European forests

- Large changes in European forest resources during recent decades

Source: adapted from Verkerk 2015; multiple data sources
European forests

Known Primary Forests of Europe

- Conifer
- Broadleaf

Source: Sabatini et al. 2018

Carbon stock

Growing stock

Height

Mean forest age

Source: Moreno et al. 2017
Management challenges ahead

- Increasing global demand for materials due to a growing and increasingly rich global population

- How will future demands affect European forests?
  - Latest outlooks suggest no major changes in roundwood harvest and consumption until 2030 (Jonsson et al. 2018)

Projected global development of raw material extraction (+41% in GHG emissions)

Source: Hatfield-Dodds et al. 2017
Management challenges ahead

• Climate change and large disturbances projected to affect Europe’s forests

- Gudrun storm Sweden (2005)
- Vaia storm Italy (2018)
- Wildfire Portugal (2017)
- Spruce mortality in Germany (2019)
Forest management in Europe

• Improved information is needed on how forests are currently managed in Europe
  • Development of overview of forest management in Europe in GenTree project

• 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 to each forest management choice
  • Textual, qualitative descriptions of forest management practices in a country
  • 27 countries, involving >50 experts (external to the project!)

• Focus on EU for period >1990
# Forest management decisions

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Source: Duncker et al. 2011
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, limited 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 non-native species has increased steadily in most parts of Europe between 1990 and 2015

Source: San-Miguel et al. 2016
• Decision by a forest manager on the material to be used during the regeneration stage

• Rather good information on the availability and types of forest reproductive material, limited information on what is used

• Bare root seedlings are most commonly used for planting

Annual plant transfer (in million) by country and species based on the period 2004 until 2014. Size of pie charts corresponds to the quantity of introduced seedlings

Source: Jansen et al. 2019
• 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: mainly tractor with plough
• Regeneration: mainly manual (approx. 5% mechanically planted in Finland)
• Harvesting: large differences between countries

Degree of mechanization in harvesting activities

Source: Prinz and Anttila (unpublished)
Application of chemical agents

- Use of chemical substances to reduce or prevent competition or pests that may negatively affect the establishment and development of a stand
- Poor information availability
- The amount of pesticides used in European forestry is significantly less than the use in agriculture. When applied the amounts per application range between 0.1 and 2.2 kg active ingredient ha\(^{-1}\) yr\(^{-1}\)
- Mechanical control of unwanted plants more common than use of herbicides

Forestry pesticide and herbicide use in 2009 in 13 European countries

Source: McCarthy et al. 2011
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; most coppice forests are to large extent abandoned
(Climate-) Smart Forestry

- Atlas provides valuable information on how management could be improved to address multiple societal demands, while considering regional conditions in an uncertain future

- Conserve high carbon stocks in old forests that are not at a high risk of disturbance;

- Activate and improve the management and protection of fire-prone forests to safeguard their carbon stocks;

- Optimize forest genetic resources and silviculture (breeding material, planting, tending and harvesting) in forests that are grown primarily for timber

- Increase share of broadleaves and mixed forests to enhance resilience
Concluding remarks

• Information basis on state of Europe’s forests is improving, but solid information is needed on forest management:
  • Limited information available for numerous management decisions (e.g. machine operation, fertilization, application of chemical agents, cutting regimes);
• Atlas reveals substantial differences in management between European regions and countries.
• Atlas provides value information for developing:
  • Climate-smart forestry strategies
  • Forest Reference Levels
  • Forest genetic resource conservation and use
  • Outlook and scenario studies
  • ...
Thank you!