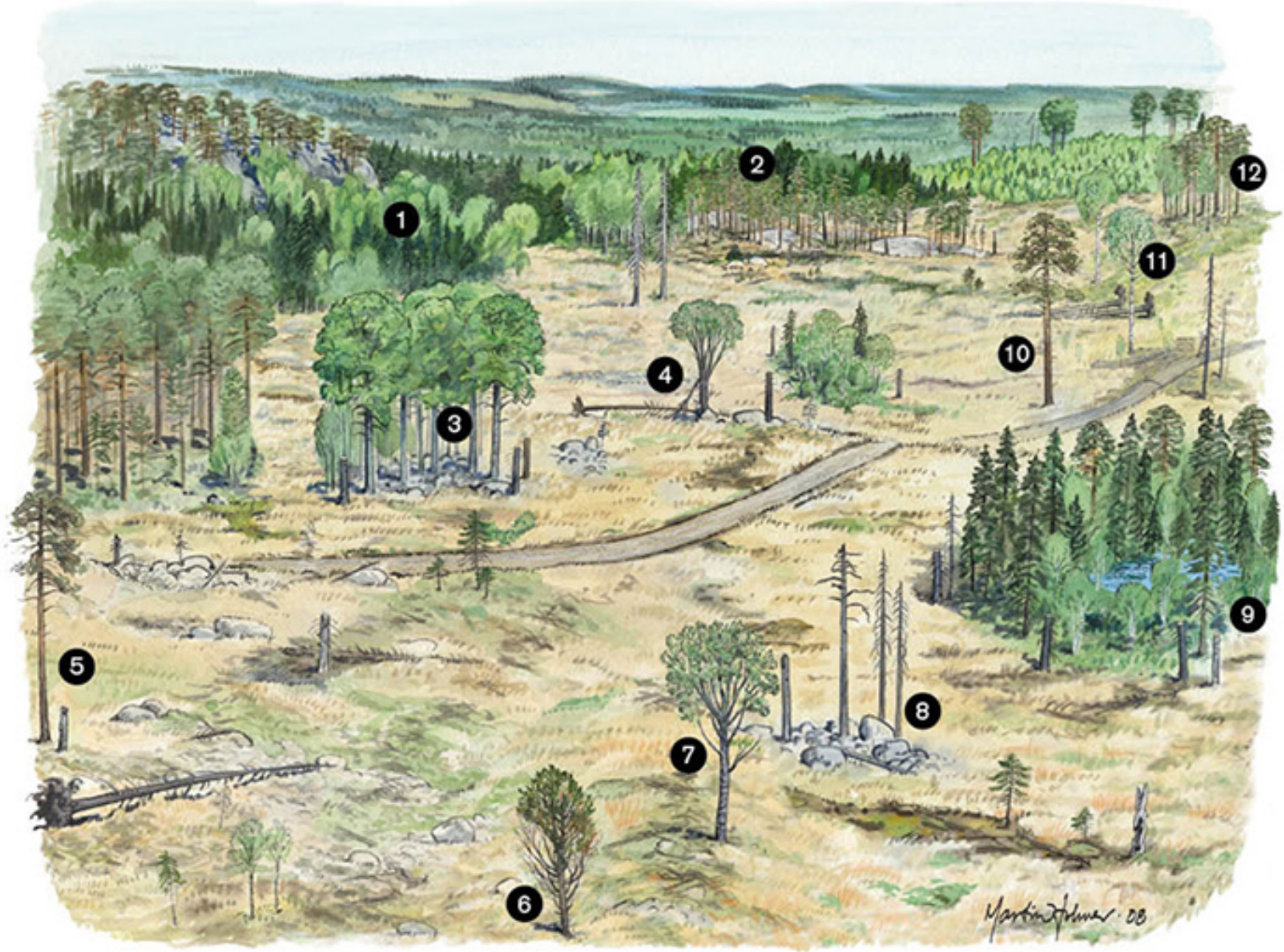
Can forest growth increase?

Yes

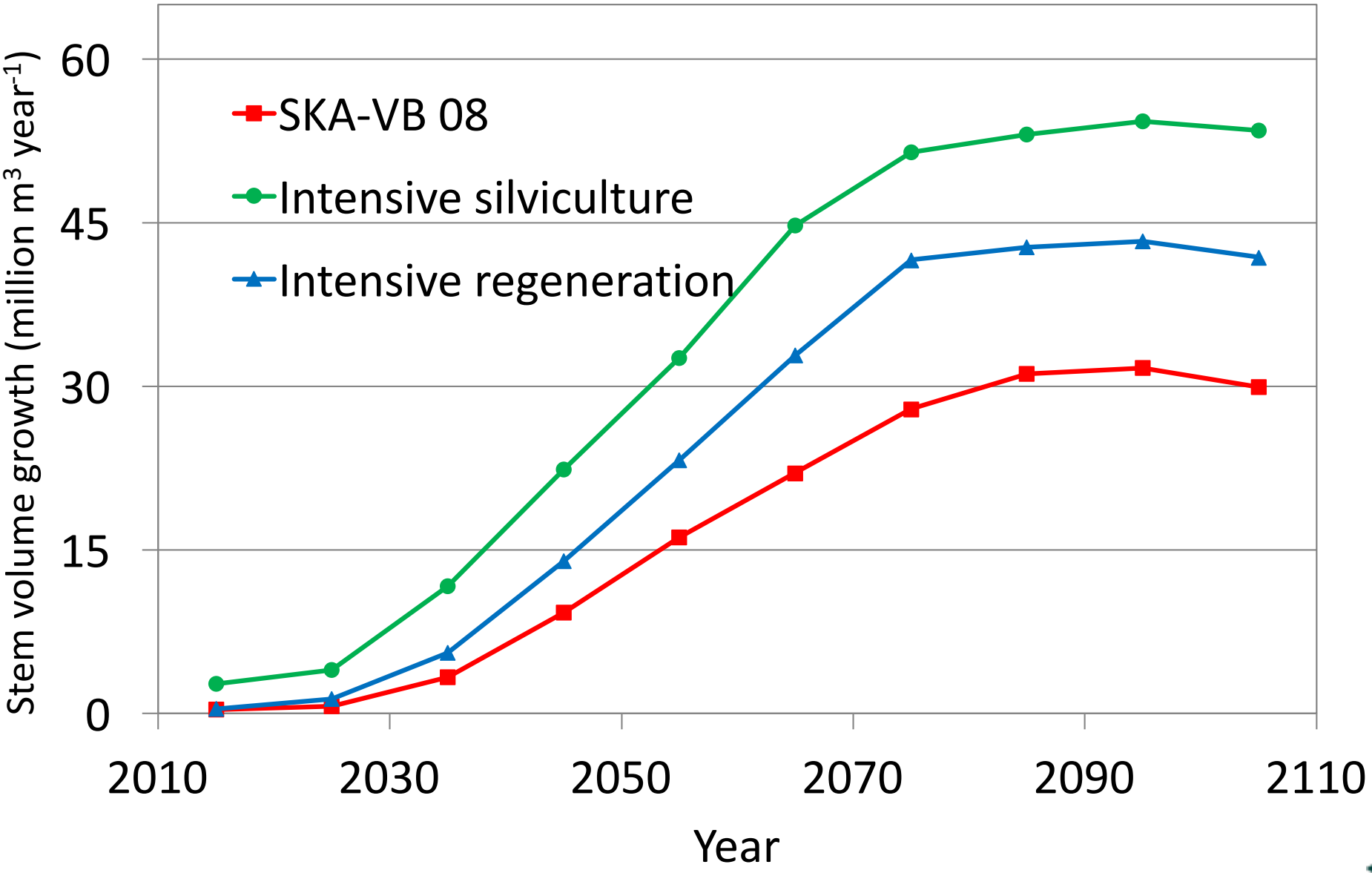
General nature considerations



What is in the tool-box?

- Avoid damage
- Regeneration
- Tree species
- Genetically improved seedlings
- Conventional fertilization and fertilization in young Norway spruce
- Drainage / improvement of existing drainage
- Pre-commercial thinning
- Thinning
- Rotation length – timing of final felling

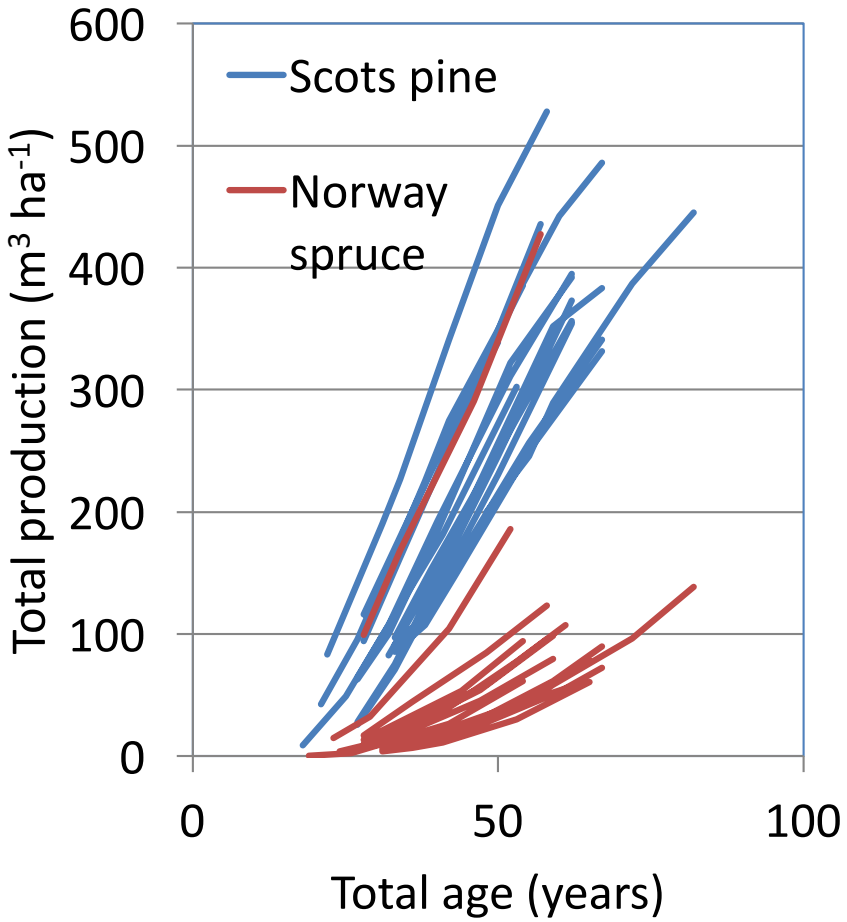
Regeneration in MINT



What is intensive regeneration?

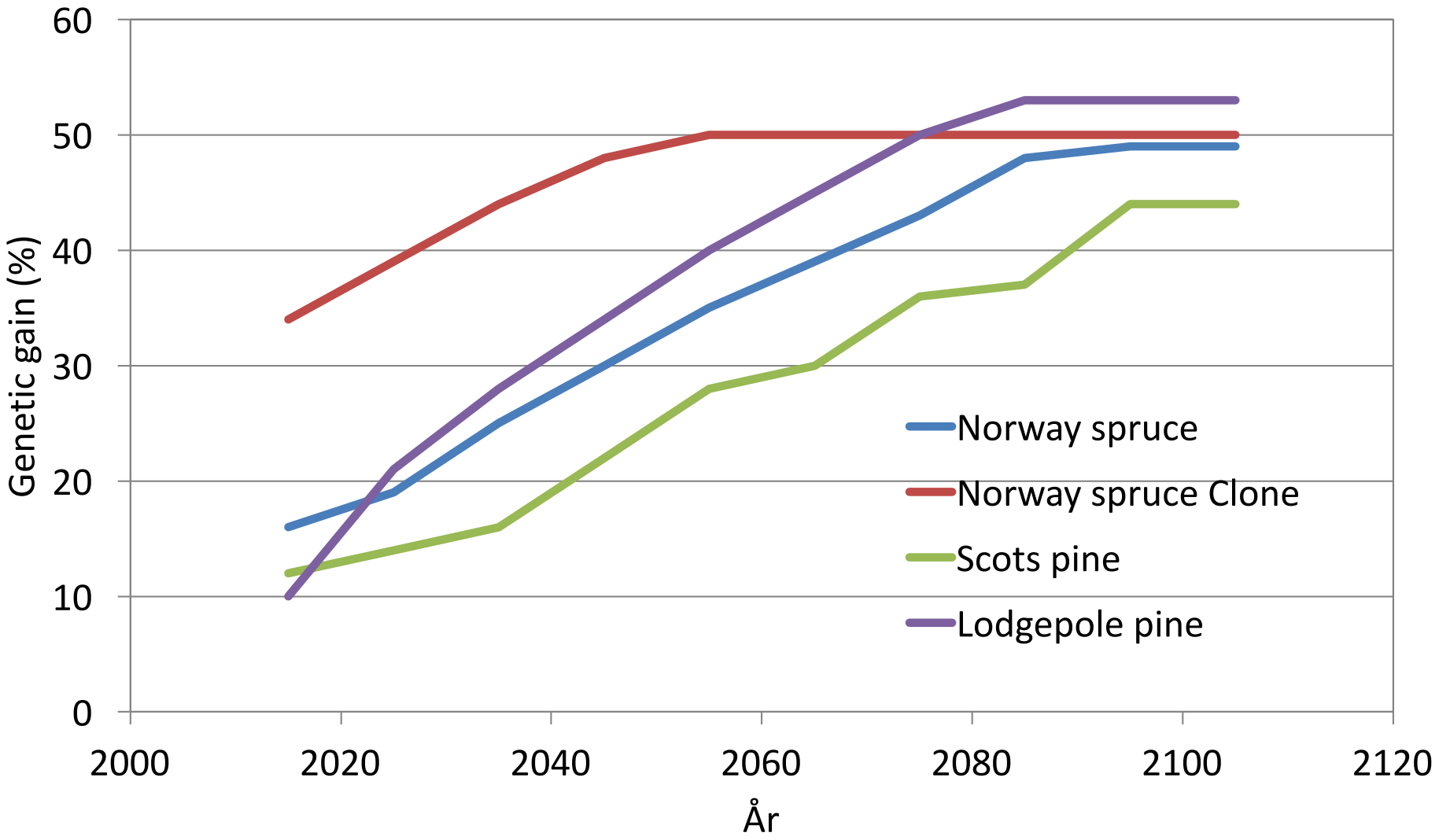
- Planting instead of natural regeneration and a focus on survival of planted seedlings
  - Scarification
  - Protection against pine-weevil damage
  - Seedling type and handling of seedlings
  - Avoid browsing

Tree species

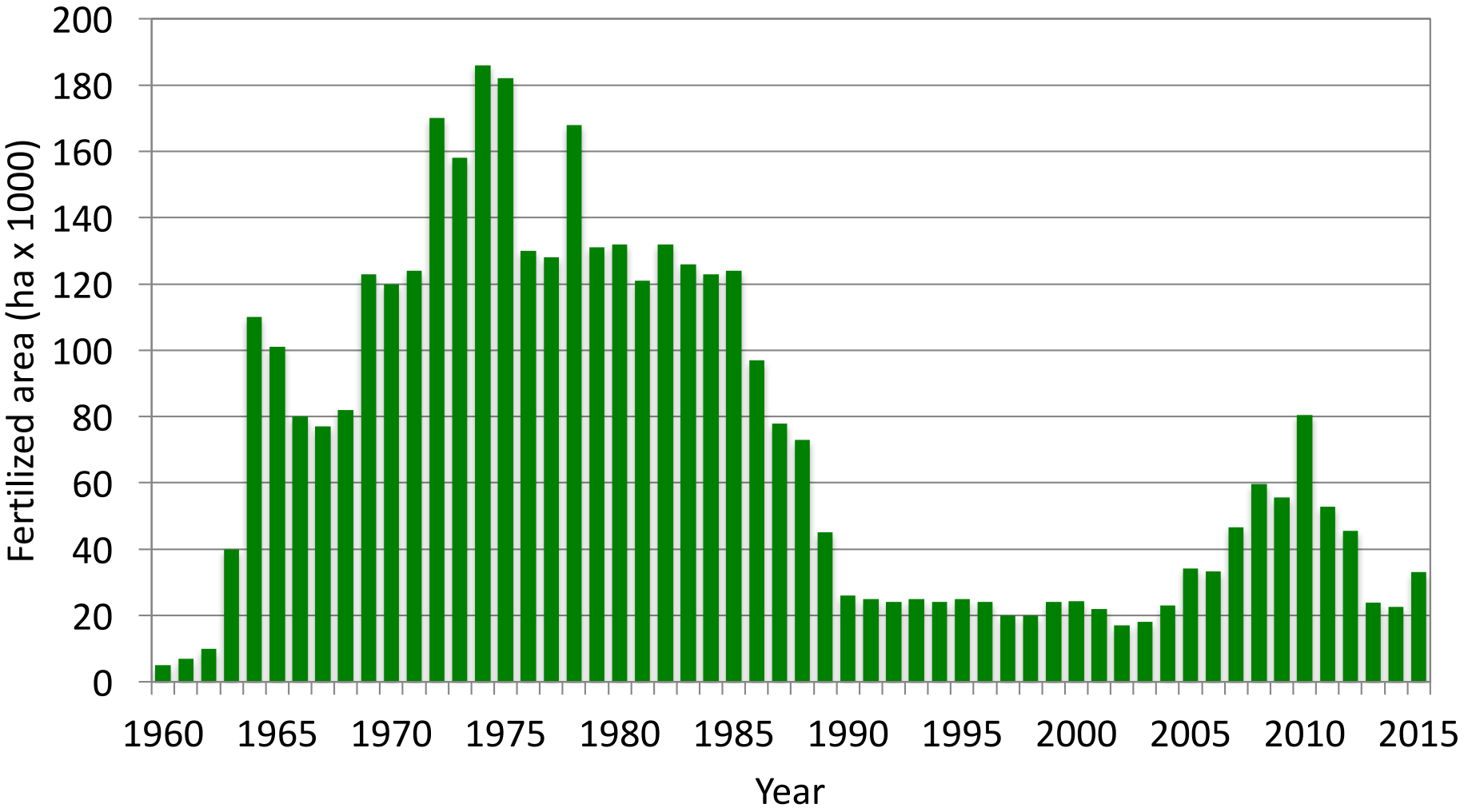


- Lodgepole pine
- Poplars and hybrid aspen
- Improved birch
- Sitka spruce
- Hybrid larch, Siberian larch
- Grand fir
- Douglas fir

Expected genetic gain

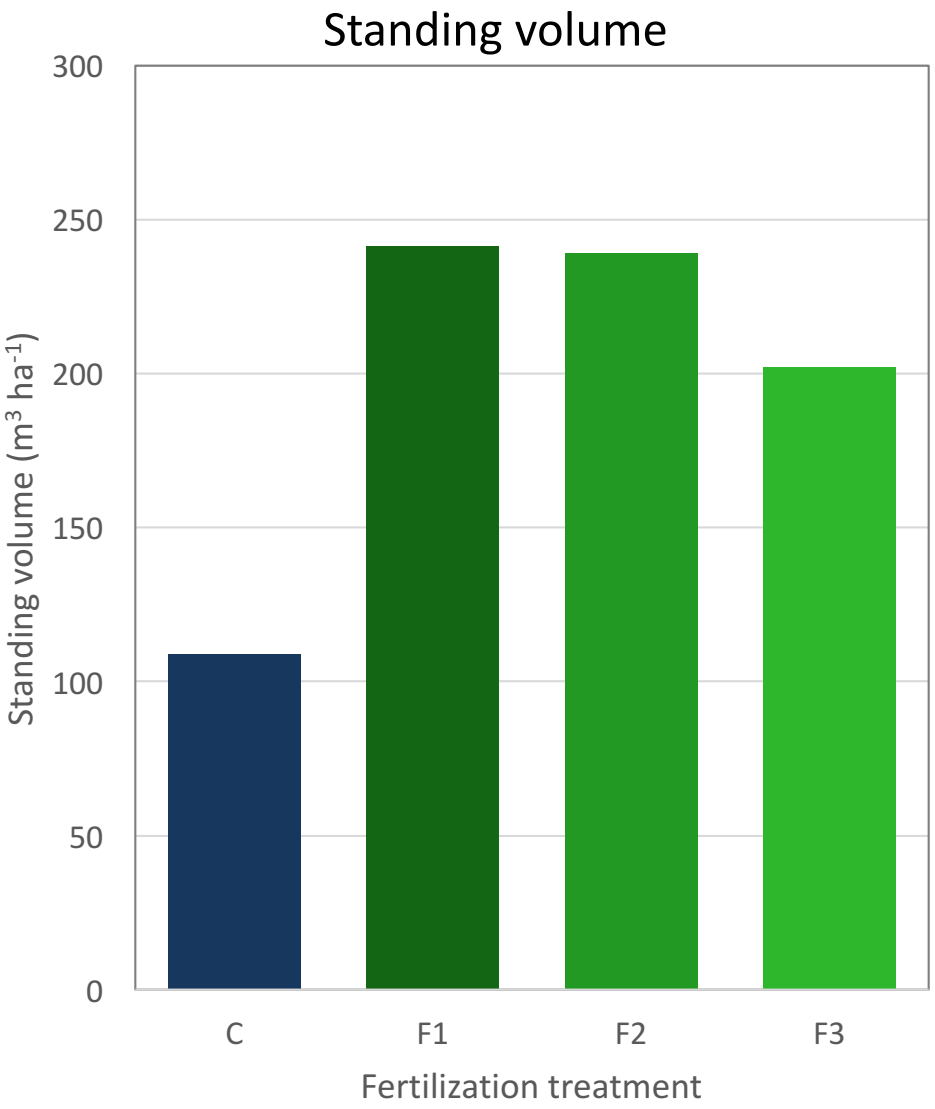


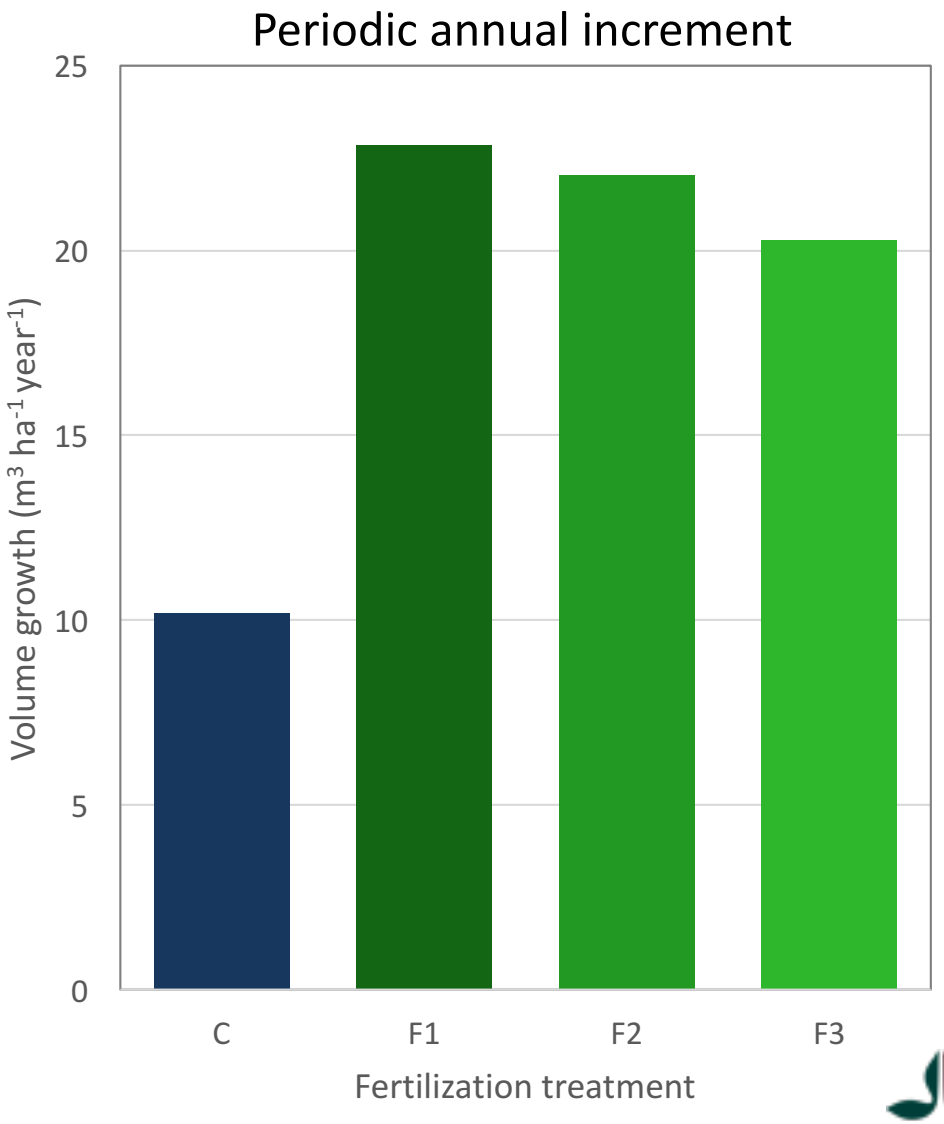
Conventional fertilization in Sweden



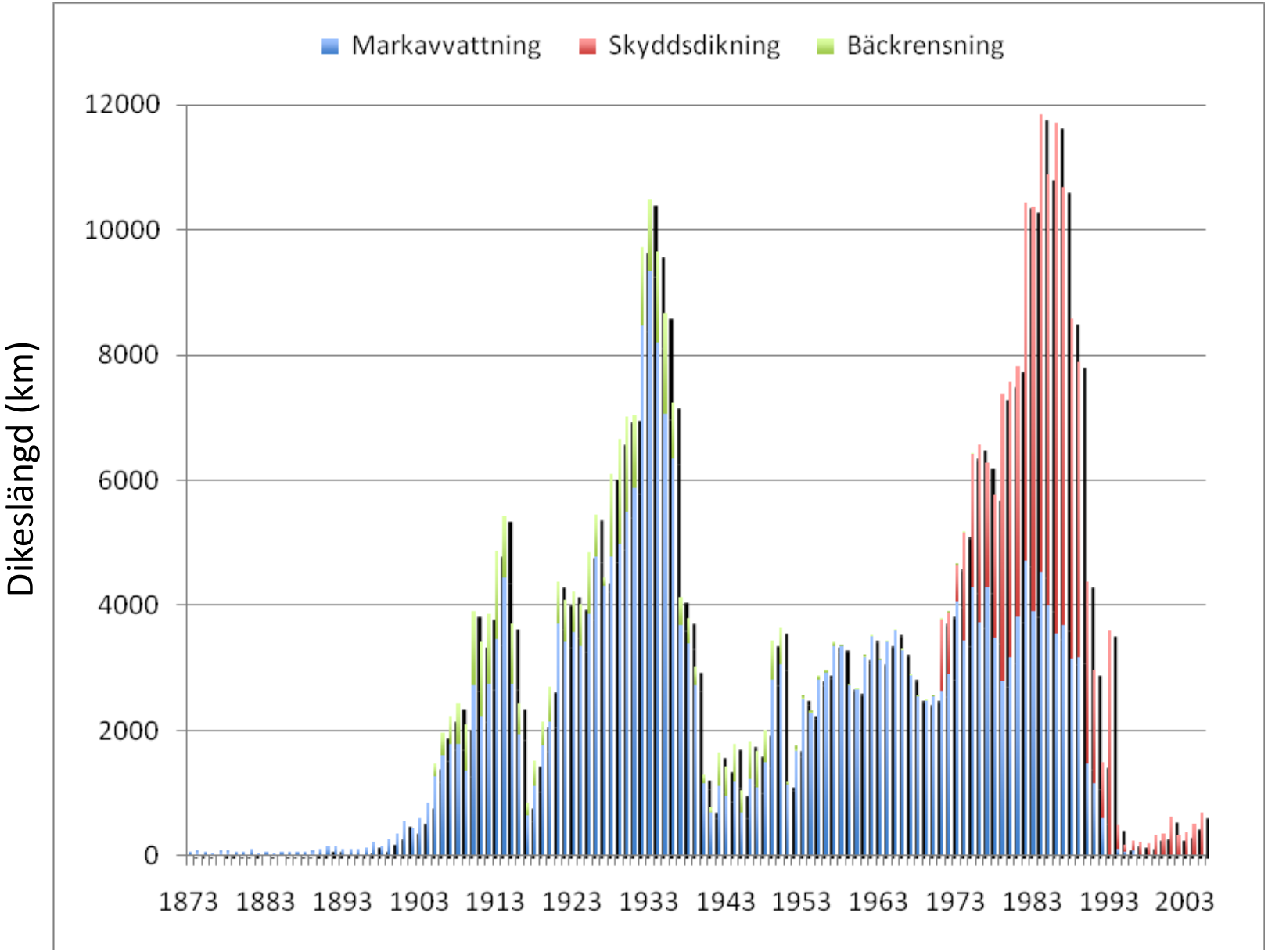
Fertilization in young Norway spruce stands

Standing volume and growth 15 years after start of fertilization





Drainage

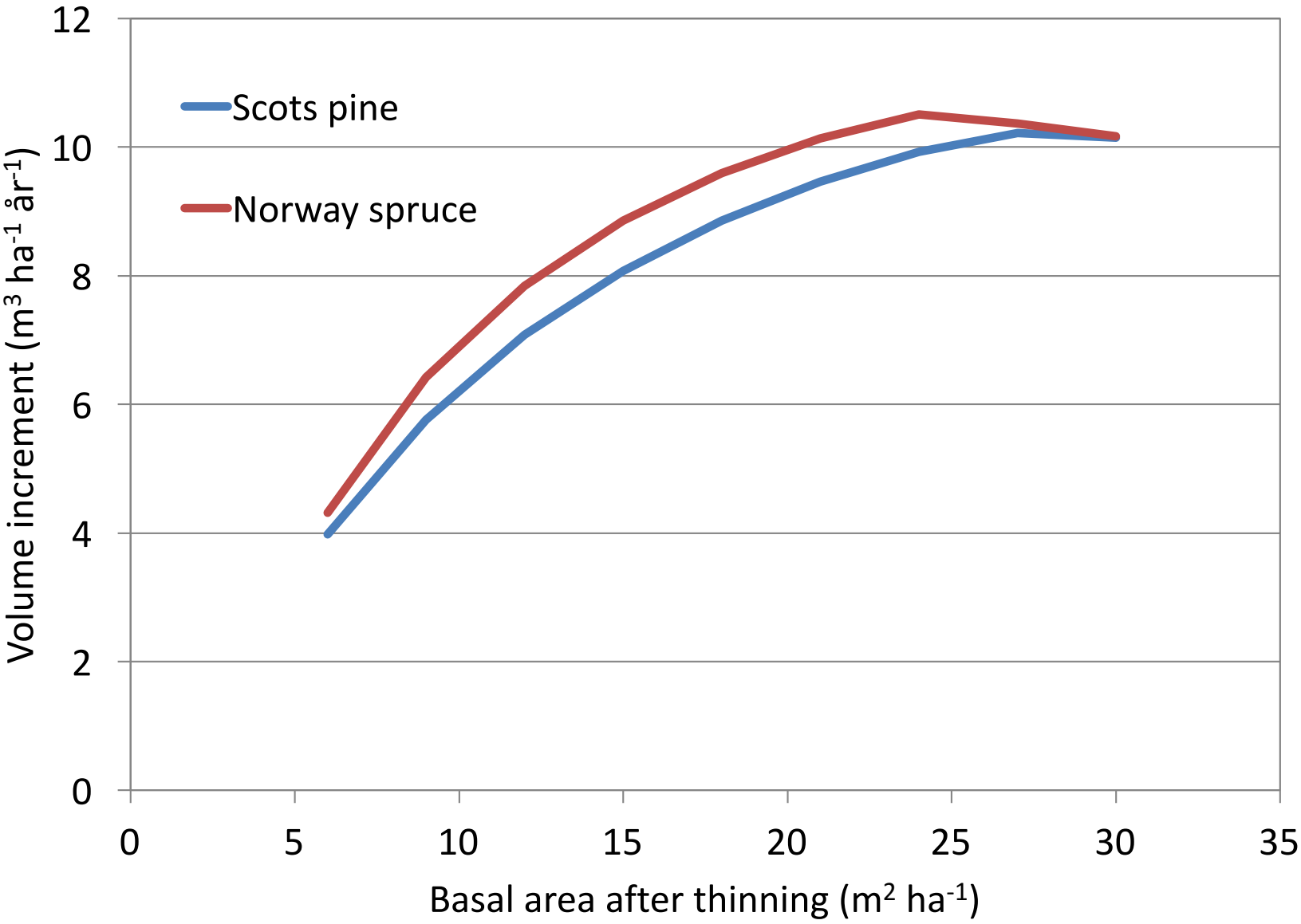

Markavvattning
Skyddsdikning
Bäckrensning
Dikeslängd (km)
12000
10000
8000
6000
4000
2000
0
1873
1883
1893
1903
1913
1923
1933
1943
1953
1963
1973
1983
1993
2003

Pre-commercial thinning

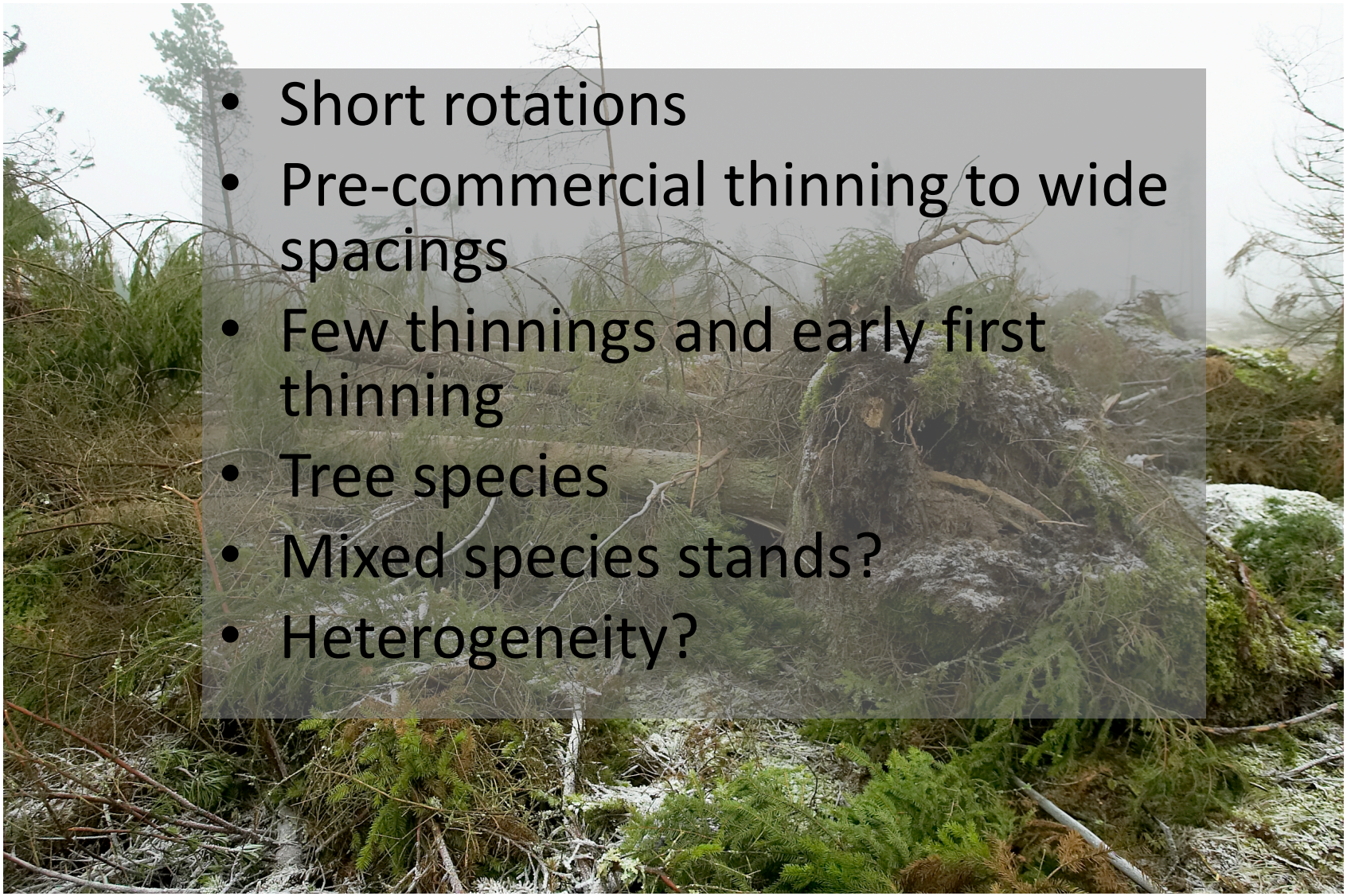
Pre-commercial thinning

- Probably the most important silvicultural treatment
- Sets the arena for silviculture for the rest of the rotation
- Regulation of tree species composition
- Dense spacings for high production but a compromise between production and economy
- Possibility to produce bioenergy in young stands

Commercial thinning

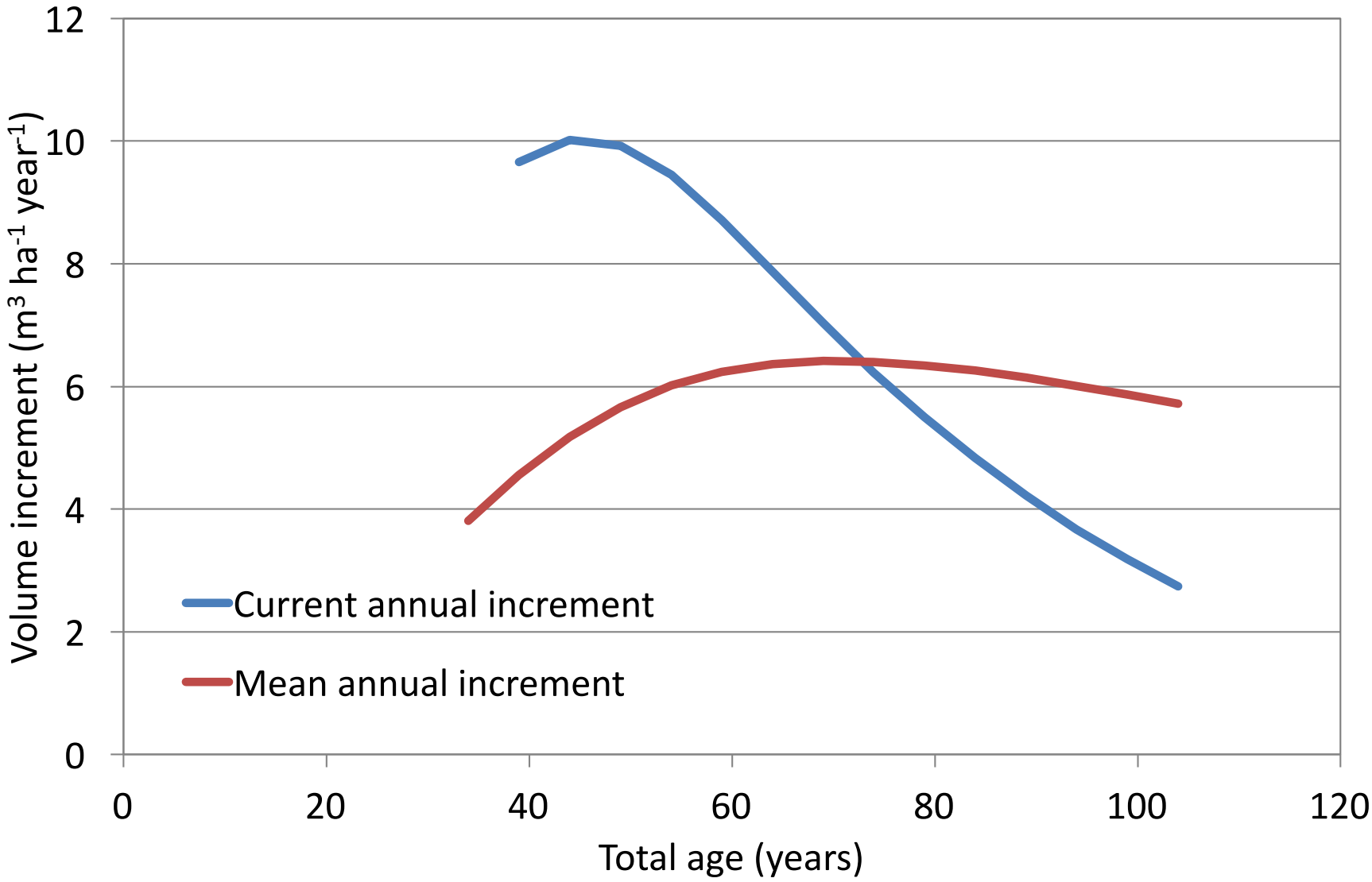


Wind throw



- Short rotations
- Pre-commercial thinning to wide spacings
- Few thinnings and early first thinning
- Tree species
- Mixed species stands?
- Heterogeneity?

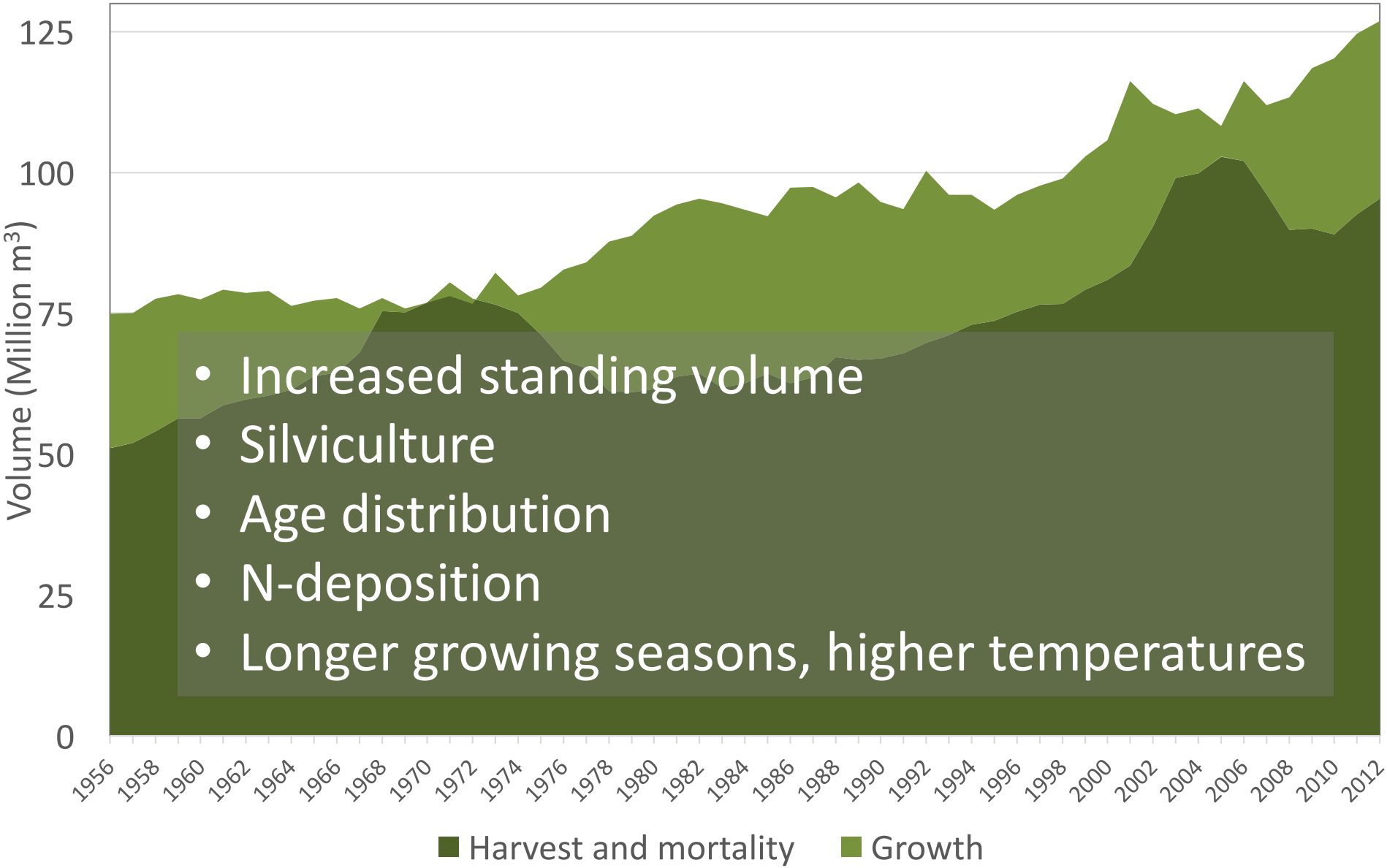
Rotation length



Rotation length

- The old forest stands in the way of the ”new fast-growing forest”
  - Genetically improved material
  - Tree species
  - Regeneration treatments
- Damage
  - Wind-throw
  - Root-rot
  - Insect damage

Harvest, mortality and growth



- Increased standing volume
- Silviculture
- Age distribution
- N-deposition
- Longer growing seasons, higher temperatures

Conclusion

- Growth will probably continue to increase (genetics, silviculture, climate change)
- It is possible to go beyond the increase of growth that is built into the system
- However, most growth improving treatments have a lag-period (starting with regeneration)
- Forests that will contribute to growth in 2050 are established today