Progress on linking forest genetic resources to forest management and policy

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Outline of this talk

- Focus: adapting management and policy to optimize the use of forest genetic resources
- Identify how innovative FGR conservation and monitoring as identified in GENTREE may be incorporated into current management and policy
- EUFORGEN SC in June 2018: presentation of atlas of forest management approaches and policy database
- This presentation:
  - Brief summary of the forest management atlas
  - Decision tree on linkages between forest management and FGR
  - Started to interpret results of policy analysis

Atlas with overview of forest management practices

- Overview per forest management decision
  - Forest management approach framework by Duncker et al. (next slide)
  - Main source of information: literature, statistical yearbooks and databases
- Country-level overview on each forest management choice
  - Contents: qualitative descriptions of forest management practices in a country (based on common template)
  - 26 narratives received, involving >50 experts (external to the project!)
- Focus on EU for period >1990

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Part 3: country reports

Austria

Naturalness of tree species composition

Considerations: species composition in relation to the potential natural vegetation, share of site-adapted tree species, share of introduced tree species.

As the result of past management the current tree species composition differs from the potential natural vegetation in many parts of Austria. In particular, Norway spruce (Picea abies (L.) Karst.), Scots pine (Pinus sylvestris L.) and European larch (Larix decidua L.) are overrepresented, while Silver fir (Abies alba Mill.) and broadleaved species (and particularly European beech, Fagus sylvatica L.) are underrepresented in the current vegetation relative to the potential natural vegetation. However, Austria's forests are characterized by great heterogeneity in climate and site conditions, ranging from broadleaved-dominated natural forest types in the low elevation areas to conifer-dominated natural forest types in high elevation areas. Generally, the naturalness of the current vegetation composition increases and the human influence on forests decreases with elevation.

For current silvicultural planning and tree species selection the potential natural vegetation serves as a widely used guideline in Austria's forestry. Consequently, the share of Norway spruce has decreased and the share of broadleaved species has increased since the 1990s. Increasingly, climate change adaptation is discussed in the context of tree species selection, and subsidy programs often promote the establishment of mixed and/or broadleaved-dominated forest types in anticipation of future warming.

The share of non-native tree species remains very low (approximately 0.5% of the growing stock) and restricted to specific sites (e.g. floodplain forests along the Danube, dry low elevation sites). However, in the context of climate change adaptation, drought-tolerant non-native tree species such as Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) are increasingly discussed in research and management.

Tree improvement

Considerations: use of improved breeding material, use of genetically modified organisms.

Improved breeding material is not commonly used in Austrian forestry, but has been the focus of recent research. Genetically modified organisms are not planted in Austria's forests.

Type of regeneration

Considerations: planting, seeding, natural regeneration, or coppice.

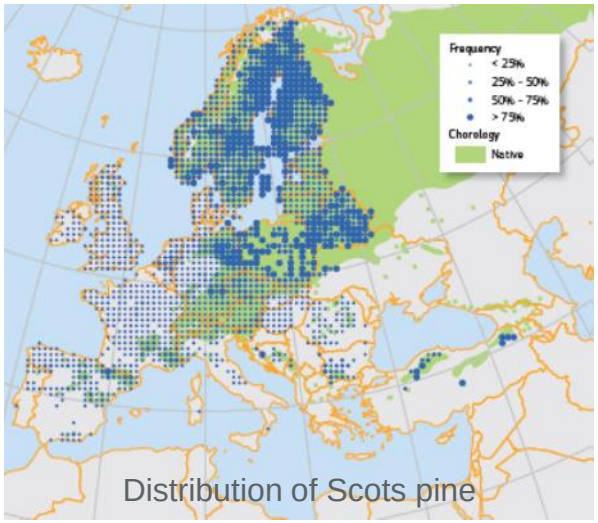
A large share of Austria's forests (>90%) is regenerated naturally. Depending on the tree species that are regenerated (shade-tolerant or light-demanding) silvicultural approaches frequently employed in the natural regeneration of forests are shelterwood cuts, gap-cuts, gap-strip cuts, strip-cuts, and overstorey removal over established regeneration. Cut-block sizes are usually small, with gaps ranging from a few hundred square meters to clear cuts <0.5 ha (with a maximum clear cut size of 2 ha permitted by the Austrian forest act). If natural regeneration is not feasible or the overstorey tree species composition does not match with the silvicultural target species composition planting or enrichment planting are used. Furthermore, planting has been used to quickly revegetate the large areas disturbed

Decision	Silvicultural operations	Considerations
Naturalness of tree species composition	Selection of tree species	Species composition in relation to the potential natural vegetation, share of site-adapted tree species, share of introduced tree species
Tree improvement	Selection of tree genotypes	Use of improved breeding material, use of genetically modified organisms
Type of regeneration	Stand establishment	Planting, seeding, natural regeneration, or coppice
Machine operation	Fertilizing, Liming, Soil preparation, Thinning, Final harvest	Use of forest machinery for soil preparation, thinning, final harvest
Soil cultivation	Soil preparation, Drainage	Mechanical, physical, and chemical site preparation, drainage
Fertilization / Liming	Fertilization, Liming	Fertilization to increase yield (amelioration), compensation for nutrient extraction and re-establishment of natural biogeochemical cycles
Application of chemical agents	Pest control	Application of pesticides, herbicides
Integration of nature protection	Tree retention, special habitats	Tolerance of biotope/habitat trees, tolerance of deadwood, biotope protection within stands
Wood removals	Thinning (stem), Final harvest (stem), residue removal, stump removal	Tree components (stem, residues, stumps) extracted in thinning or harvesting operations
Cutting regime	Final harvest	No management, continuous cover, even-aged forest with shelterwood, even-aged forest with clearcutting, coppice, coppice with standards, short rotation
Maturity	Final harvest	Felling age in relation to the potential life span of a given tree species

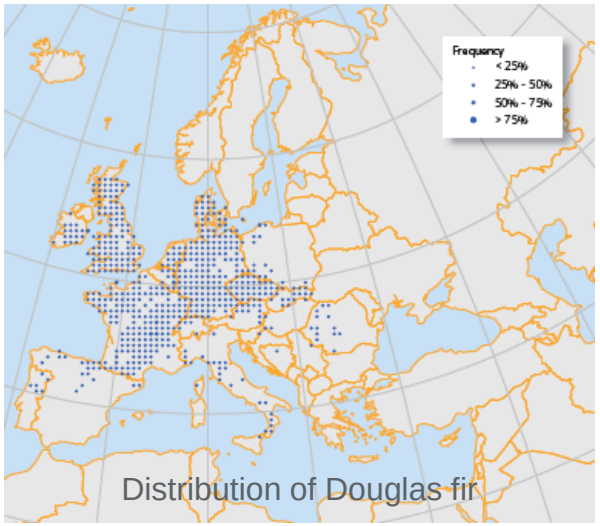
Source: Duncker et al. 2011

Example: Naturalness of tree species composition

- The naturalness of the tree species composition in relation to the potential natural vegetation of a site.
- Good information availability from multiple sources on species composition, moderate information on changes in tree species composition
- Decrease in forest area dominated by a single tree species and increased preference for broadleaved species (mainly central Europe)
- The area covered by introduced tree has increased steadily in most parts of Europe between 1990 and 2015



Distribution of Scots pine

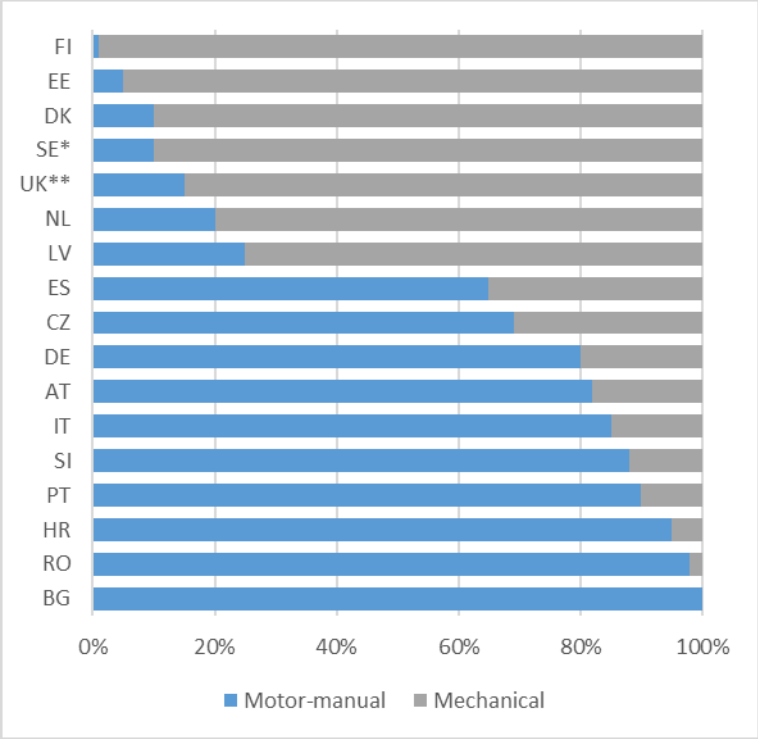


Distribution of Douglas fir

Source: San-Miguel et al. 2016

Example: Machine operation

- Vehicle movements on the forest soil and the degree a forests needs to be opened up to ensure access of the machinery
- Poor information availability
- Site preparation: tractor with plough
- Regeneration: mainly manual (approx. 5% mechanically planted in Finland
- Harvesting: large differences between countries



Degree of mechanization
Source: Prinz (unpublished)

Example: Cutting regime

- The extent that a forest area is cleared - or to which the forest canopy is opened up - by a final harvest operation
- Limited information availability
- Clear-cutting is the dominant harvest system in Europe, but there is a trend in adopting other systems to develop more structurally rich forests (central Europe and the British Isles). Clear-cutting has been forbidden in Slovenia since 1947
- 8.8-20 million ha of coppice forests, but most coppice forests are abandoned

Management system	Species group	North	Central -West	Central -East	South-West	South-East
Even-aged forest: Uniform clear-cut system	Light demanding conifers					
	Shade tolerant conifers					
	Mediterranean conifers					
	Fast growing deciduous					
	Slow growing light demanding deciduous					
	Slow growing shade tolerant deciduous					
Even-aged forest with shelterwood	Light demanding conifers					
	Shade tolerant conifers					
	Mediterranean conifers					
	Fast growing deciduous					
	Slow growing light demanding deciduous					
	Slow growing shade tolerant deciduous					
	Mediterranean evergreens					
Continuous cover forest management	Shade tolerant conifers					
	Slow growing shade tolerant deciduous					
Coppice	Fast growing deciduous					
	Slow growing light demanding deciduous					
	Mediterranean evergreens					
Coppice with standards	Slow growing light demanding deciduous					
	Slow growing shade tolerant deciduous					
Short rotation	Light demanding conifers					
	Fast growing deciduous					

Common harvest systems in Europe
(darker shading indicates a system is more common)
Source: Cardellini et al. 2018

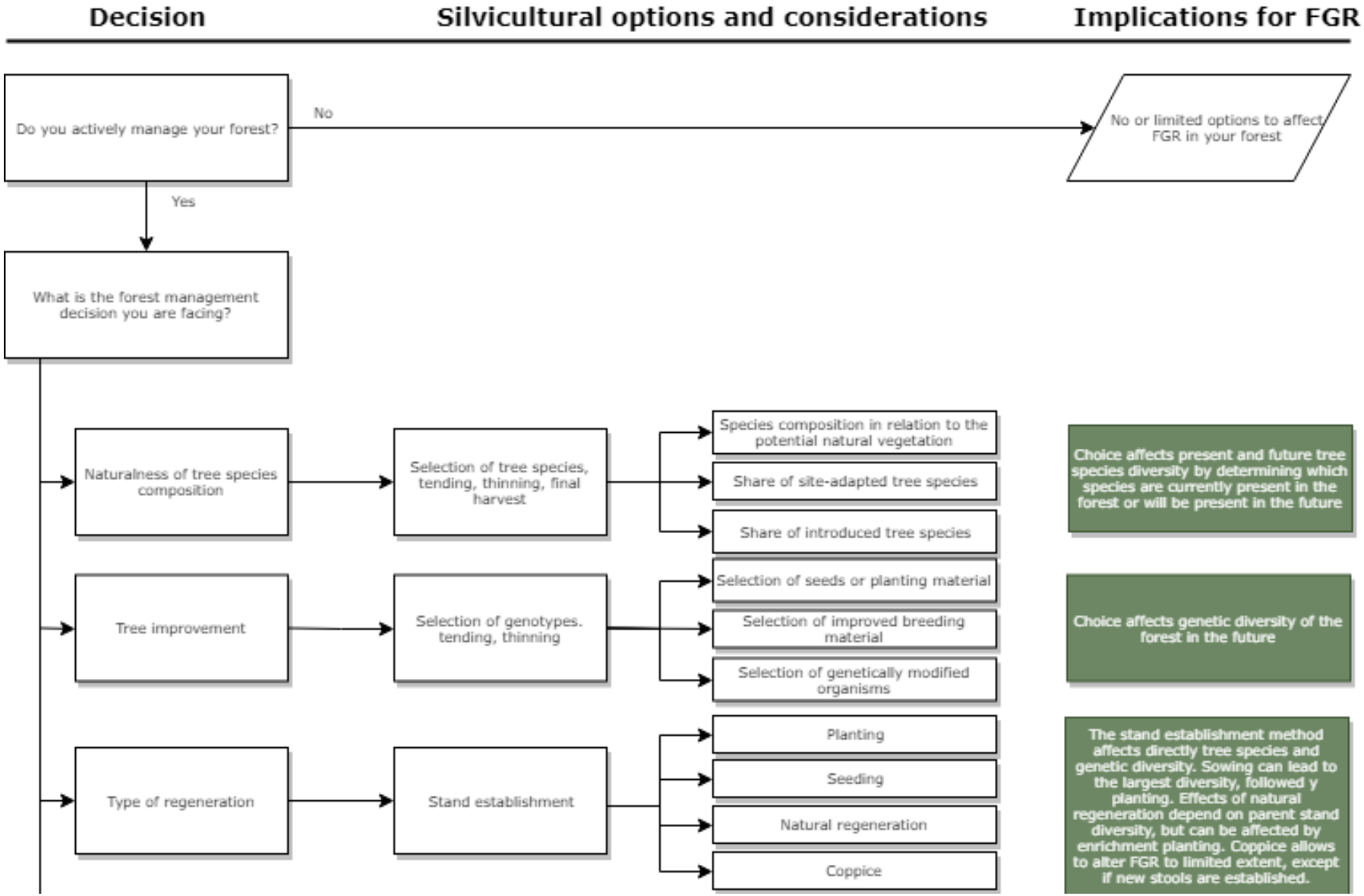
Summary: atlas of forest management approaches

- Substantial differences in management between European regions and countries (management paradigms, technology)
- Unique overview of forest management in Europe
  - Previous efforts focused only on single or few management decisions
  - Limited information available for numerous management decisions (e.g. machine operation, fertilization, agents, harvest systems)
  - Large amount of participating experts indicating high interest!

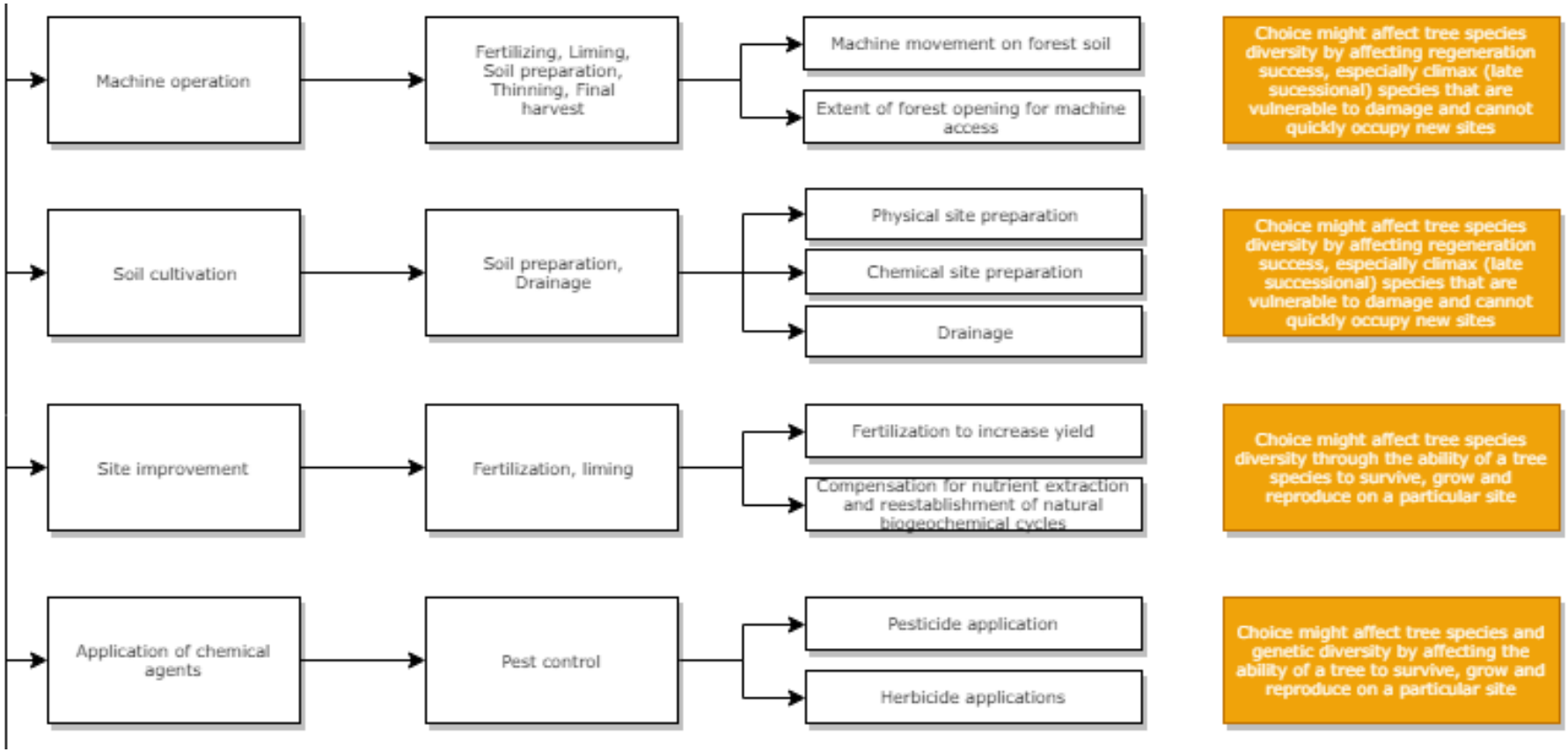
Links between forest management and FGR

- Several existing reviews:
  - Lefèvre (2004); Ratnam et al. (2014); Finkeldey & Ziehe (2004); Hosius et al. (2006); Geburek & Muller (2005); Kavaliauskas et al. (2018)
- Existing overviews predominantly focus on:
  - Regeneration (species, provenances, type)
  - Removals (thinnings, final harvest)
  - Cutting regimes (clearcut, shelterwood,…)
- First attempt made to link forest managemen to FGR through a decision tree

Links between forest management and FGR



Links between forest management and FGR



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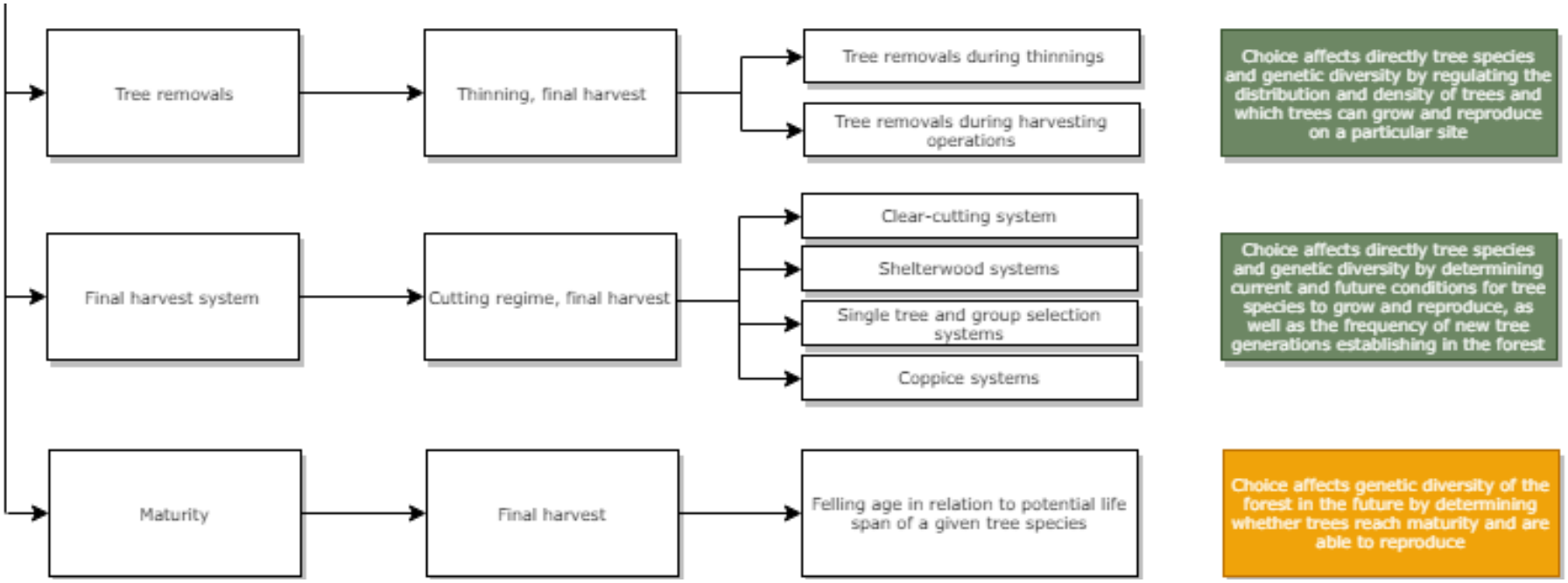
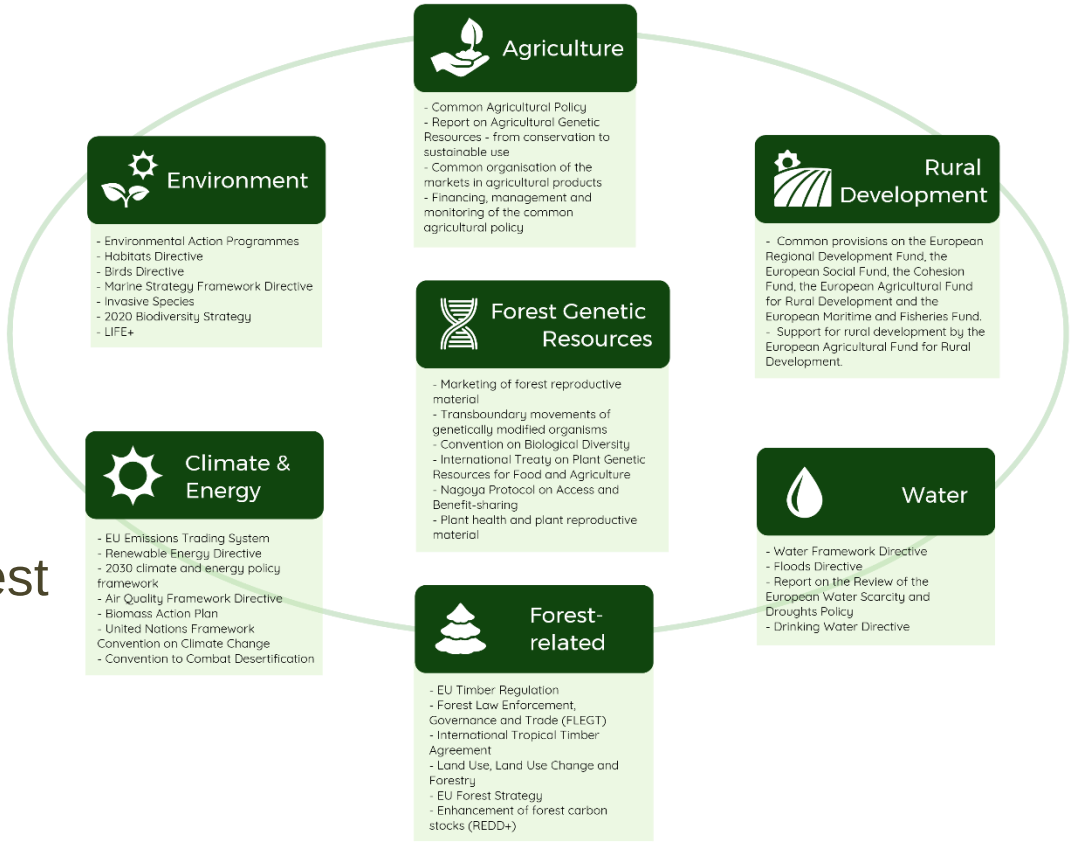


Review of policy instruments and measures

Report on policy instruments and measures that may influence the uptake of conservation strategies (GENTREE deliverable 5.1)

- Analyses policy conflicts and trade-offs affecting FGR
- Provides recommendations for future policies aimed at maintaining multifunctional forest landscapes under changing climate conditions

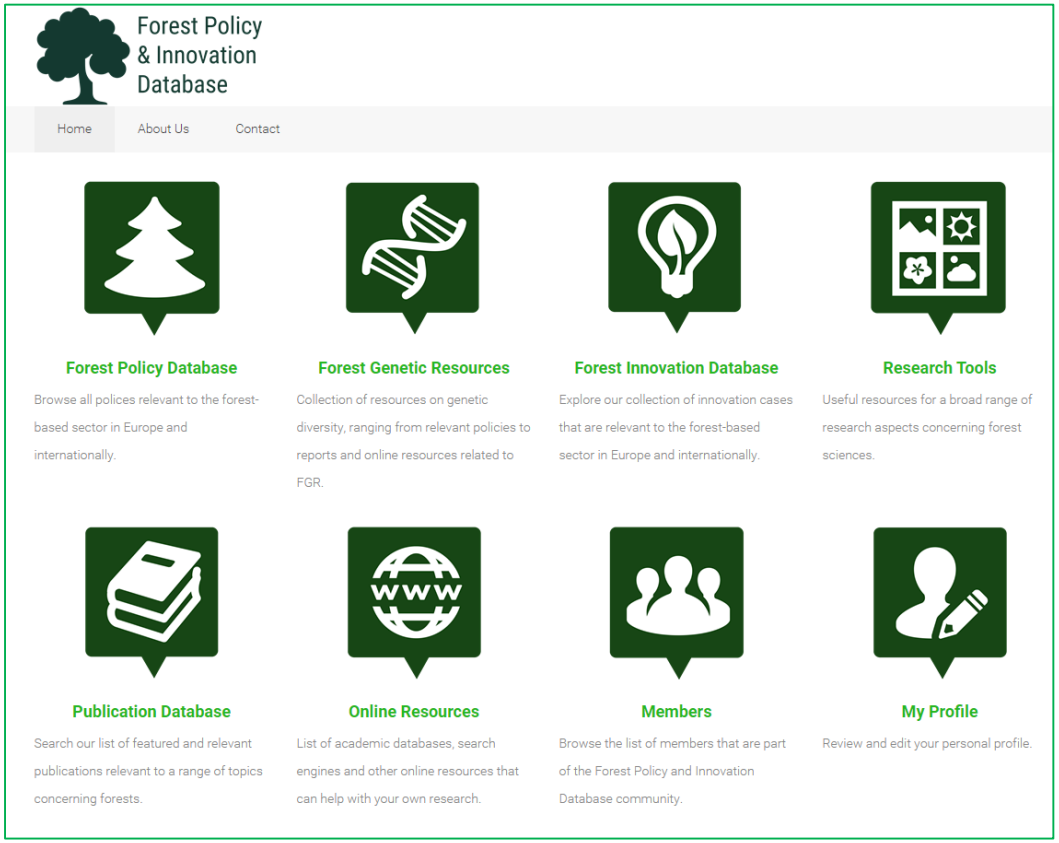


Source: GENTREE deliverable 5.1

Review of policy instruments and measures

Policy database constructed:

- **852 policy documents** covering a wide range of areas, ranging from agriculture, biodiversity, climate change, environment to forestry, etc.
- **88 policy documents** specifically covering FGR and forest reproduction (126 policy documents if plant health is included).
- **41 legally-binding instruments** specific to FGR, forest reprodution, plant health and invasive species



http://policydatabase.boku.ac.at/index.php/forest-genetic-resources

Source: GENTREE deliverable 5.1

Summary of policy review outcomes

Issues requiring attention:

- EU policies affecting FGR (and forests in general) are fragmented and not well integrated
- Non-coordinated or conflicting policy objectives are driven by different policy pathways and target setting across governance levels
- There still is a lack of awareness in public and among policy makers on the importance of FGR conservation
  - The use of existing science-based recommendations on management and sustainable use of FGR has improved policy-making (e.g., through EUFORGEN)

Source: GENTREE deliverable 5.1

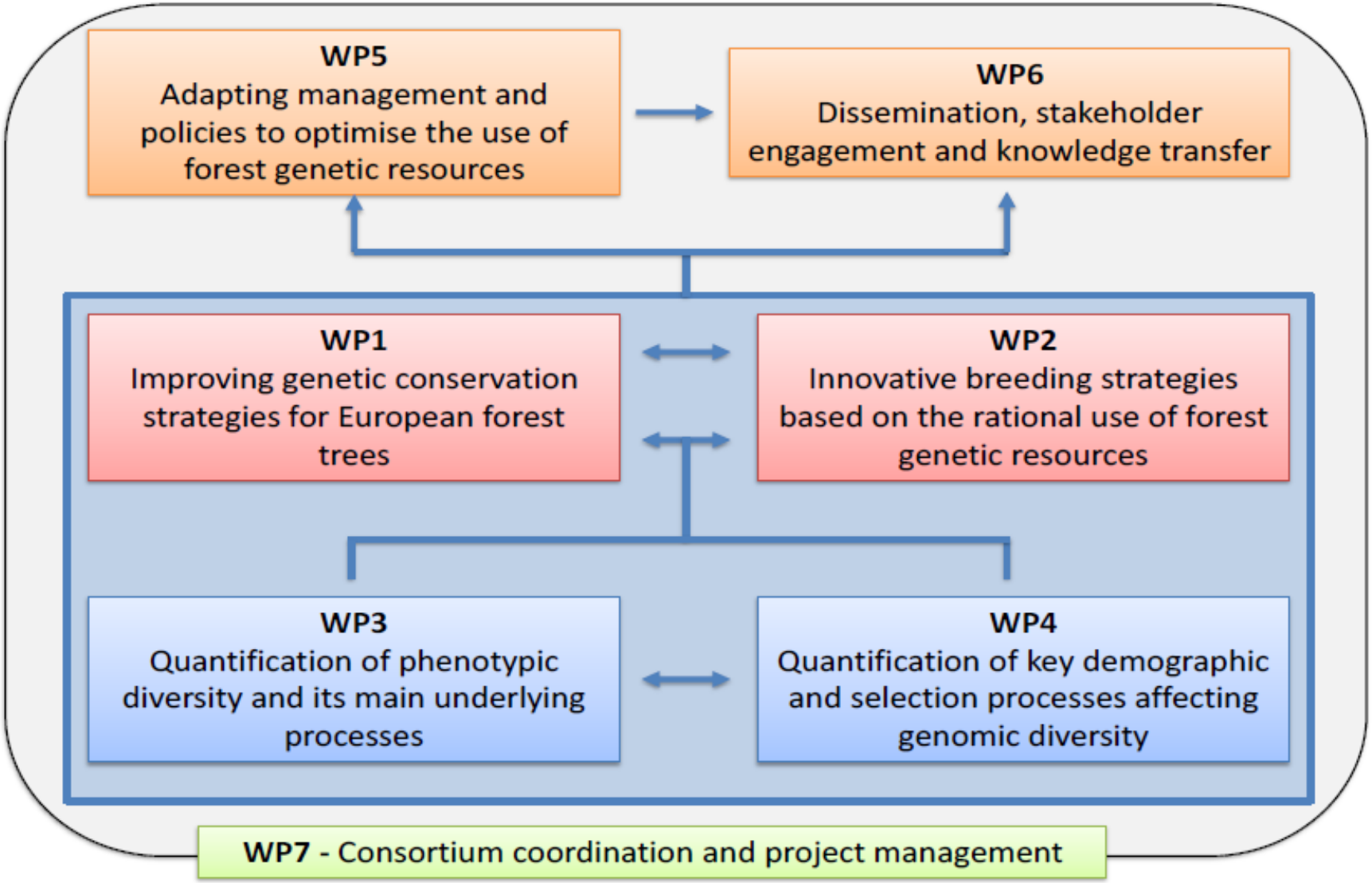
Summary of policy review outcomes

Preliminary recommendations / suggestions:

- Horizontal (across sectors) and vertical (across levels of governance) policy integration should be strengthened to achieve a coherent policy approach for FGR.
- Policy-making and priority setting on FGR would benefit from participatory approaches to address trade-offs and conflicts between sectors (e.g. nature conservation and energy) and to support improved policy coherence
- Communication between policy-makers, the private sector and practitioners should be further improved on FGR conservation and management
- The links between alternative (and currently often conflicting) policy implementation and forest management should be better understood with their consequential impacts on FGR

Source: GENTREE deliverable 5.1

Next steps: linking GenTree innovations to forest management and policy



Next steps: linking GenTree innovations to forest management and policy

- How can innovative FGR conservation and management be incorporated into management and policy throughout Europe?
- Can we move forward from understanding implications between policies and management and their impacts on FGR towards pro-actively influence policy and management to improve FGR conservation and management?