impacts of climate change“

Bilateral strategy of forest reproductive material transport and usage in the Austro-Hungarian border region

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Contents

1. Background

One of the biggest challenges of the 21st century is the anthropogenic climate change and its consequences. According to the European Environmental Agency even under moderate climate scenarios (RCP 4.5) warming of around 2 degrees Celsius is expected by the end of the century, but the pessimistic RCP 8.5 scenario project an increase of up to 6 degrees Celsius. These changes will also have a major impact on our natural world, including a great threat to our forests. As almost half of Austria and about one fifth of Hungary are covered with forests (www.fao.org), in both countries warming climate are likely to affect forest growth, productivity, tree vitality and species composition in the long term (Spathelf et al. 2014). These rapid changes, such as increases in temperature, changes in precipitation and increasing frequency of extreme weather events (Gálos et al. 2007) are beyond the capacity of forests to keep up with. Climate change can also trigger natural catastrophes such as landslides, storms, forest fires or pest outbreaks. The outcomes and consequences of climate change are manifold: some tree species may show persistence, local adaptation or cope with migration, while others may disappear from given regions and be replaced by native or even invasive species. Although these changed environmental conditions affect tree species and habitats differently, forest biodiversity and local tree species compositions possible be altered in many regions in the future (Buras & Menzel 2018). Assuming a limited natural migration capacity and local adaptation, many species are expected to face significant loss of suitable habitats and therefore decreased distribution in the future (Dydreski et al. 2017). Until the end of the 21st century forests undergo remarkable changes and therefore human intervention is unavoidable to mitigate some of the damage what new climatic conditions may cause. Foresters, stakeholders and policy makers must minimize both climate-related environmental and economic risks, because not just the ecological consequences are terrifying, but the economic impacts may be great too. To fight against and to mitigate climate change forest managers should target alternative and new management methods already at present. One approach to compensate for loss of biodiversity and of species distribution range is the selection of suitable, resilient and potentially adapted provenances and seed sources or even new tree species for the future (Sousa-Silva et al. 2018). This is called assisted migration, which is a human supported relocation of species or genotypes within or even beyond their natural distribution range to new locations that are going to be more suitable under future climate conditions to decrease the damage of climate change (Benito-Garzon & Fernandez-Manjarrés 2015). The re- and translocation must be based on scientific evidences such as future climate data, vulnerability maps, projected possibility of occurrence and species distribution modelling and must take local site conditions into account. In every case of assisted migration social, political, economic and ecological issues must be considered. This human altered migration may be crucial already in the present day, because tree species and populations are not able to cope with rapid climate change due to their slow, sometimes several generation-lasting natural migration pace and the geographical barriers. During the application of assisted migration if climate data allows first different genotypes or new provenances of the same species should be considered as replacement, but if it is not possible other native species should be used during the procedure. The final option is the utilization of non-native species for reforestation, but with sufficient knowledge of long-term performance, possible species-specific diseases and invasiveness as an absolute prerequisite. Keeping this order of forest reproductive material origins, the risk of invasion or hybridization may be avoidable. In forestry the main concern in the future is the productivity and its maintenance. Assisted migration

could be a solution to keep forest cover at a higher level and it offers next to better sustainability and higher biodiversity also huge economic benefits for the future.

2. Aims

The aim of our activity is to foster assisted migration initiatives in order to enhance the resilience of the local forest cover in climate change by

(1) reviewing the national legislations and official procedures regarding FRM production, transfer and use;
(2) summarizing the future perspectives of beech and sessile oak forests based on the vulnerability assessment;
(3) formalizing recommendations on the FRM transfer in the programme area.

3. Review of the national regulations on the forest reproductive material transfer

3.1. Austria

Legal background regarding FRM transfer in Austria

As in the European Union a legal framework of forest reproductive material (FRM) transfer already exists, Austrian national legislation is also based on the Council Directive 1999/105/EC of 22th of December 1999. The Act and the Regulation on the Marketing of Forest Reproductive Material in Austria entered into force on 1 January 2003 and is known as “Forstliches Vermehrungsgutgesetz 2003" (Act of Forest Reproductive Material) and the "Forstliche Vermehrungsgutverordnung" (Regulation of Forest Reproductive Material). The Act of Forest Reproductive Material is to be applied: production, import (also from a third country), export (also to a third country), putting forest reproductive material on the market (within the EU).

Species under FRM regulations

The tree species list in Annex 1. (Table A1.1) contains all species that are regulated in accordance with the Act of Forest Reproductive Material. This also includes species that are not important in Austria but in other Member States. Nevertheless, they have been included in national legislation, since in the case of contract cultivation for other Member States or in the case of production for foreign consumers, the cultivation and marketing are subject to official control.

Austrian regions of provenance

In all EU Member States, thus also in Austria regions of provenance are delineated, all regions of provenance apply to all regulated tree species. The delimitation of these regions depends on several criteria such as climatic and topographic similarities (so called biogeographical regions), on natural distribution of species and are based on the forest growth regions. Thus, the different regions identified are largely to be considered as areas with identical or similar ecological conditions. The present division distinguish 22 regions of provenance, divided in nine ecologically similar forest regions (Fig. 1). There are also 7 different altitudinal zones recognised in case of all regions (colline, sub montane, low montane, middle montane, high montane, low subalpine and high subalpine). Since Austrian forests have a comparatively large vertical extent, the altitudinal levels play a particularly relevant role. These classes are so called biophysical elevation classes, taking the

different climatic properties into account, not the actual altitude, therefore the assigned elevation classes differ in the regions (Fig. 2). It can be well illustrated how differentiated the absolute altitude meters are to be seen in the context of the respective altitude stage extensions in the corresponding regions of provenance and how important it is to pay attention not to the concrete altitude value but to the respective altitude stage when transferring reproductive material to another region of provenance. For example, the "middle montane" elevation zone in Region 1.3 varies from 1100-1400m, but in Regions 4.1 and 4.2 the zone varies from 800-1200m and in Region 6.2 from 1000-1100m.

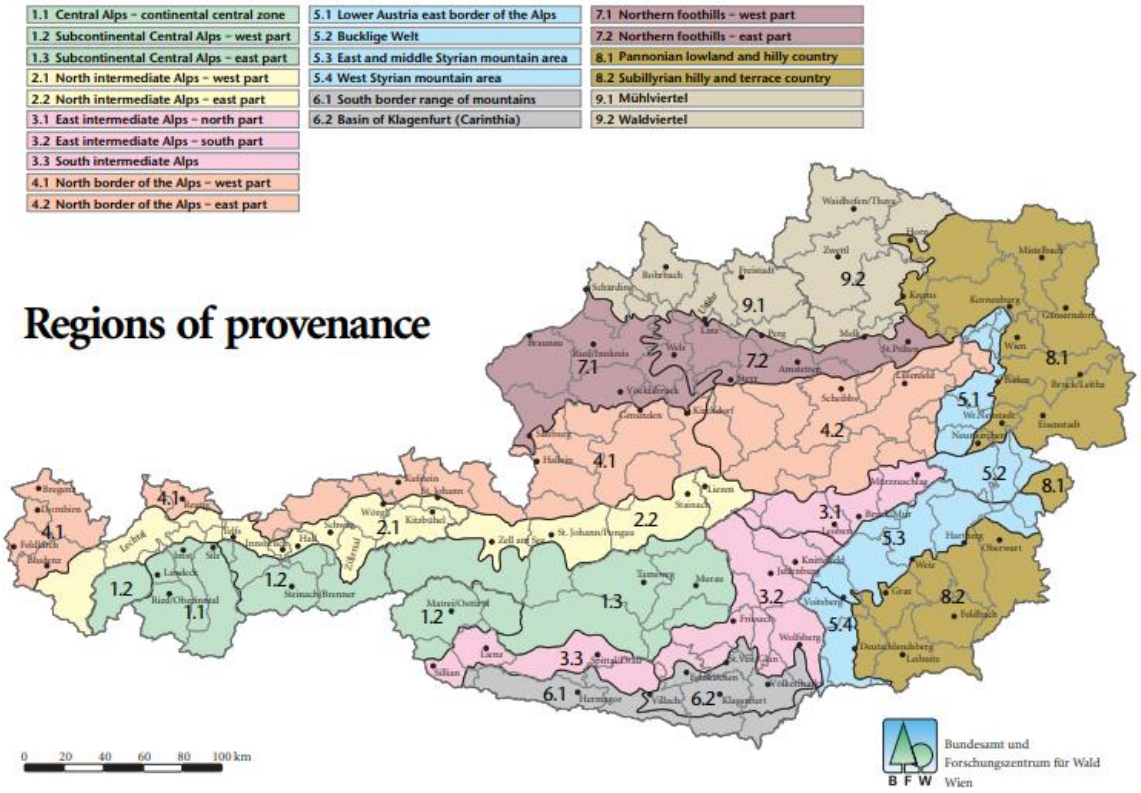

Figure 1: Regions of provenance in Austria (source: BFW)

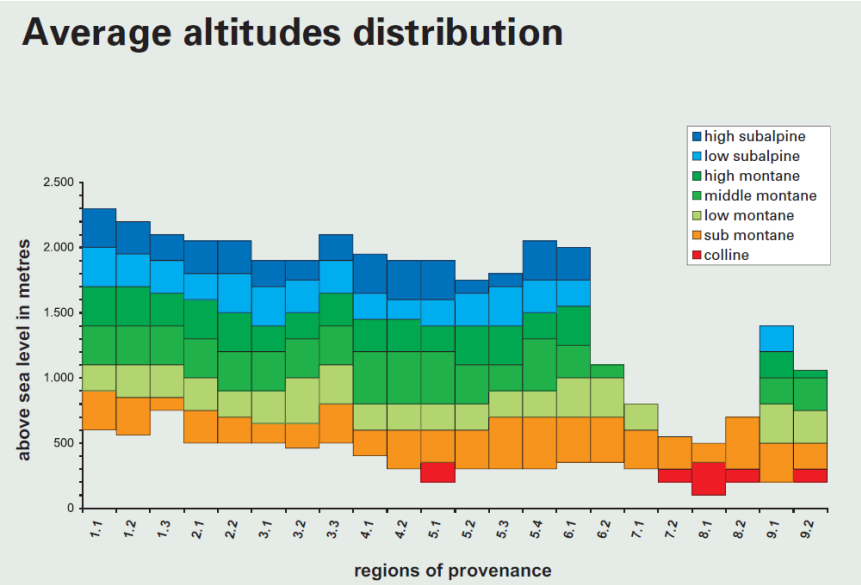

Figure 2: Altitude belts in different Austrian regions of provenances (source: C. Wurzer & I. Strohschneider, BFW)

Categories of FRM

The following four categories of FRM are used in Austria according to the requirements of Directive 1999/105/EC: source identified (exclusively for species newly covered by law), selected (for seed stands), qualified (for seed orchards and poplar clones) and tested. Only 16 tree species are permitted for the production of FRM under source-identified category (Table 1). The rest of the regulated tree species need to be classified under the other three categories.

Scientific name	**Austrian name**
Acer platanoides	Spitzahorn
Alnus incana	Grauerle
Betula pendula	Weißbirke, Gewöhnl. Birke
Betula pubescens	Moorbirke
Carpinus betulus	Hainbuche
Castanea sativa	Edelkastanie, Maroni
Fraxinus angustifolia	Quirlesche
Quercus cerris	Zerreiche
Robinia pseudoacacia	Robinie, Falsche Akazie
Tilia platyphyllos	Sommerlinde
Populus alba	Silberpappel, Weißpappel
Populus nigra	Schwarzpappel
Populus tremula	Zitterpappel
Populus x canescens	Graupappel
Abies grandis	Riesentanne
Quercus pubescens	Flaumeiche

Table 1: Tree species belong to the source-identified category

Recommendations on FRM use in Austria

These provenance recommendations are not mandatory in Austria, but should be considered as professional advices, suggestions.

FRM transfer among EU and third countries

FRM transfer among EU countries is based on the Council Directive 1999/105/EC and follows the regulation of the Austrian national legislation. EU countries which intend to transfer FRM to Austria must inform the Federal Forest Office Austria (Bundesamt für Wald) using information papers. Registered Austrian FRM producers and/or traders when they transfer FRM to other EU countries must inform the Federal Forest Office, which will contact the respective national authorities via information papers. To import and trade with FRM from third countries the legislation of the Council Directive 1999/105/EC and the OECD Forest Seed and Plant Scheme must be followed even if the reproductive material is demonstrably intended for non-forest purposes or for personal use. Import of FRM from third countries requires a granted prior permission from the Federal Forest Office and follows strict phytosanitary regulations. In special cases of importing from third countries, a confirmation is needed from the responsible District Forest Inspectorate (Bezirksforstinspektion) as proof of use for experiments, breeding projects or scientific purposes.

Official control system and administrative procedure of FRM transfer and usage

To authorise a seed stand, an application must be sent by the stakeholder or the District Forest Inspectorate to the Federal Forest Office Austria. Approval of a stand is granted by the Federal Forest Office upon submission of a positive expert opinion. When approving stands, among other things the following requirements must be checked: origin, shape characteristics, age, quality, homogeneity, state of health and resistance, adaptability. The stands, which are approved as source material for FRM are given a register reference number (Zulassungszeichen). Register reference number is mandatory in every case. Invoices and/or delivery notes must contain this number code which identifies the exact location of the seed stand, seed orchard from which the seed or other FRM was collected or taken. This reference number can be found in the National Register of Basic Material held by the Federal Forest Office Austria. Different reference number types belong to the FRM categories (source Identified, selected, qualified, poplar clones in category "qualified"). Additionally, in Austria reference samples are taken from every tree harvested for seed and stored for prospective controls. For official controls, proper documentation through master certificates and delivery notes is necessary. The master certificate in Austria is issued by the District Forest Authority after harvest and consists of four pages: a white folio belongs to the harvest entrepreneur, a pink folio is for the Federal Forest Office Austria, a yellow folio is kept by the District Forest Authority and a blue folio belongs to the forest owner respectively to the owner of the seed orchard or the stool-bed. The master certificate number is the most important basis for ensuring identity and must be stated on the invoice. The master certificate enables official control of the first removal of the reproductive material from the place of collection or harvest and is intended to prevent reproductive material from non-approved basic material or other sources from being subsequently falsely declared. The master certificate is also the basis for control when moving to other Member States, as the master certificate number accompanies the delivery to the forestry end user. For forest seeds from third countries the number used instead of the master certificate number is that of the import permit which is issued by the Federal Forest Office.

For the scheme of the official FRM control scheme in Austria see Annex 2.

References and useful links

http://bfw.ac.at/hkd/herkauswahl.eignerqry
https://www.bfw.gv.at/die-forstlichen-wuchsgebiete-oesterreichs/
https://bfw.ac.at/cms_stamm/Bundesamt/PDF/Poster_FRM_DE_EN_2016.pdf
https://bfw.ac.at/rz/bfwcms.web?dok=5107
https://bfw.ac.at/rz/bfwcms.web?dok=4930
https://bfw.ac.at/rz/bfwcms.web?dok=4167
Kilian W., Müller F. & Starlinger F. 1994: Die forstlichen Wuchsgebiete Österreichs. Eine Naturraumgliederung nach waldökologischen Gesichtspunkten. FBVA-Berichte 82: 1-60.

3.2. Hungary

Legal background

The national legislation on forest reproductive material production, transfer and use in Hungary has been developed in accordance with the Council Directive 1999/105/EC and the OECD Forest Seed and Plant Scheme. The 110/2003. (X. 21.) FVM Decree on the forest reproductive material (ESZR), in accordance with the XXXVII/2009 Act on forestry, forest protection and forest management and the LII/2003 Act on state approval of plant varieties, on reproductive material production and trade, defines the legal background of FRM production, certification, transfer, trade and utilization in order to maintain genetically diverse forest cover that is well adapted to the environment and the evolutionary capacity of natural systems and biological species and taxa by using high quality and well-adapted genetic material in forests.

Species considered by the FRM regulation

The ESZR covers 86 tree species, as well as their varieties and artificial hybrids (Annex 1., table A1.2). In addition to the species listed in the Directive 1999/105/EC, 39 species or groups of species of national interest have been mentioned. Although several species appearing on the Directive list lack any importance on Hungary presently, they have been covered by the national legislation in order to keep their nursery production and planting material trade under official control.

Regions of provenance

In Hungary, the delineation of the regions of provenance has been based on eco-geographical factors including climatic and topographic characteristics, soil properties and water availability information, and on forest typology. The boundaries of these regions follow the borders of the forest management subregions. As topographic features have already been covered in the delineation, there is no additional altitudinal classification.

According to the ESZR, six regions of provenance have been specified for *Fagus sylvatica*, *Fraxinus excelsior*, *Quercus cerris* and *Qu. petraea* (Fig. 3A), five for *Juglans nigra*, *Quercus robur* and *Qu. rubra* (Fig. 3B) and four for *Alnus glutinosa*, *Fraxinus angustifolia*, *Populus alba*, P. *nigra* and *Salix alba* (Fig. 3C). For the species not mentioned above, the entire country is considered as a single region of provenance.

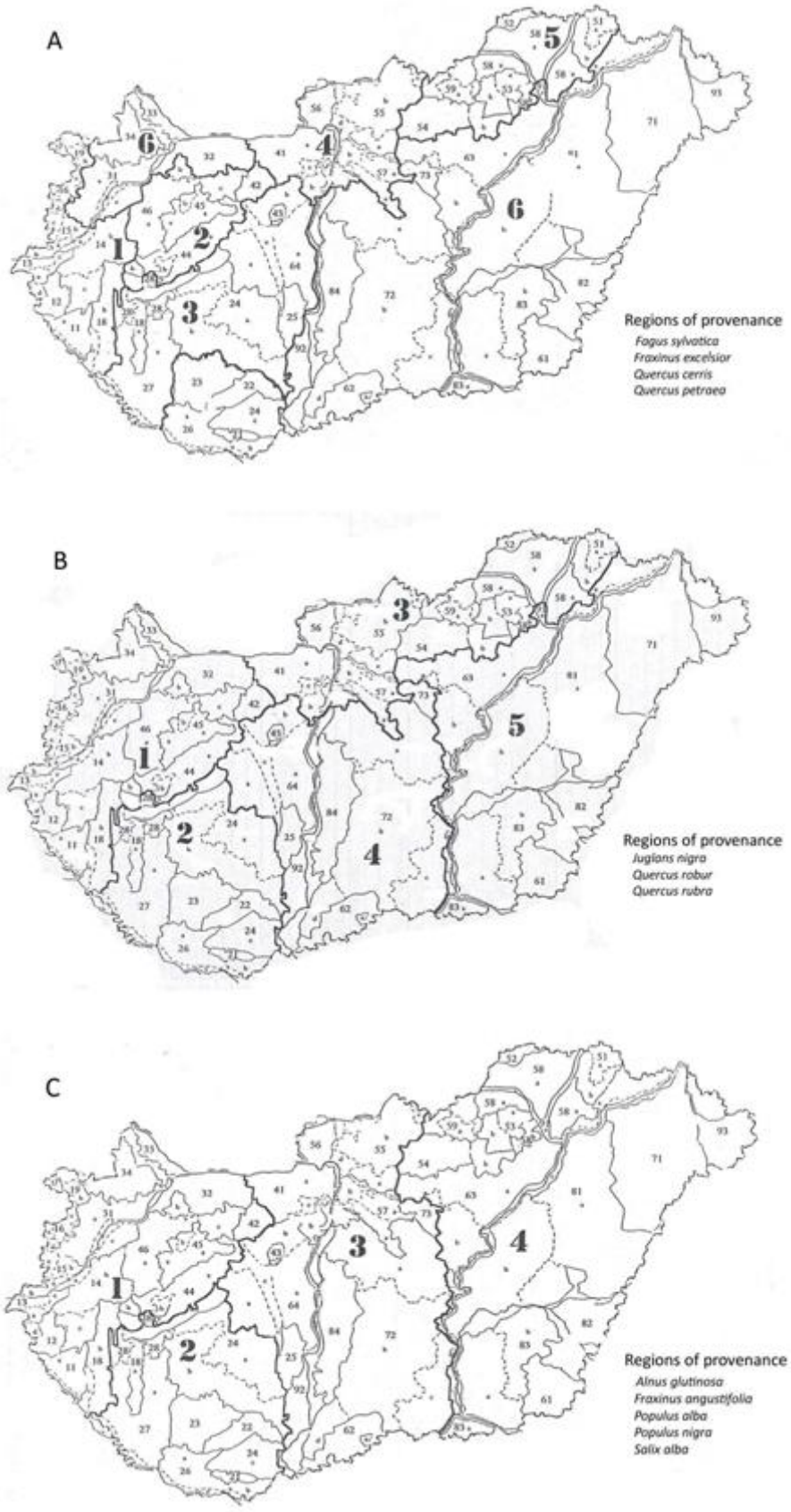

Figure 3: Regions of provenance in Hungary

FRM categories

The ESZR has adopted and applies the 4 categories – source identified, selected, qualified and tested – as specified in the Council Directive 1999/105/EC. Category-based restrictions exist only in case of *Pinus sylvestris* and *Robinia pseudoacacia*, where FRM from 'source identified' category cannot be used for forestry purposes, and of poplar and willow vegetative material, where 'tested' category can be deployed to forest land, exclusively. In case of the rest of the listed species, FRM production, transfer and use is not restricted on the basis of the category of the source.

Recommendations on FRM use

The ESZR contains general recommendations for the use of propagating material within the region of provenance, specifies areas from which FRM transfer is desirable in case of need, provides itemized list of geographic regions to advise conifer FRM transfer to Hungary and specifies areas from which the FRM transfer should be completely avoided. However, these are recommendations only, without any binding power. Generally, there is no subsidy system connected to the use of specific FRM quality, however, limited funds have been made available for supporting the use of pre-adapted sources in artificial regeneration.

Exceptions from quality and administration rules may apply for FRM used for scientific, experimental, demonstration and educational purposes and for nature conservation measures, including forest genetic resources conservation activities.

Use of FRM from other countries

As a general rule, FRM originating from European Union member countries is free to be transferred, marketed and deployed to Hungary following the procedures set by the Council Directive 1999/105/EG and the ESZR. The source of the FRM has to be registered in the EU or listed in the national register of the source country. The appointed authority of the source country is required to contact the Hungarian authority on FRM control, the National Food Chain Safety Office (NFCSO), via information sheets according to the 1598/2002/EC directive.

FRM import from third country is possible if the equivalence conditions set by Council Decision EC/971/2008 are met or a special permission is granted to the registered FRM producer or trader by the NFCSO.

Administrative and control procedures in FRM production, transfer and use

The appointed authority responsible for the official control and administrative activities is the National Food Chain Safety Office (NFCSO). The authority should be contacted via the Regional Government Offices. FRM-related tasks of NFCSO include maintenance of the National Register of domestic sources and the database of the forest genetic conservation units, authorization and control of the establishment of new FRM sources and control of FRM production and transfer. The tracking of FRM transfer through the production chain is facilitated via the master certificate containing the registration number and the location of the source, the type and category of the FRM, the date of the harvest and the quantity harvested.

References and useful links

Forestry Act: https://njt.hu/jogszabaly/2009-37-00-00.27
Implementation law of the Forestry Act: https://njt.hu/jogszabaly/2017-61-20-11
Decree on the forest reproductive material: https://njt.hu/jogszabaly/2003-110-20-82
https://portal.nebih.gov.hu/-/szaporito-alapanyag-gyujt-1

https://portal.nebih.gov.hu/web/guest/-/szarmazas-azonositott-magforrasok-regisztracioja
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https://portal.nebih.gov.hu/web/guest/-/tajekoztatas-3-orszagba-iranyulo-export-eseten-az-eljarasrendrol-kivonat-a-110-2003-x-21-fvm-rendeletbol-

3.3. Summary

Reviewing the legislations and official procedures of the two countries concerning FRM production and transfer, it can be concluded that both national regulations comply with the framework and the minimum requirements set by the Council Directive 1999/105/EC and the OECD Forest Seed and Plant Scheme. The control schemes are set and are in compliance with the Council Directive, the communication channels are well defined between the official bodies.

No additional geographic restrictions are applied on the FRM transfer, only category-based restrictions exist in case of certain species. Although provenance recommendations have been set in the legal background, these are only recommendations without mandatory elements. Thus, assisted migration initiatives in the programme area are not hindered by national legislations.

Although the tracking of FRM is well defined and facilitated via the master certificate and its derivative documents, records on the deployment (final utilization in afforestation) are not preserved.

4. Vulnerability of beech and sessile oak forests in the programme area

Model-based information background on the present status and future perspectives of 7 keystone tree species have been developed by the Interreg CE project SUSTREE in continental scale (CHAKRABORTY ET AL. 2021). Local application and interpretation of the existing species distribution models resulted in detailed information on the future distribution, probability of occurrence and vulnerability of European beech (*Fagus sylvatica*) and sessile oak (*Quercus petraea*) for the Austrian-Hungarian border area. Generally, the REIN-Forest vulnerability assessment projects characteristic changes in the species composition of the forest cover in low and mid-elevations.

4.1. European beech

Vast majority of the low elevation beech occurrences is to be considered moderately vulnerable at the shortest term (2041-2060) only, and severely vulnerable for the end of the century (Fig. 4). Typically, the vulnerability model shows high – and continuously increasing – exposition to adverse climatic regimes in the Hungarian side of the program area, in Burgenland and Southern Styria. However, at the higher altitudes of the Eastern Alps, beech will most probably keep its dominance in forest stands or, at least, is projected to suffer minor losses.

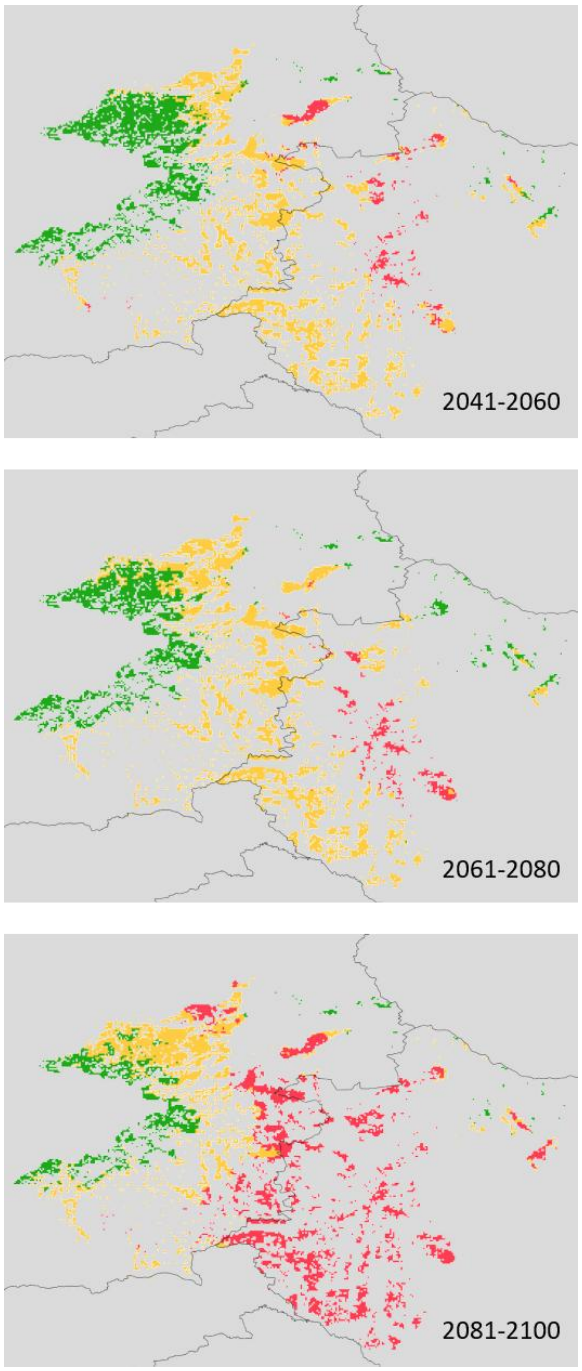

Figure 4. Vulnerability of European beech (*Fagus sylvatica*) stands in the Austrian-Hungarian border region (green: non-vulnerable, yellow: moderately, red: severely vulnerable)

4.2. Sessile oak

Near the xeric (lower) limits of the sessile oak occurrences, the presence of this species will diminish and it will most probably disappear or occur as mixture species only in thermophilous formations. The modelled drop in probability of occurrences suggests notable compositional changes even in the core area where the oak is obviously dominant at the

moment. The vulnerability assessment for the sessile oak shows generally high vulnerability in lowland and colline oak stands, as well as possibility for range extension in the sub-Alpine and Alpine sites of Austria, where sessile oak might be able to capitalize on local habitat losses of beech (Fig. 5).

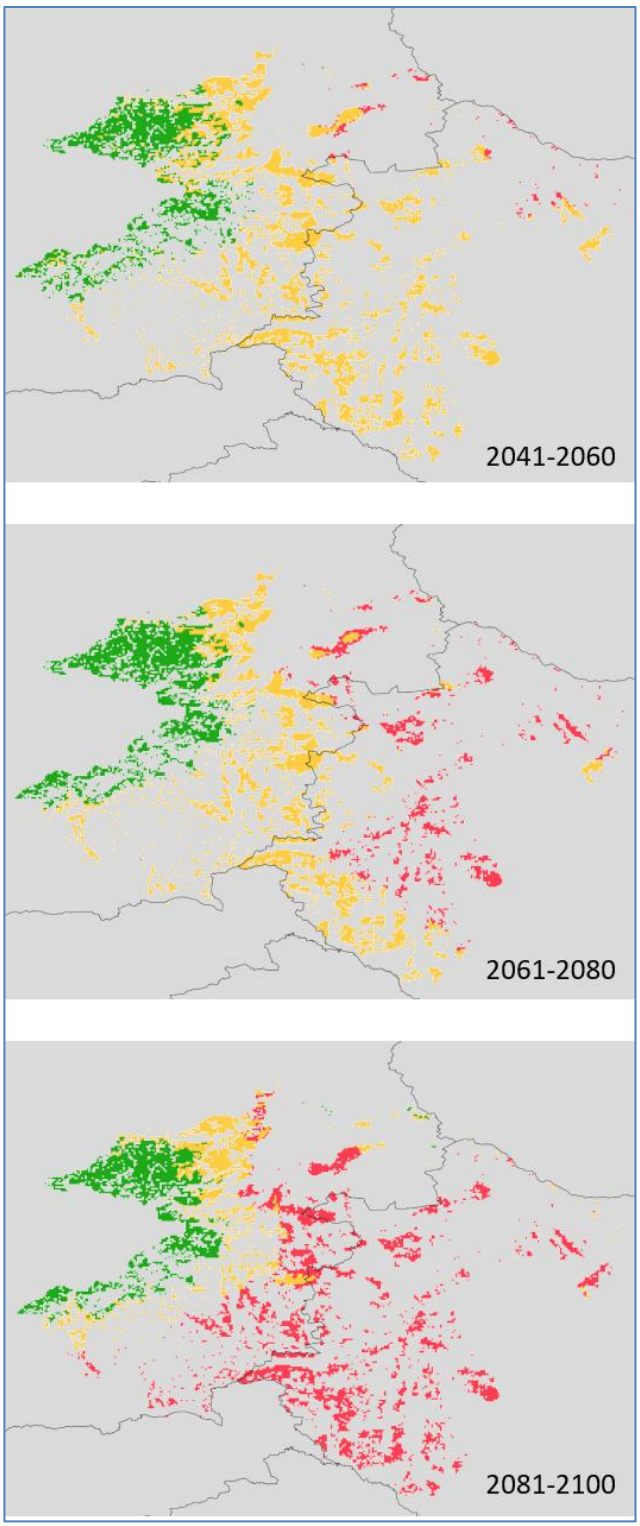

Figure 5. Vulnerability of sessile oak (*Quercus petraea*) stands in the Austrian-Hungarian border region (green: non-vulnerable, yellow: moderately, red: severely vulnerable)

5. Recommendations

Regeneration of forests, being natural or artificial, is based on the utilization of forest genetic resources. Natural regeneration relies on genetic material that is already available on a certain geographic location, while artificial regeneration typically involves FRM transfer. FRM has been traded in Europe for centuries and is being transferred in large quantities today, too, as forest managers seek to minimize the risks and costs of forest regeneration. Most European countries have recommendations or guidelines for selecting species, or even provenances, that can be used in a given site or geographic region. However, these recommendations are mostly based on present or past climatic conditions. They therefore provide limited advice for selecting FRM that will be suitable to form stable stock until the end of their rotation period under notably different climatic conditions than today.

5.1 Local in not the best, anymore

Ecological conditions may vary widely between sites and the magnitude of the selection pressure also varies in different tree populations. Natural selection removes the least suited genotypes at a site and this is used as a basis for the "native species and local provenances should be preferred where appropriate" principle (MCPFE, 1993). Undoubtedly, forest trees exhibit manifold local adaptation to the climate of their habitat guaranteeing optimal growth and survival under stable environmental conditions. Rapid climate change disrupts the link between climate and local adaptation thereby challenging the "local is best" paradigm (Gaviria et al. 2019).

The utilization of forest genetic resources and the transfer of FRM in context of climate change have been discussed at policy level in the FOREST EUROPE process (Koskela et al 2007). Various European projects, including Interreg CE SUSTREE, have tested the feasibility of harmonizing national provenance regions across the continent and have re-evaluated existing provenance trials to predict how climate change will affect forest growth and how individual species and provenances will perform under changing climatic conditions. Artificial regeneration and assisted migration facilitated via systematic transfer of FRM have been identified as unique opportunity and valuable option to enhance the climatic adaptation of future forests (Konnert et al. 2015).

5.2. Assisted migration as an option

Current climate change is altering forest habitat conditions in Europe at such a pace that the natural processes (selection, gene flow, migration) that drive evolution and adaptation will not act fast enough. Therefore, human intervention in the form of FRM transfer (assisted migration) is needed to foster adaptation of forests to changing ecological conditions, especially in those areas that are most severely affected or threatened by climate change. Science has repeatedly shown that the vast intraspecific diversity within forest tree species is a unique resource for climate change adaptation measures. The utilization of this diversity should be prioritized before looking for other native or non-native trees as options for species substitution (see 'three lines of defence' in SUSTREE Policy Brief #2, Chakraborty et al. 2019).

5.3. Recommended FRM transfer in the programme area

Based on the vulnerability assessment results, notable shifts in species composition of natural forests are expected in the border region. Both of the model species will face habitat, or at least, demographic losses throughout their occurrences in majority of the modelled area by the end of the

century. The most severe changes will occur in the Hungarian side of the programme area and in Burgenland (Fig. 4 and 5).

In the non-vulnerable zone, forest managers are recommended to regenerate forests of native species according to the local best practices, whether it is artificial or natural regeneration. Use of local FRM is not contraindicated, however, mixing of FRM from pre-adapted sources during the supplemental plantings is highly advisable.

In moderately vulnerable sites, supplemental or exclusive use of pre-adapted material is recommended. In order to maintain stability and reduce the risks, mixed stands should be established where supplemental species can compensate for the decreasing share of the model species.

In the highly vulnerable sites, where the projected decrease in the probability of occurrence is more than 50% if local FRM will be used in the future, introduction of assisted migration measures is a must. Forest and conservation managers are recommended to identify the populations that are able to tolerate the future climatic environment of the site and rely on these FRM sources in artificial regeneration or in establishment of new forests. Alternative species must also be considered, with priority on native species and on their pre-adapted FRM sources.

5.4. Decision support systems

National-scale recommendation systems have been established to support local forest and conservation managers in Austria (http://bfw.ac.at/hkd/herkauswahl.eignerqry) and in Hungary, too (http://www.ertigis.hu/intranet/krfv/klimarfv.htm).

Continental-scale decision support tool, called SusSelect, has been developed within the framework of SUSTREE project that is publicly available and downloadable from the Google Play (https://play.google.com/store/apps/details?id=com.topolynx.susselect) or other application deposits (https://apkpure.com/susselect/com.topolynx.susselect/, for example). Due to its continental focus, SusSelect is capable of supplying coherent recommendations across the programme area (Annex 3).

Forest managers should consider the applicability and suitability of these support systems and use the one that best matches their own needs and expectations.

5.5. Filling knowledge gaps

The best adapted FRM of today may not prove the best adapted FRM of tomorrow under climate change. By keeping track of successes and failures in management decisions, forest managers will be able to adjust their strategies. Data on FRM – geographical origin, harvesting conditions, genetic diversity and production methods – are likely to be key information sources for plantation efforts, so that forest managers should be particularly keen to ask for and to keep a record. As stated above, authority procedures do not cover any tracking or subsequent monitoring beyond the gates of the nursery. In order to establish solid knowledge base on the potential, applicability and consequences of assisted migration activities, we strongly recommend

(1) keeping records on the deployment of individual FRM stocks, in connection to the forest management plans, forest inventory or FRM-related registers, in order to facilitate evaluation of their field performance (yield, resilience);
(2) establish a feasible monitoring system to measure the performance and stability shown in forest stands and support the managers with data for their future decisions;

(3) making joint efforts on establishing provenance trials that could serve as scientific basis for adaptation studies and for formulating practical recommendations for FRM transfer.

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Annexes

Annex 1. Tree species under FRM regulation in Austria and Hungary

Scientific name	Austrian name
Abies alba	Tanne (Weißtanne)
Abies cephalonica	griechische Tanne
Abies grandis	Riesentanne, Küstentanne
Abies pinsapo	spanische Tanne, Pinsapo-Tanne
Acer platanoides	Spitzahorn
Acer pseudoplatanus	Bergahorn
Alnus glutinosa	Schwarzerle
Alnus incana	Grauerle (Weißerle)
Betula pendula	Weißbirke (Sandbirke)
Betula pubescens	Moorbirke
Carpinus betulus	Hainbuche (Weißbuche)
Castanea sativa	Esskastanie (Maroni)
Cedrus atlantica	Atlaszeder
Cedrus libani	Libanonzeder
Fagus sylvatica	Rotbuche
Fraxinus angustifolia	Quirlesche (schmalblättrige Esche)
Fraxinus excelsior	Esche (gemeine Esche)
Larix decidua	Lärche (europäische Lärche)
Larix x eurolepis	Hybridlärche
Larix kaempferi	Japanlärche
Larix sibirica	sibirische Lärche
Picea abies	Fichte
Picea sitchensis	Sitkafichte
Pinus brutia	kalabrische Kiefer, brutische Kiefer
Pinus canariensis	kanarische Kiefer
Pinus cembra	Zirbe
Pinus contorta	Drehkiefer, Murraykiefer
Pinus halepensis	Aleppokiefer, Seekiefer
Pinus leucodermis	Panzerkiefer, Schlangenhautkiefer
Pinus nigra	Schwarzkiefer
Pinus pinaster	Strandkiefer, Seestrandkiefer
Pinus pinea	Pinie
Pinus radiata	Montereykiefer
Pinus sylvestris	Weißkiefer (gemeine Kiefer)

Populus spp.	Pappeln (diverse)
Prunus avium	Vogelkirsche
Pseudotsuga menziesii	Douglasie
Quercus cerris	Zerreiche
Quercus ilex	Steineiche
Quercus petraea	Traubeneiche
Quercus pubescens	Flaumeiche
Quercus robur	Stieleiche
Quercus rubra	Roteiche
Quercus suber	Korkeiche
Robinia pseudoacacia	Robinie
Tilia cordata	Winterlinde
Tilia platyphyllos	Sommerlinde

Table A1.1: Tree species under FRM regulations in Austria

Scientific name	**Hungarian name**
Abies alba	közönséges jegenyefenyő
Abies cephalonica	görög jegenyefenyő
Abies grandis	óriás jegenyefenyő
Abies pinsapo	spanyol (andalúz) jegenyefenyő
Acer campestre	mezei juhar
Acer platanoides	korai juhar
Acer pseudoplatanus	hegyi juhar
Acer tataricum	tatárjuhar
Aesculus hippocastanum	vadgesztenye
Alnus glutinosa	mézgás éger
Alnus incana	hamvas éger
Betula pendula	bibircses nyír
Betula pubescens	szőrös nyír
Carpinus betulus	gyertyán
Carpinus orientalis	keleti gyertyán
Castanea sativa	szelídgesztenye
Cedrus atlantica	atlaszcédrus
Cedrus libani	libanoni cédrus
Cerasus mahaleb	sajmeggy
Corylus avellana	közönséges mogyoró
Corylus colurna	törökmogyoró

Crataegus monogyna	egybibés galagonya
Crataegus oxyacantha	cseregalagonya
Elaeagnus angustifolia	keskenylevelű ezüstfa
Fagus sylvatica	bükk
Fraxinus angustifolia	magyar kőris
Fraxinus excelsior	magas kőris
Fraxinus ornus	virágos kőris
Juglans nigra	fekete dió
Juniperus communis	közönséges boróka
Larix decidua	európai vörösfenyő
Larix kaempferi	japán vörösfenyő
Larix sibirica	szibériai vörösfenyő
Larix x eurolepis	hibrid vörösfenyő
Ligustrum vulgare	közönséges fagyal
Malus sylvestris	vadalma
Morus alba	fehér eper
Padus avium	zselnicemeggy
Picea abies	lucfenyő
Picea sitchensis	szitkafenyő
Pinus brutia	keleti aleppófenyő
Pinus canariensis	kanári fenyő
Pinus cembra	cirbolyafenyő
Pinus contorta	csavarttűs fenyő
Pinus halepensis	aleppófenyő
Pinus leucodermis	páncélfenyő
Pinus nigra	feketefenyő
Pinus pinaster	tengerparti fenyő
Pinus pinea	mandulafenyő
Pinus radiata	monterey-fenyő
Pinus sylvestris	erdeifenyő
Platanus* x *hybrida	közönséges platán
Populus spp	nyár fajok és hibridek
Prunus avium	madárcseresznye
Prunus spinosa	kökény
Pseudotsuga menziesii	duglászfenyő
Pyrus pyraster	vadkörte
Quercus cerris	csertölgy
Quercus frainetto	magyar tölgy

Quercus ilex	magyaltölgy
Quercus petraea s.l.	kocsánytalan tölgy
Quercus pubescens s.l.	molyhos tölgy
Quercus robur	kocsányos tölgy
Quercus rubra	vörös tölgy
Quercus suber	paratölgy
Quercus virgiliana	olasz tölgy
Robinia pseudoacacia	Robinie
Rosa canina	vadrózsa
Salix alba	fehér fűz
Salix caprea	kecskefűz
Salix fragilis	törékeny fűz
Sambucus nigra	fekete bodza
Sophora japonica	japánakác
***Sorbus* sp.**	berkenyék
Tamarix tetrandra	korai tamariska
Taxus baccata	tiszafa
Tilia cordata	kislevelű hárs
Tilia platyphyllos	nagylevelű hárs
Tilia tomentosa	ezüst hárs
***Ulmus campestris* s.l.**	mezei szil
Ulmus glabra	hegyi szil
Ulmus laevis	vénic-szil
Ulmus pumila	szibériai szil
Viburnum lantana	kányabangita
Viburnum opulus	ostorménfa

Table A1.2: The list of species to which the national FRM regulations apply in Hungary (regular font: listed by 1999/105/EC, italic: additional species listed by the ESZR)

Annex 2. Scheme of the FRM control procedure in Austria

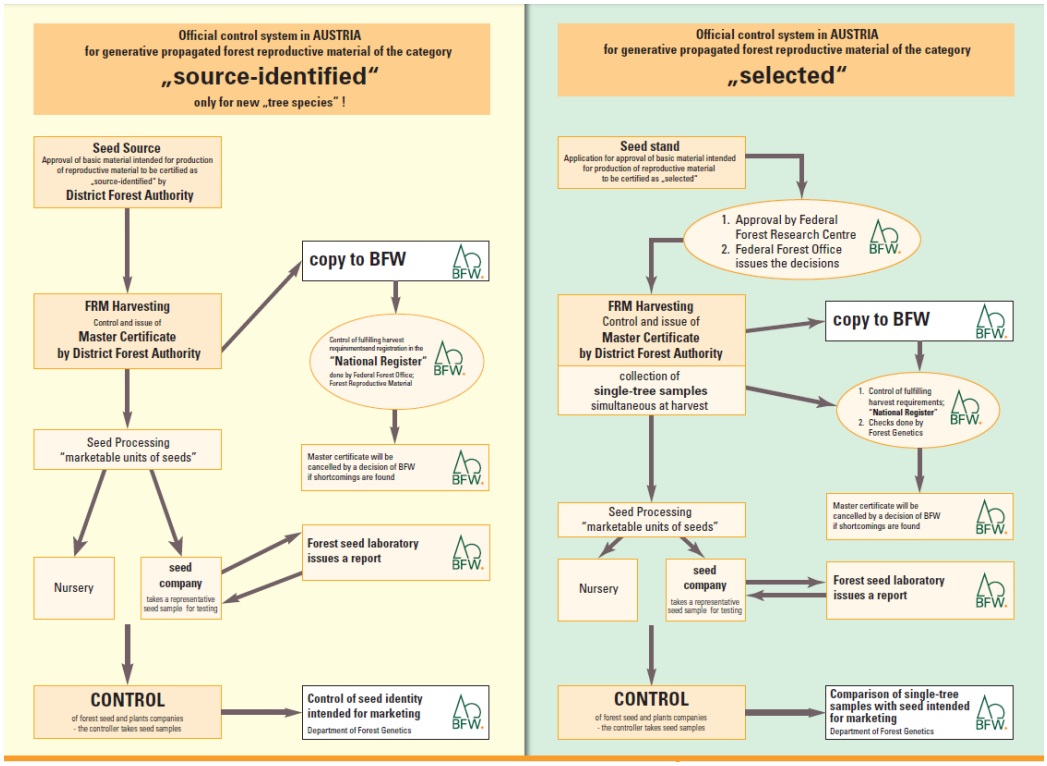


Figure A2.1: Procedure of the official control system for "source-identified" (left) and "selected" (right) categories in Austria (source: I. Strohschneider, BFW*)*

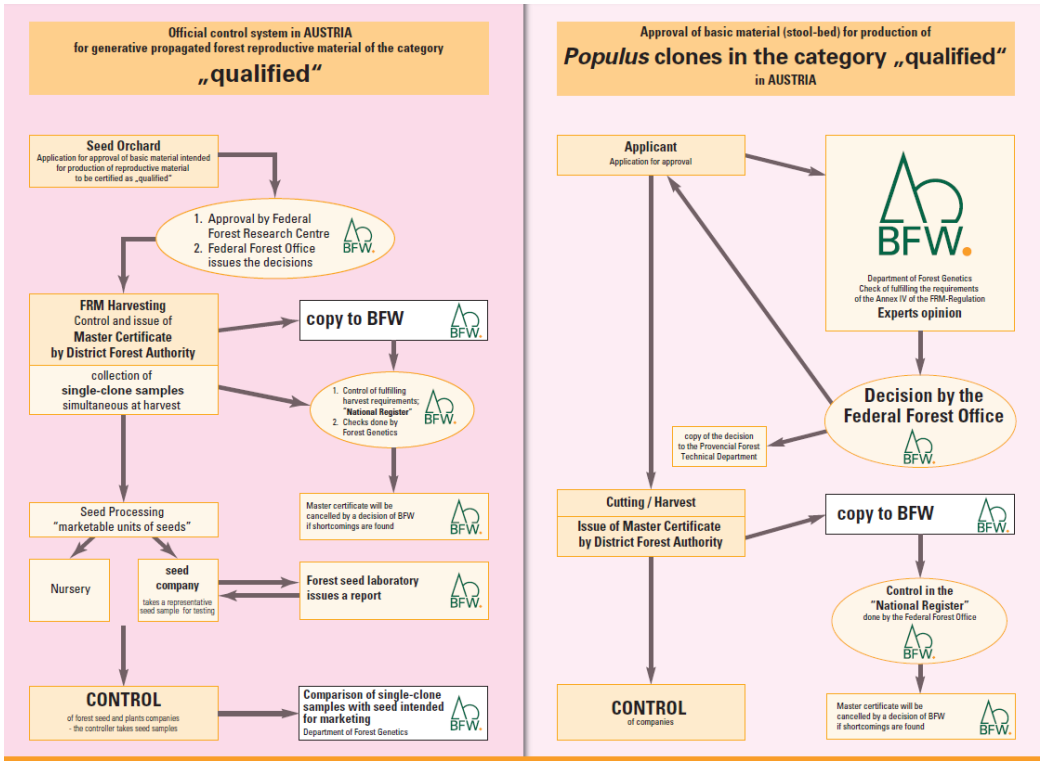
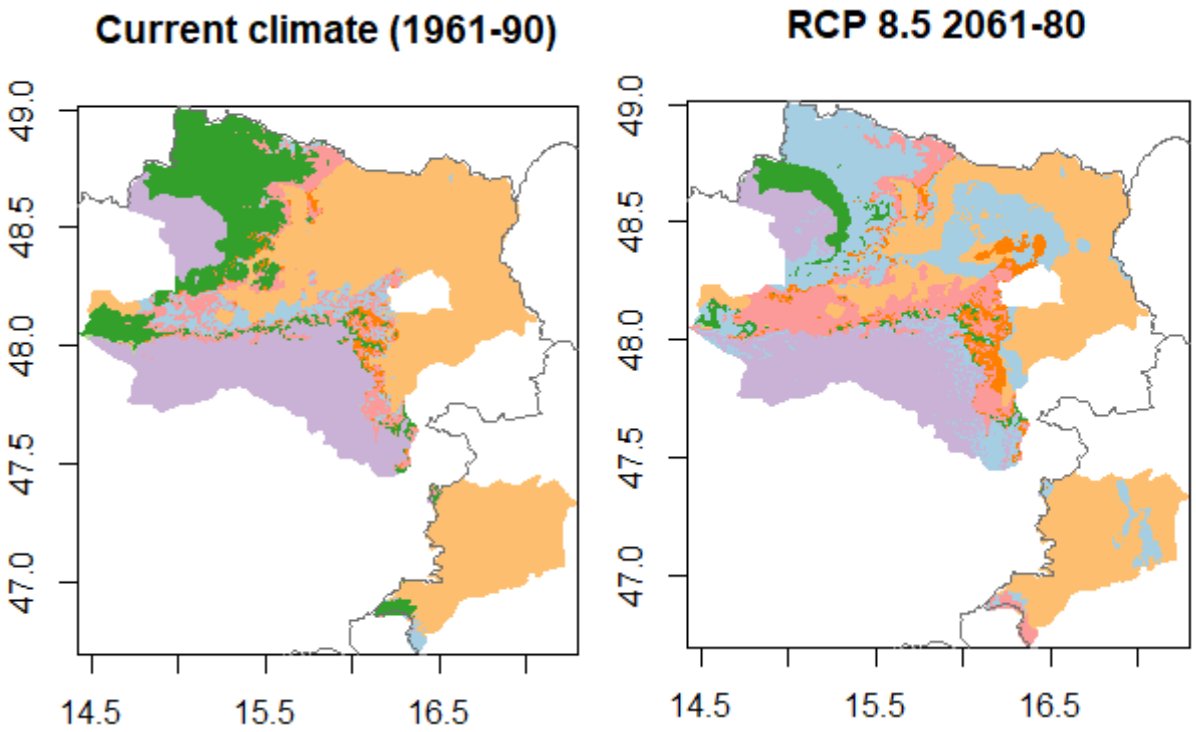
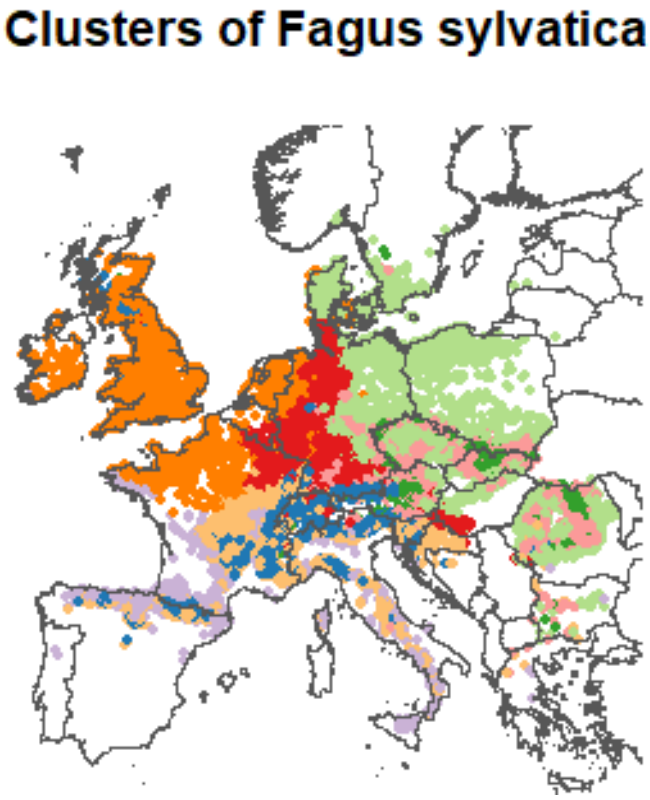
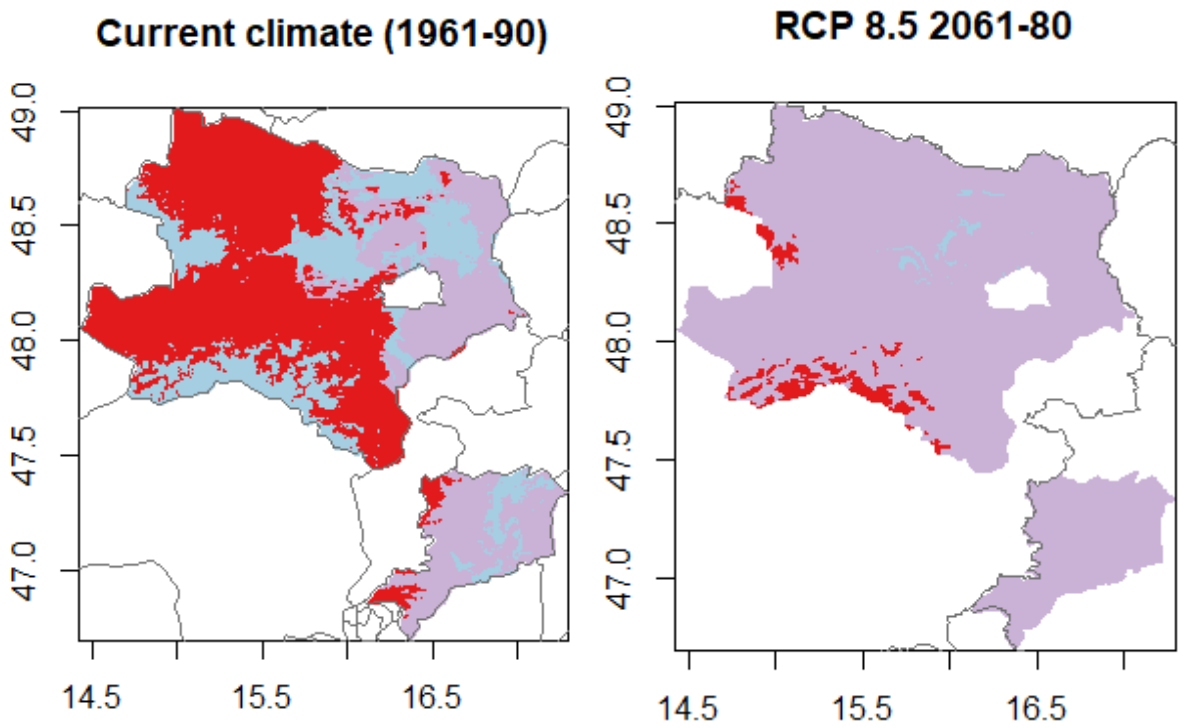


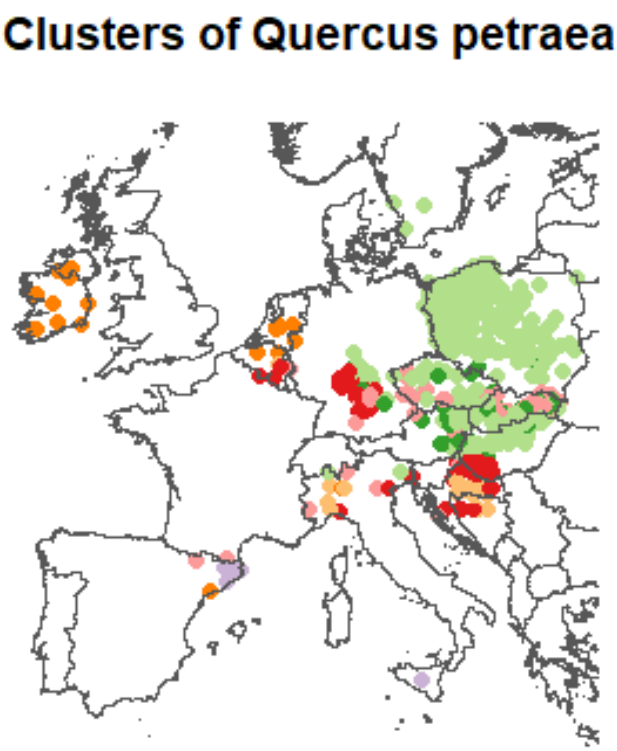
Figure A2.2: Procedure of the official control system for "qualified"(left) and Populus clones in "qualified"(right) categories in Austria (source: I. Strohschneider, BFW)

Annex 3. SusSelect recommendations for beech and sessile oak for the programme area






Current climate (1961-90)
RCP 8.5 2061-80
49.0
48.5
48.0
47.5
47.0
14.5
15.5
16.5


Clusters of Quercus petraea