Can Intensive Fertilization Mitigate Future Timber Supply Challenges in the Interior of British Columbia?

Rob Brockley
BC Ministry of Forests & Range
Kalamalka Forestry Centre
Vernon, BC

Fertilization as a mitigation strategy

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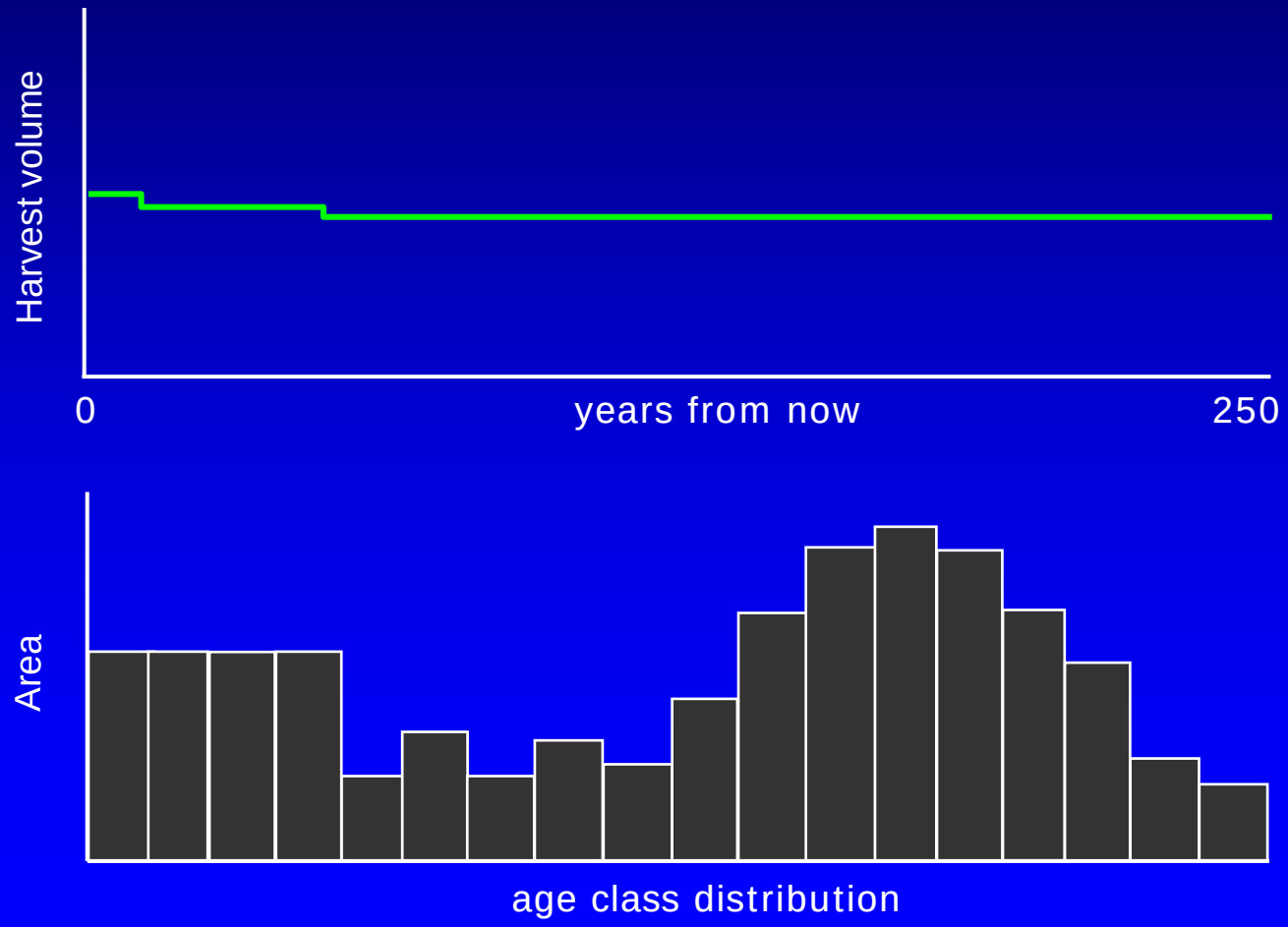
- Forest fertilization is a proven silvicultural treatment for accelerating the operability of established stands without sacrificing harvest volume
- Fertilization can be used strategically to impact the amount and timing of future harvests

How fertilization mitigates MPB mortality

Conceptual



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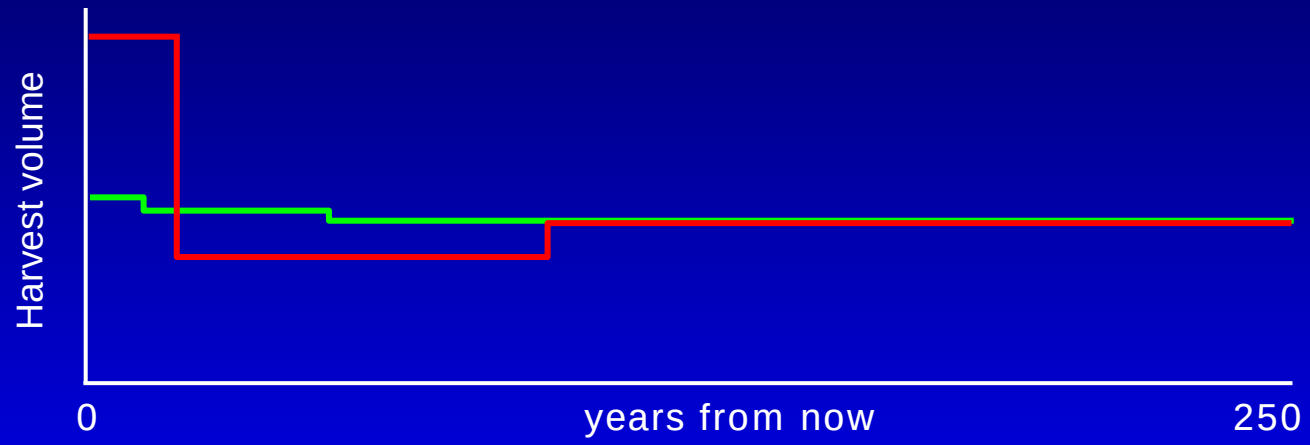

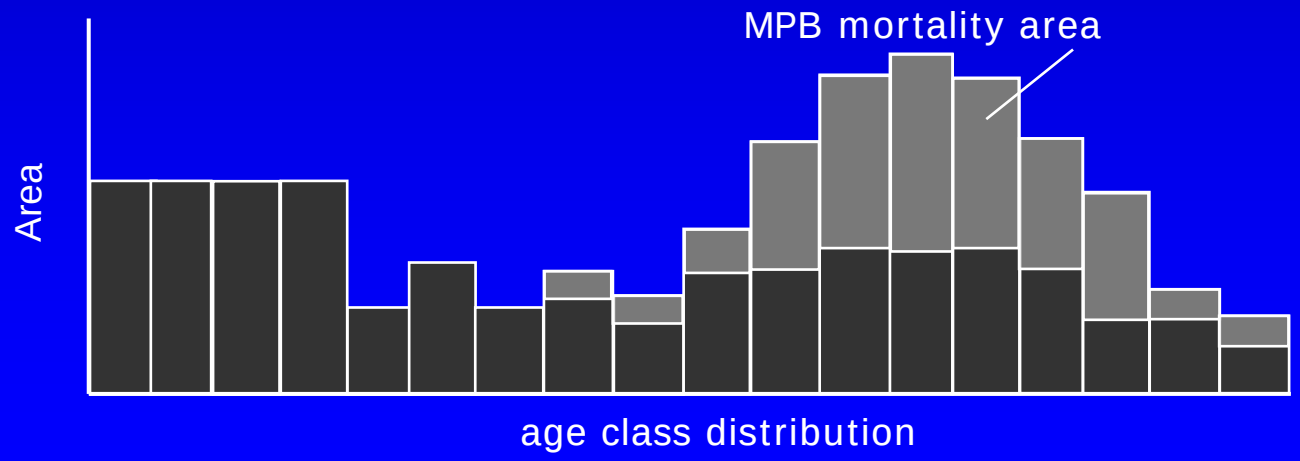

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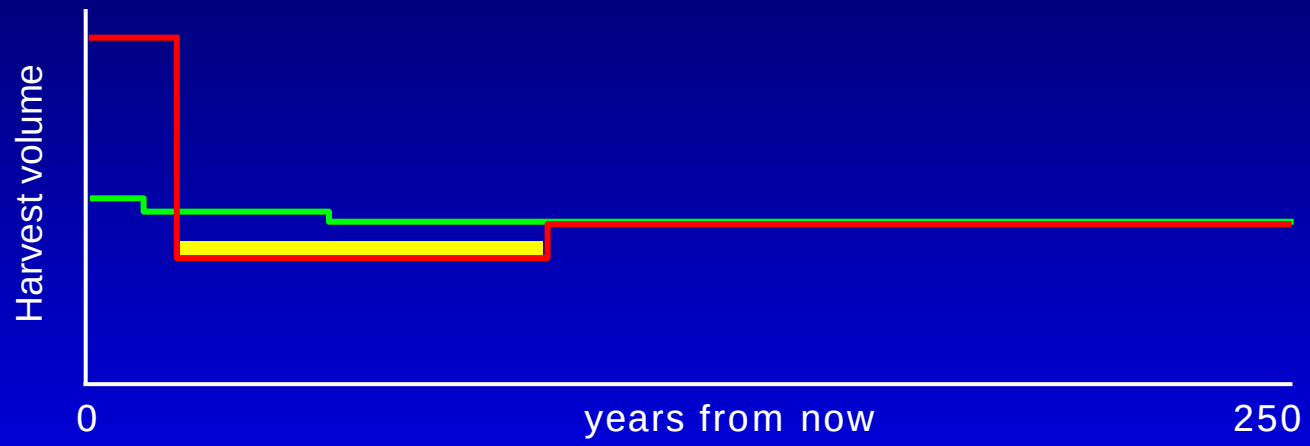
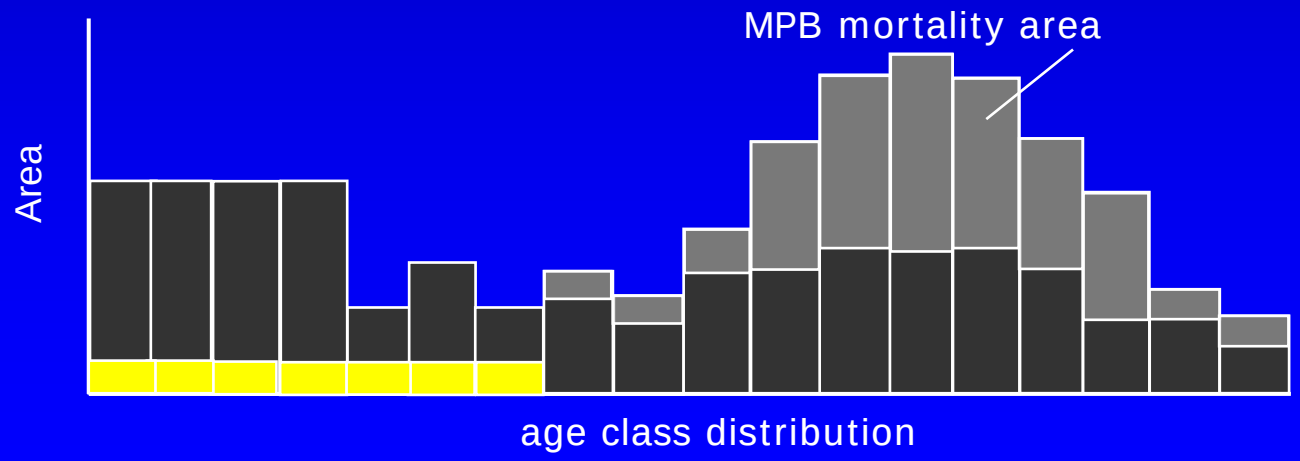
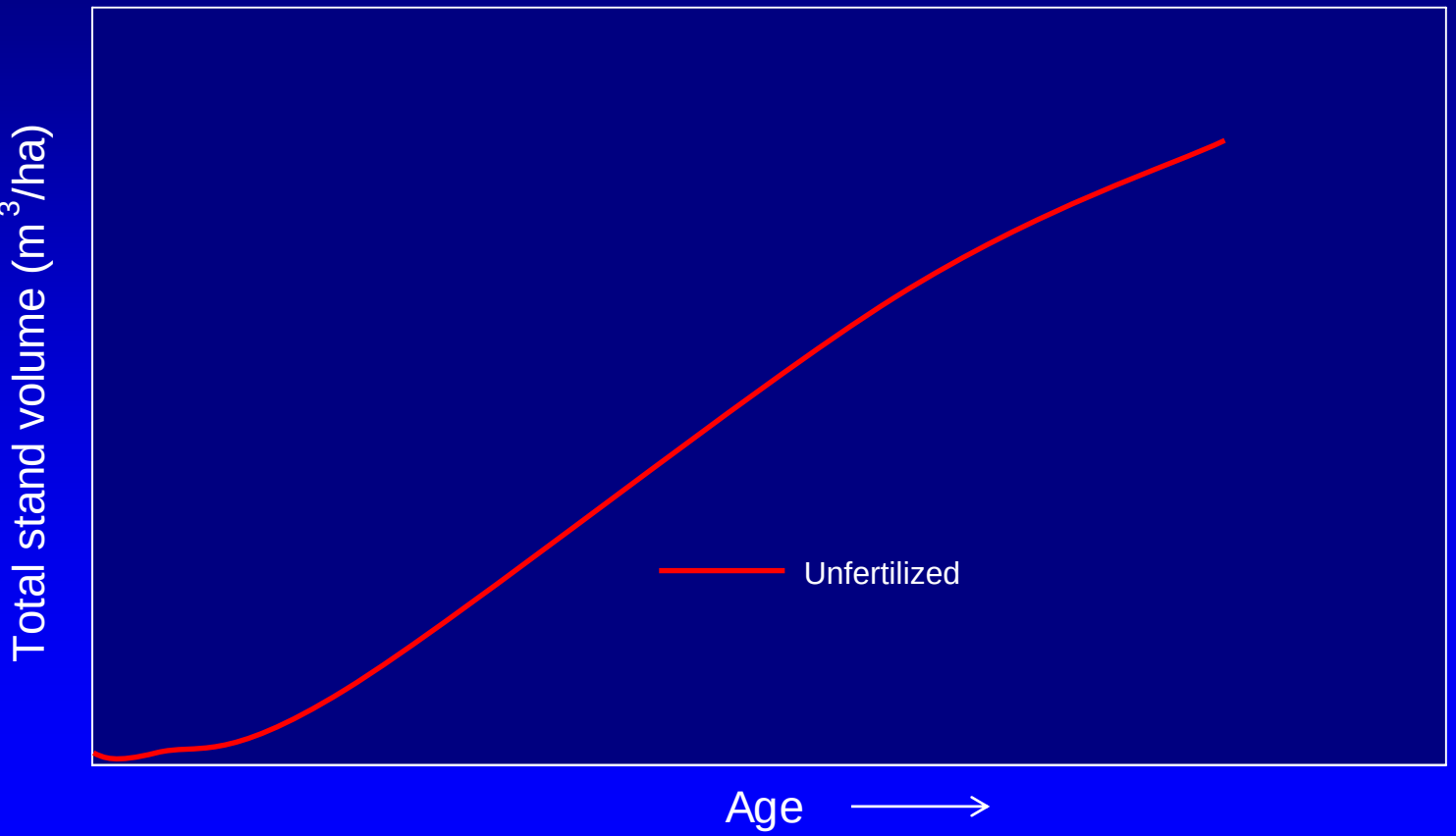




- Fertilizing 15- to 80-year-old stands (**yellow**) can increase harvest volumes 10–60 years from now

Typical pattern of growth response following "conventional" fertilization

Type 1 response



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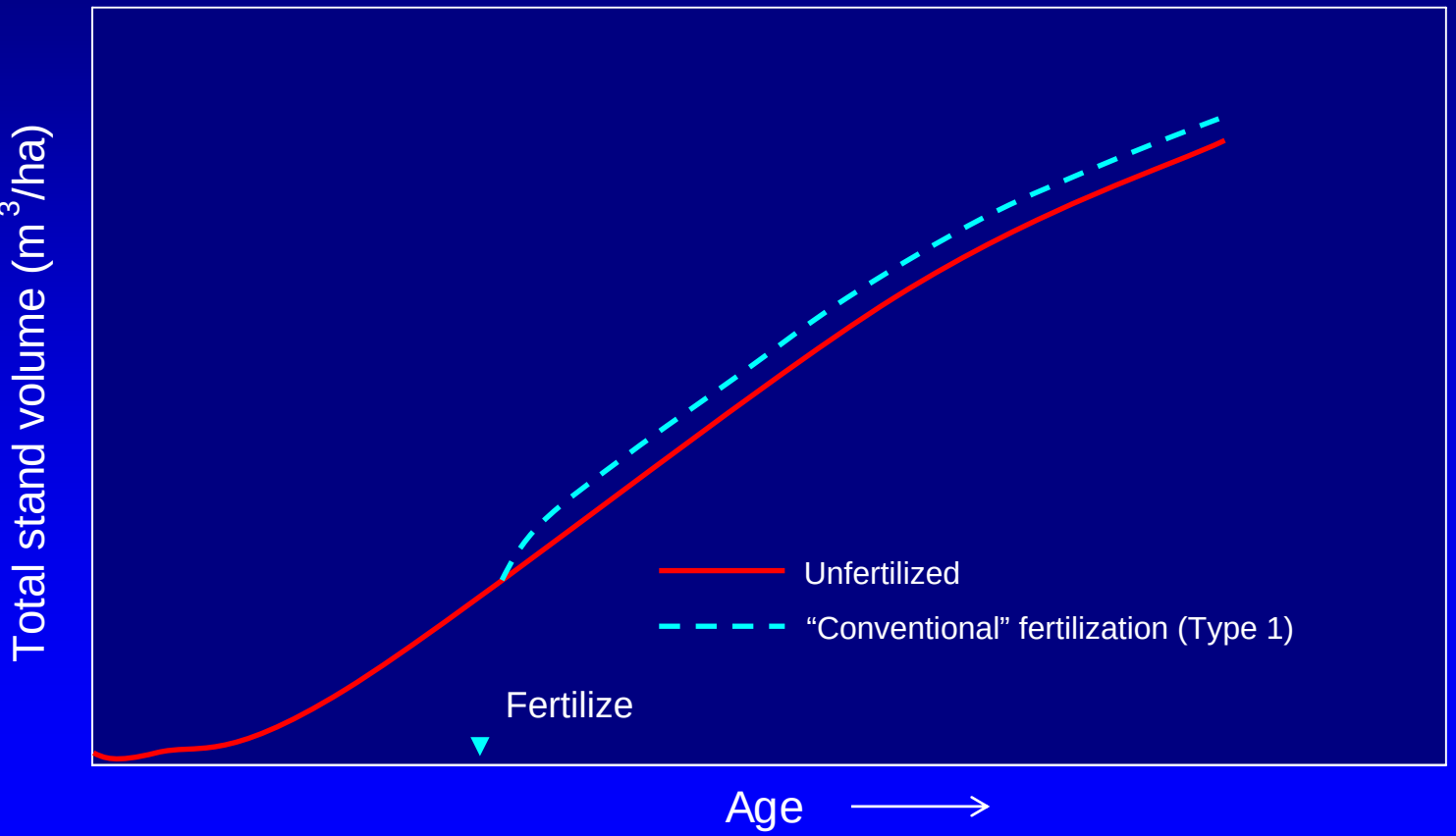

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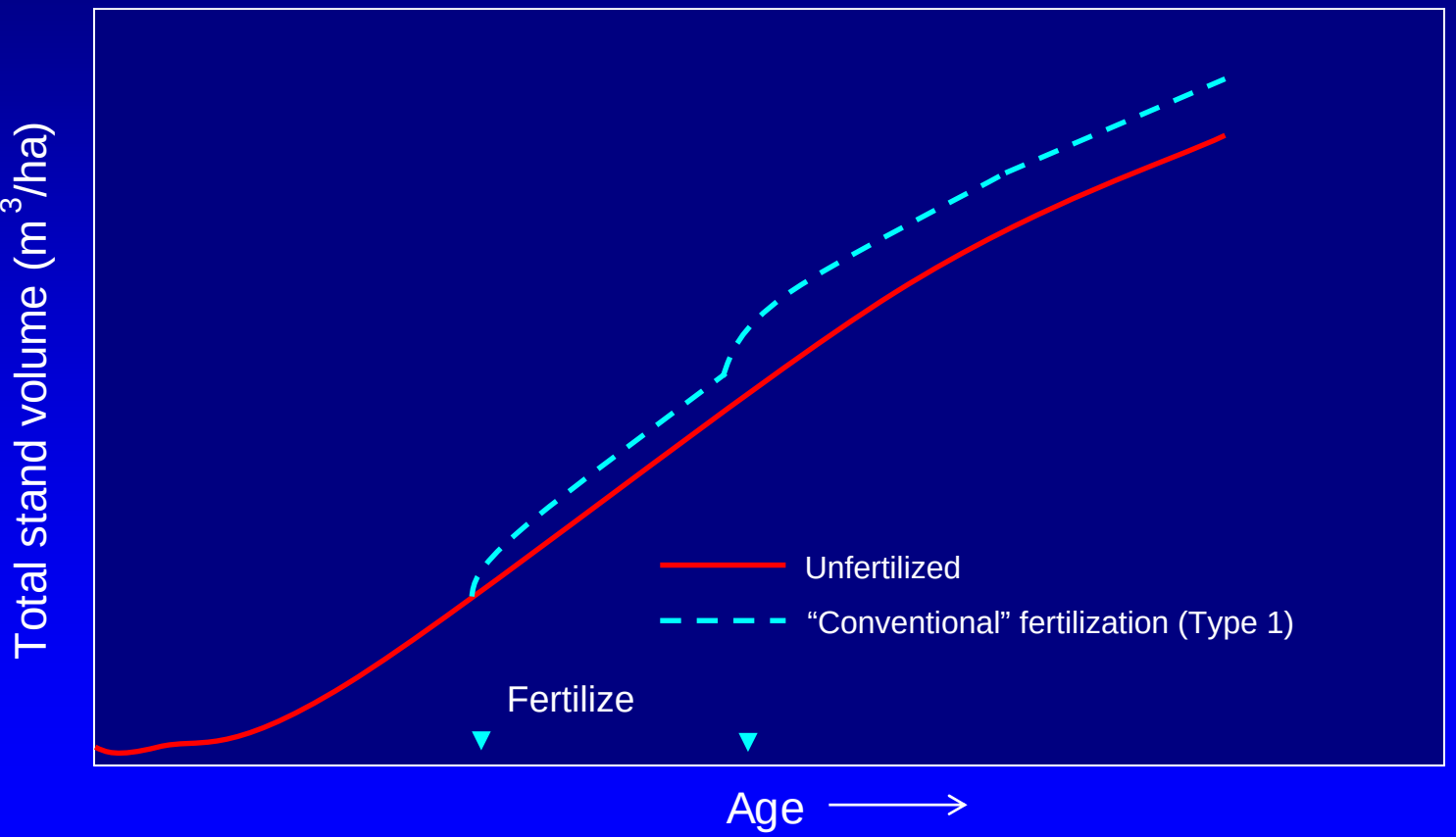
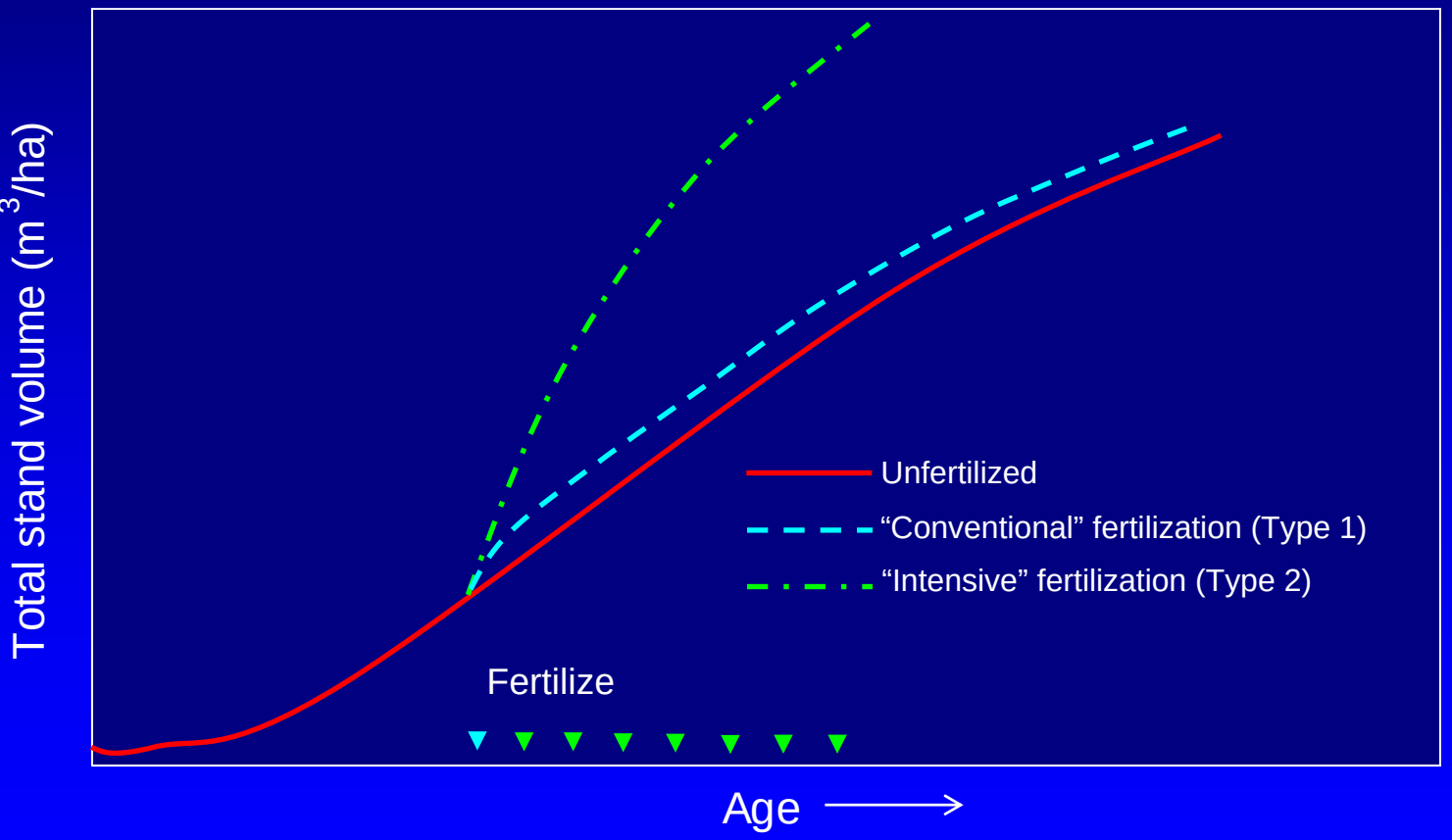


Typical pattern of growth response following "intensive" fertilization

Type 2 response



Effects of yearly fertilization on the growth of Norway spruce in northern Sweden

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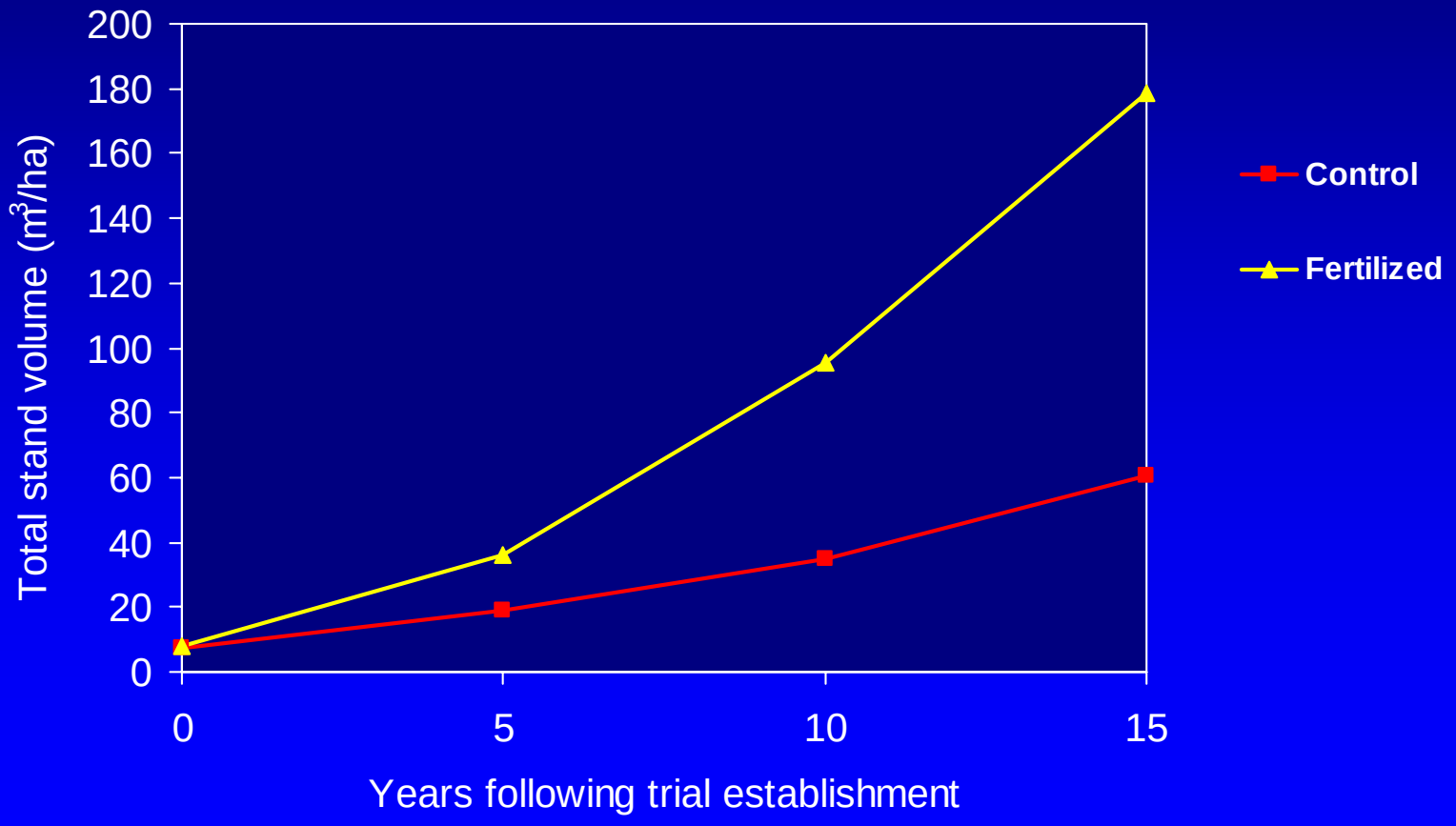
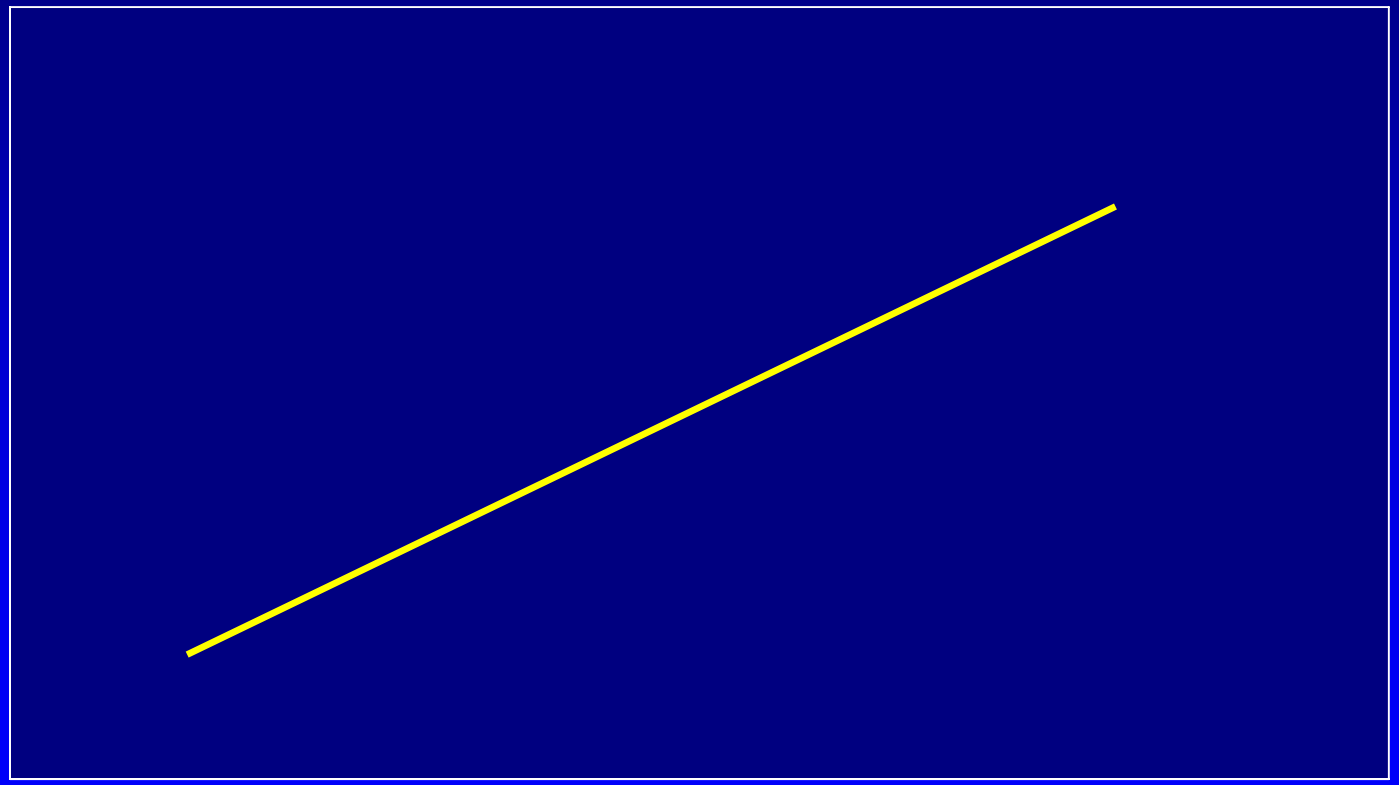


Relationship between stem wood production and light interception by forest canopy



How can light interception be maximized?

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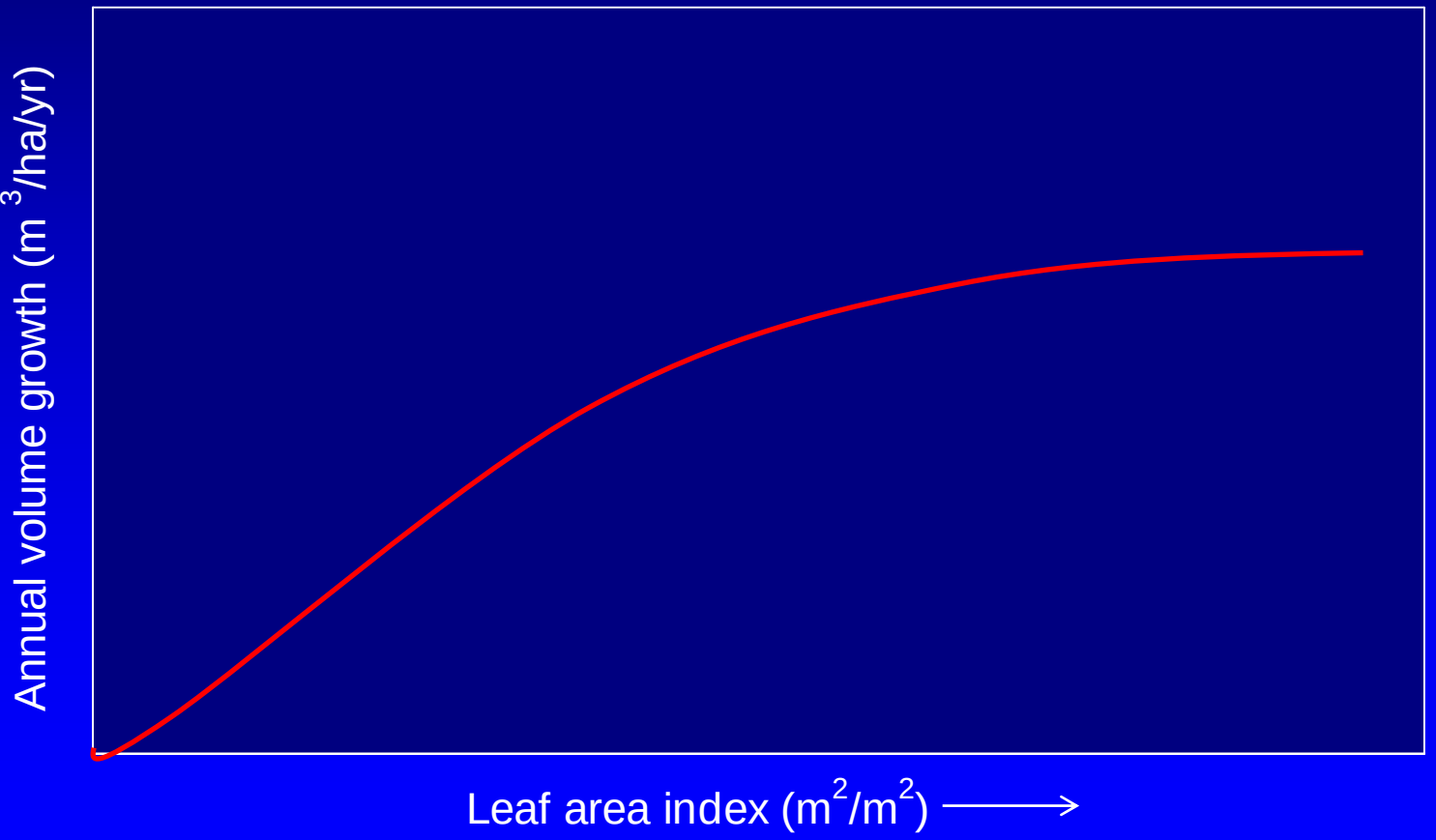
- Increase the length of the growing season
- Increase the amount of leaf area
- Leaf area is strongly influenced by nutrient availability

Relationship between annual volume growth and leaf area



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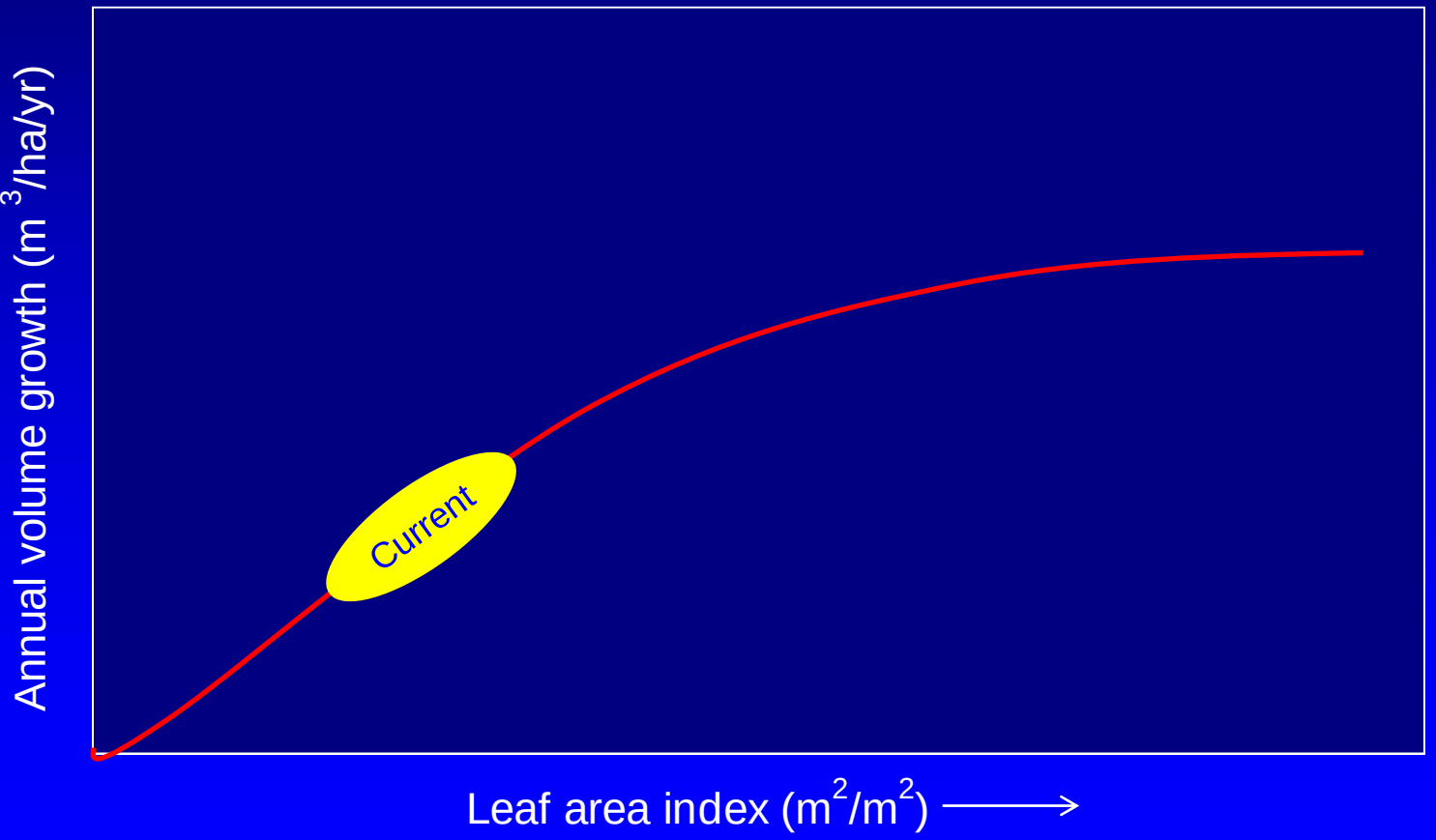

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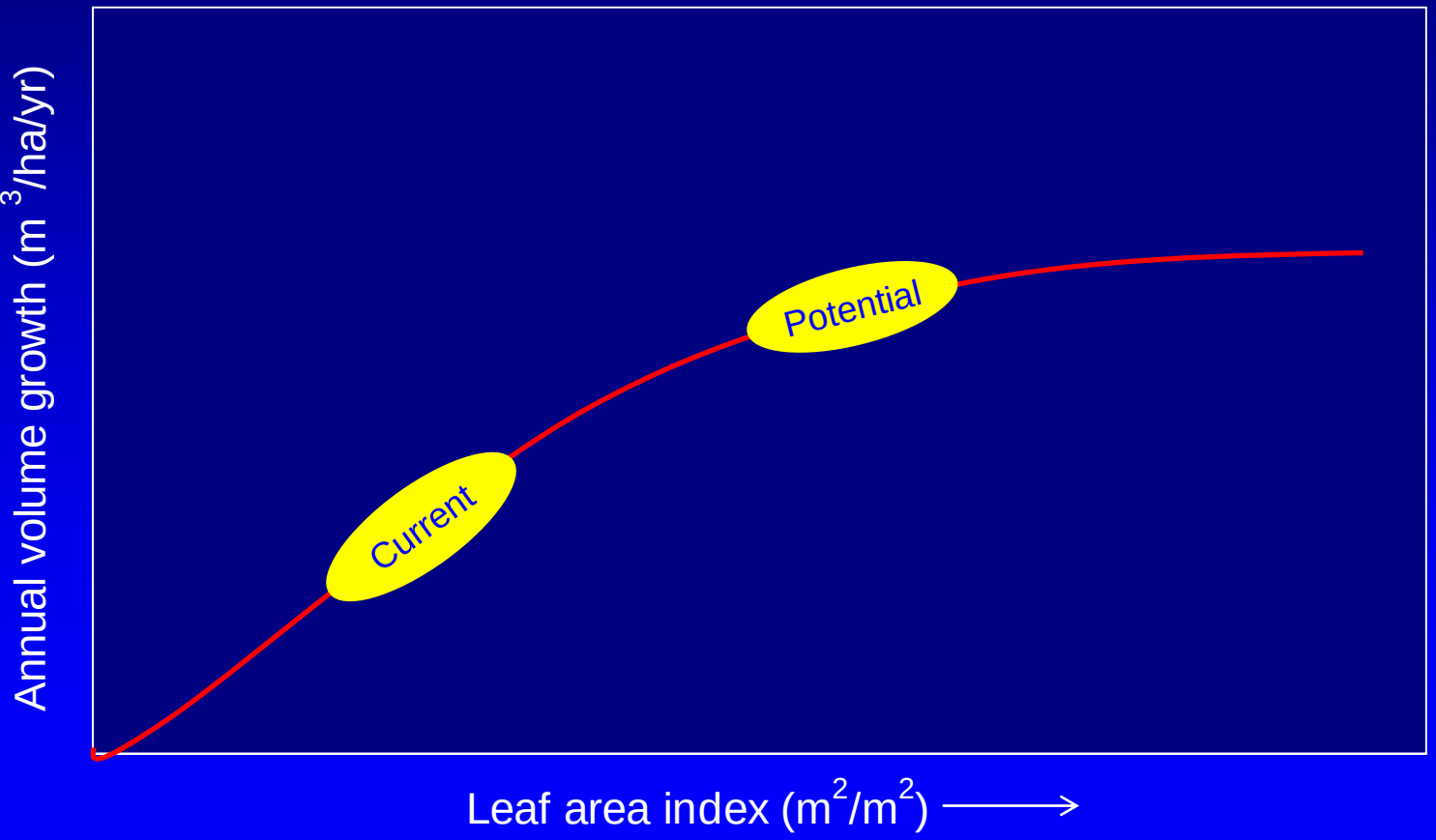

“Maximum Productivity” fertilization research

EP 886.13

- Objectives
  - determine the effects of different regimes and frequencies of repeated fertilization on the growth and development of young, managed interior forests

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- Objectives
  - determine the effects of different regimes and frequencies of repeated fertilization on the growth and development of young, managed interior forests
  - document the long-term effects of intensive, repeated fertilization on above- and below-ground timber and non-timber resources

Study sites

Sheridan Creek

- Lodgepole pine
- SBSdw2
- 13 years old, natural regeneration

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Sheridan Creek

- Lodgepole pine
- SBSdw2
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Crow Creek

- Interior spruce
- SBSmc2
- 10 years old, planted

Treatments

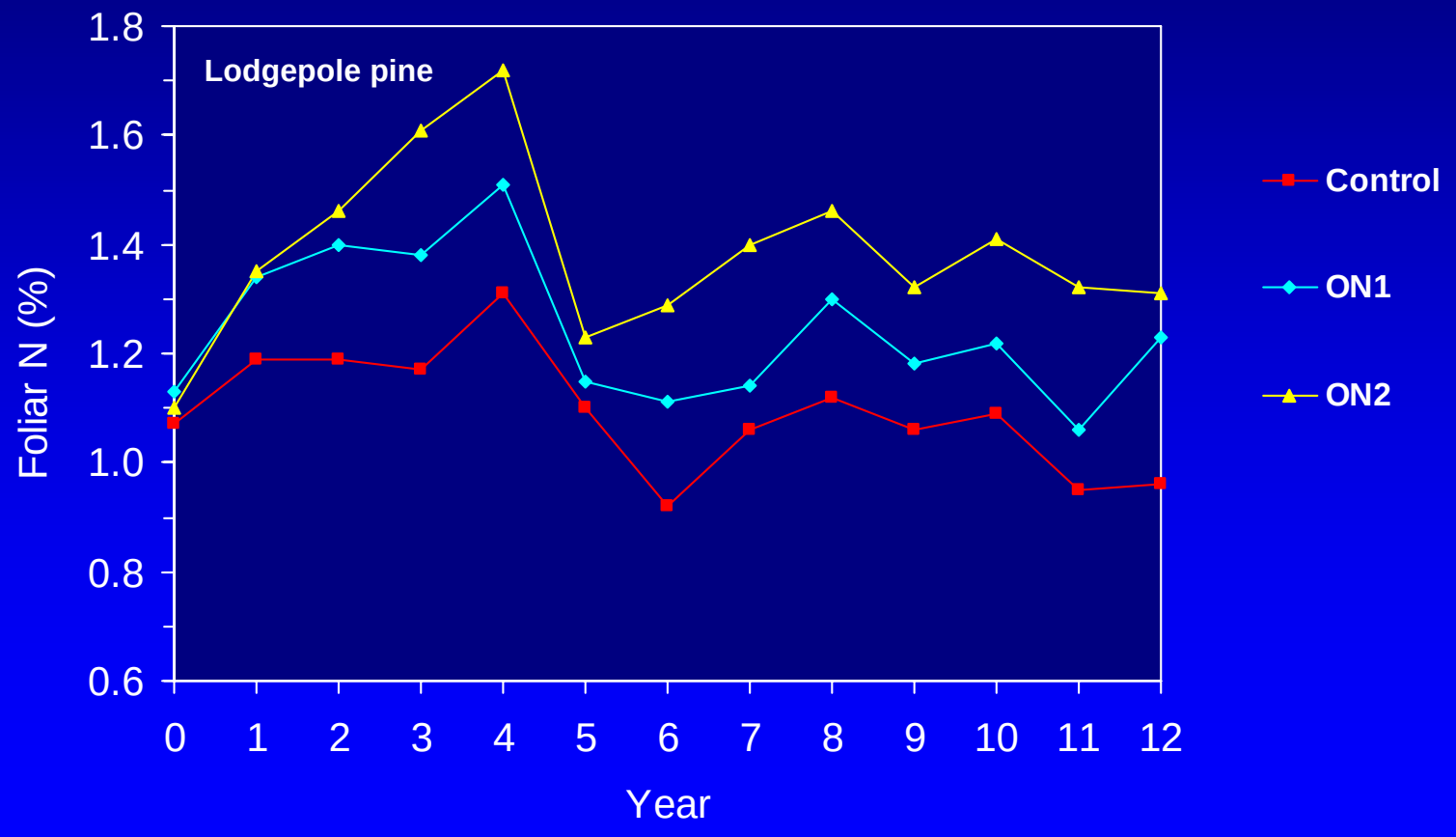
- Control
- N+B
- N+S+B
- “Complete blend”

} every 6 years

- Optimum Nutrition 1 (1.3%N)
- Optimum Nutrition 2 (1.6%N)

Foliar nitrogen by treatment and year

Lodgepole pine (Brockley 2007)



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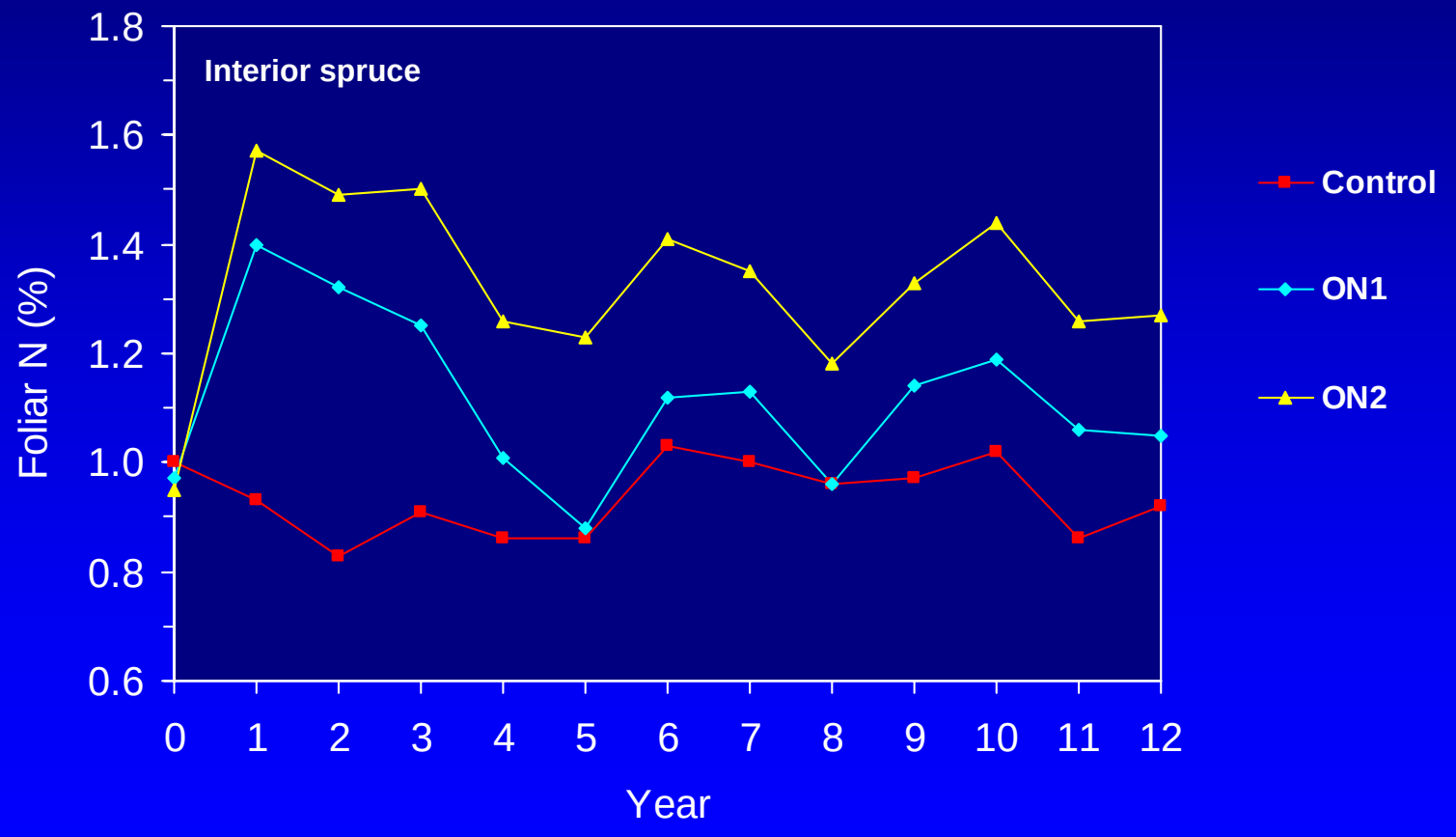

12-year tree height increment by treatment

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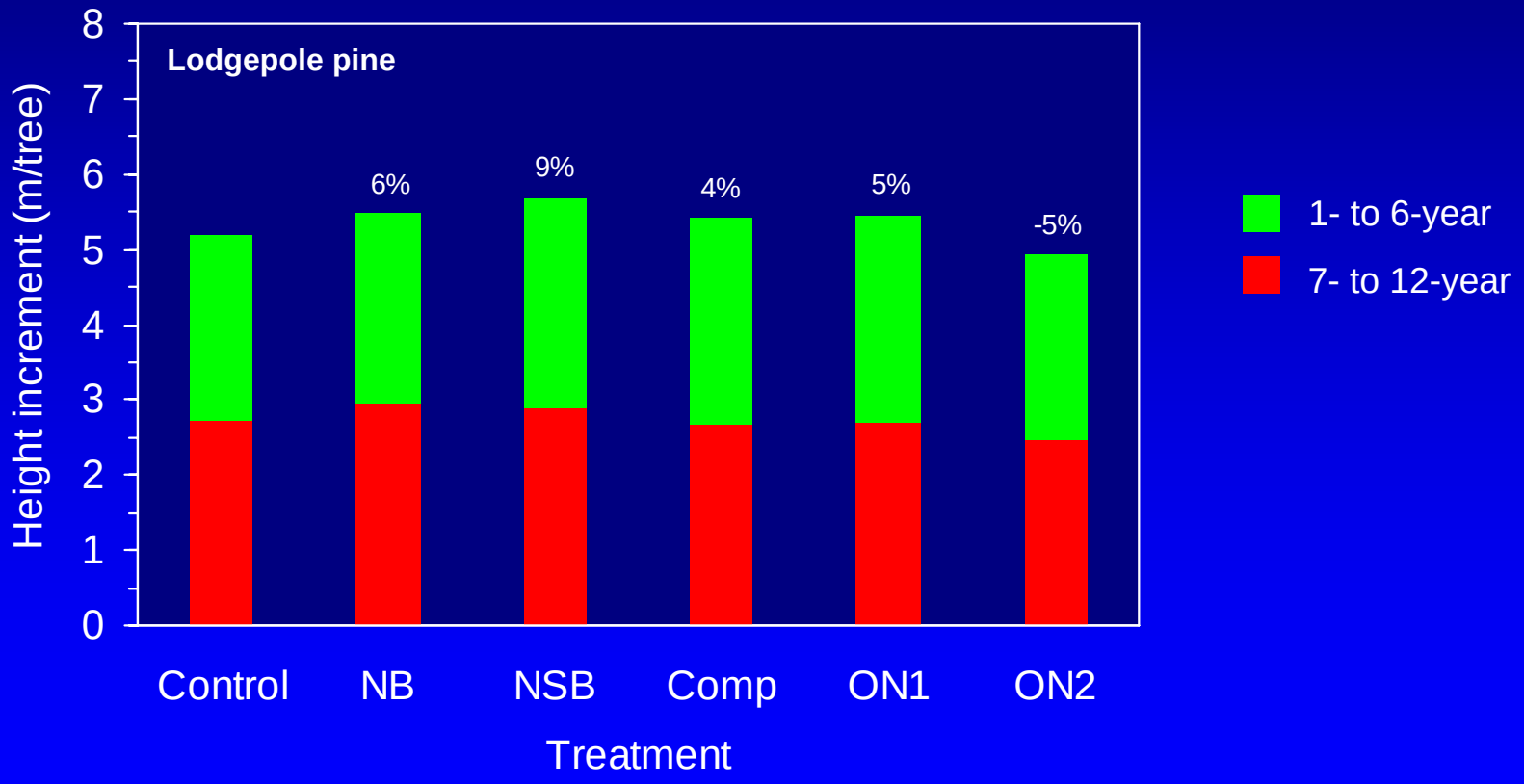

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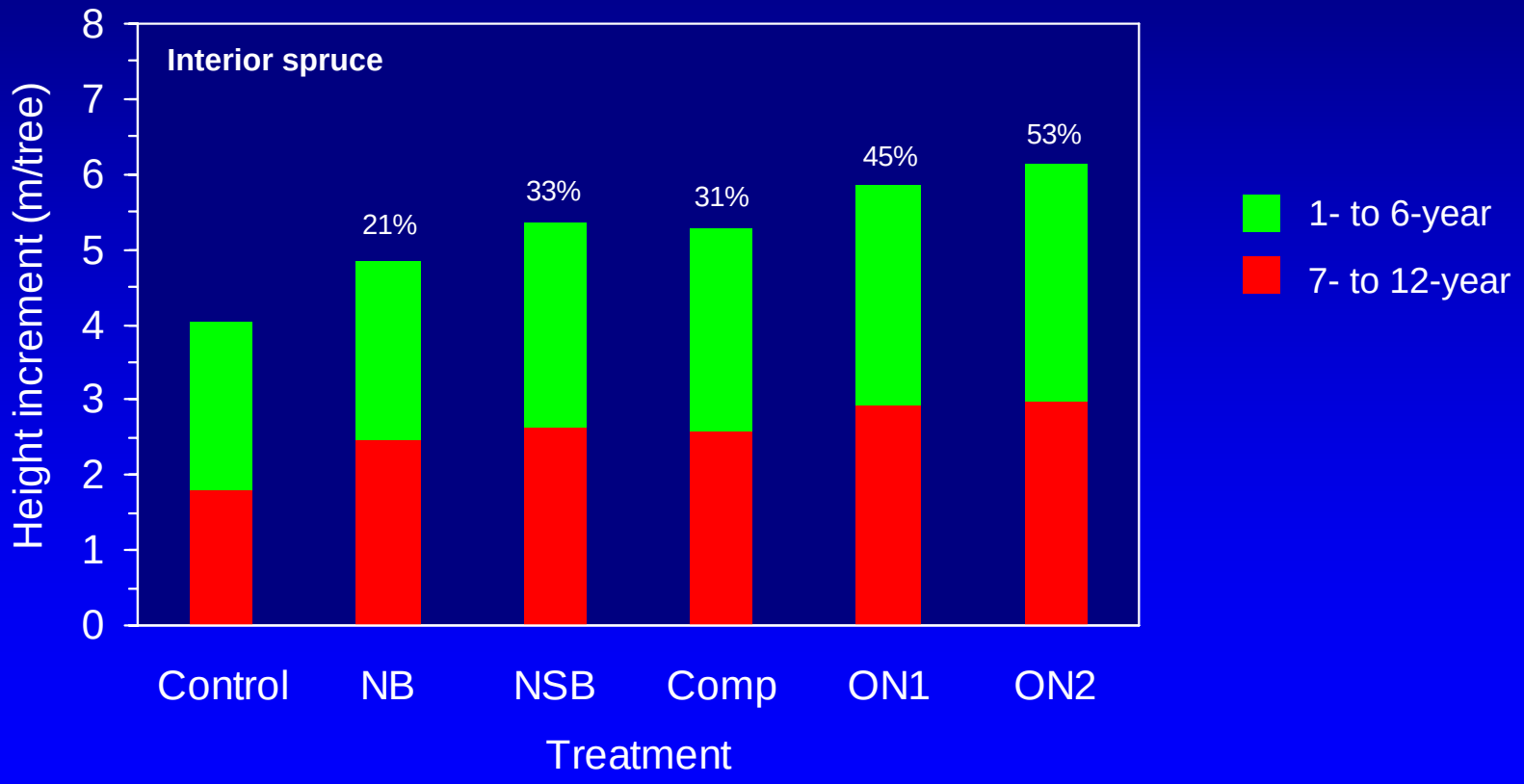

12-year stand volume increment by treatment

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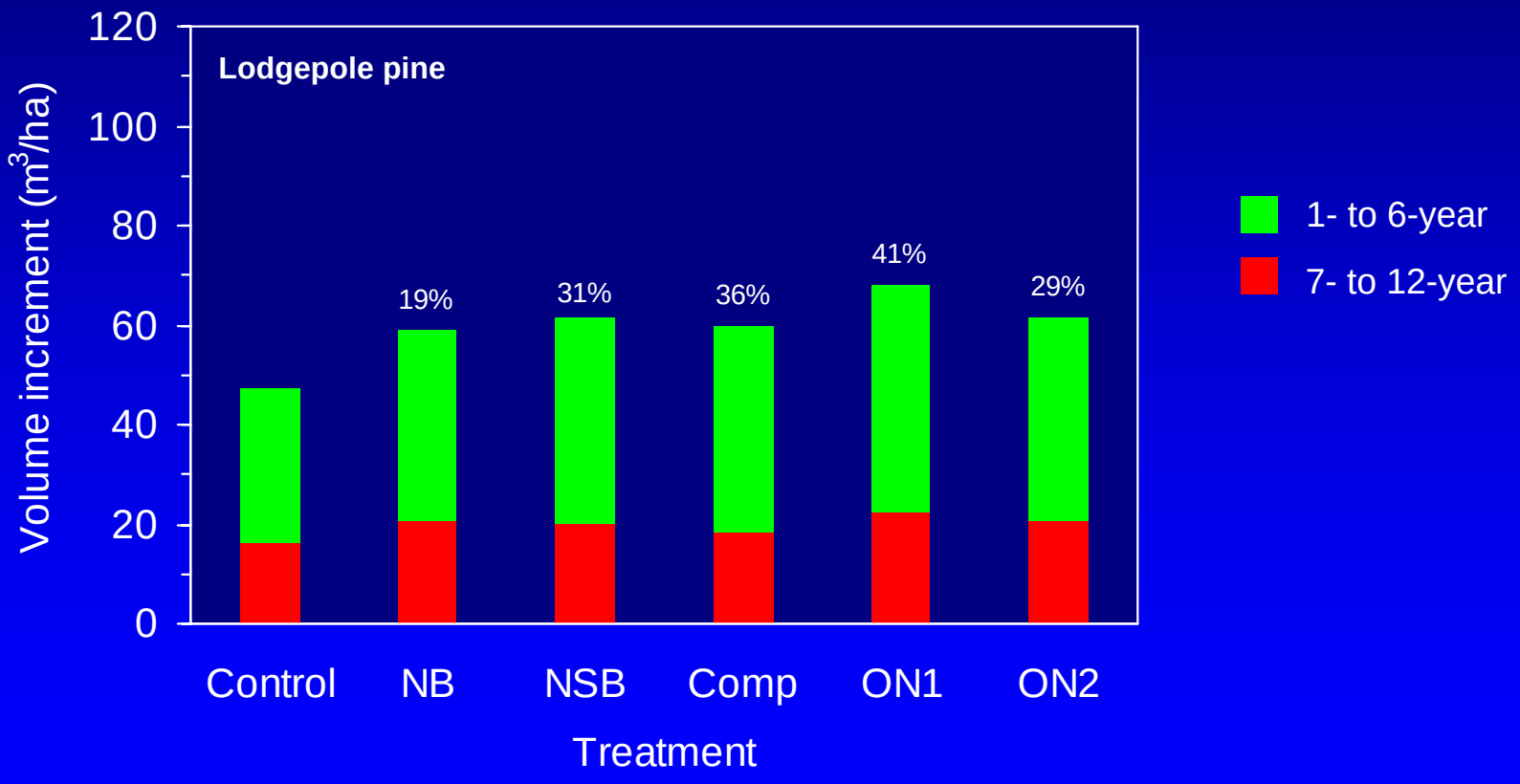

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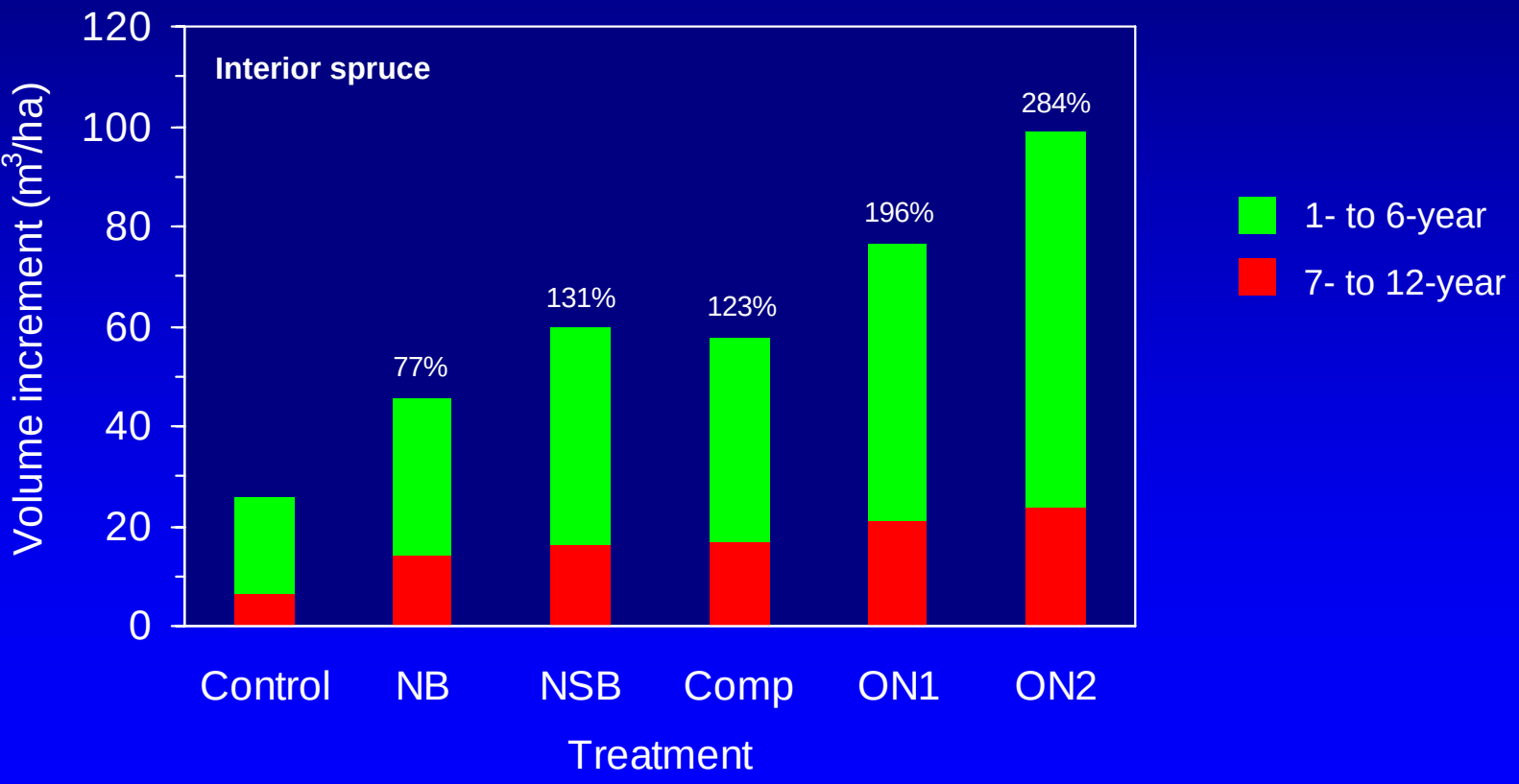

12-year stand volume development by treatment

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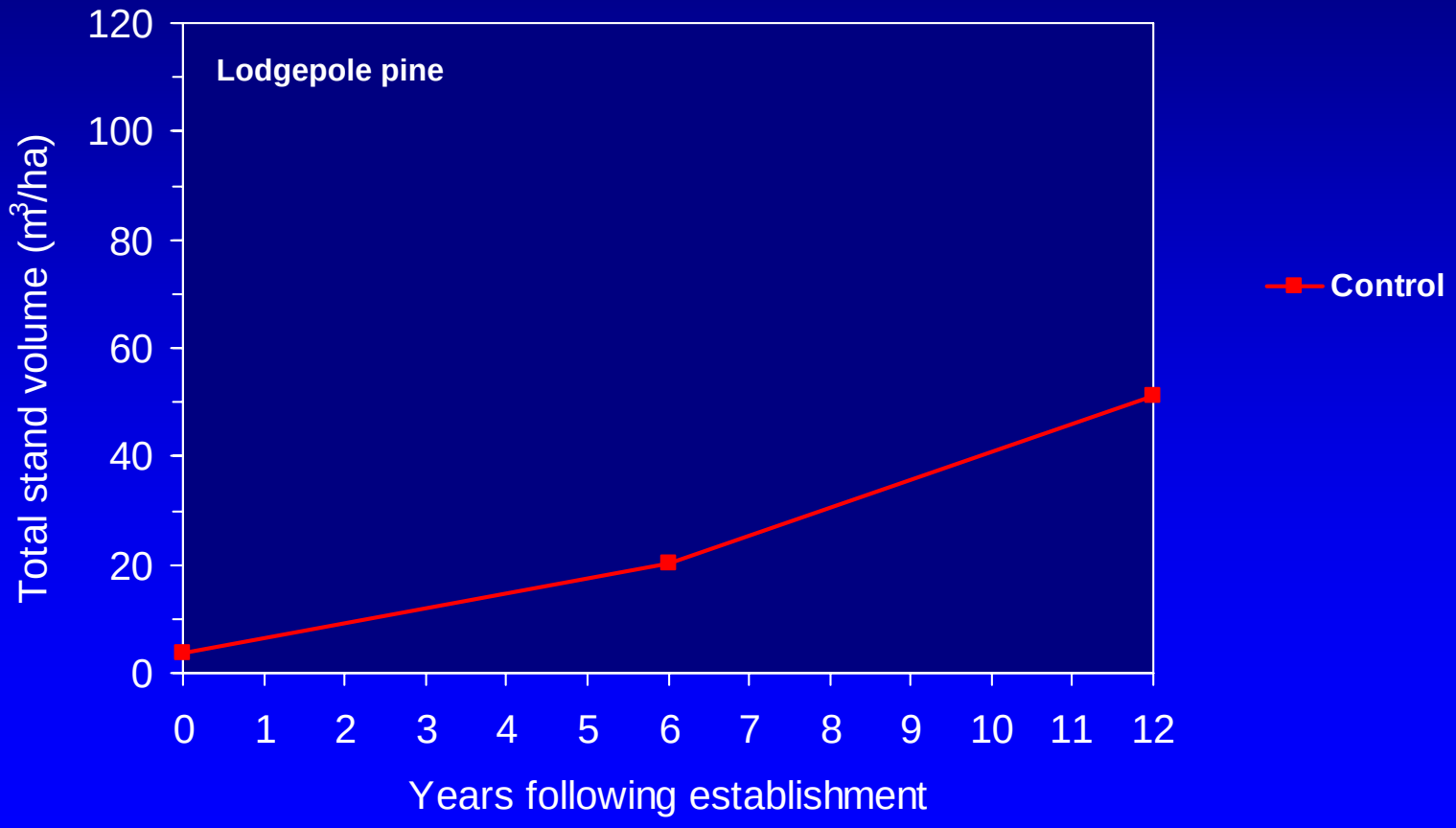

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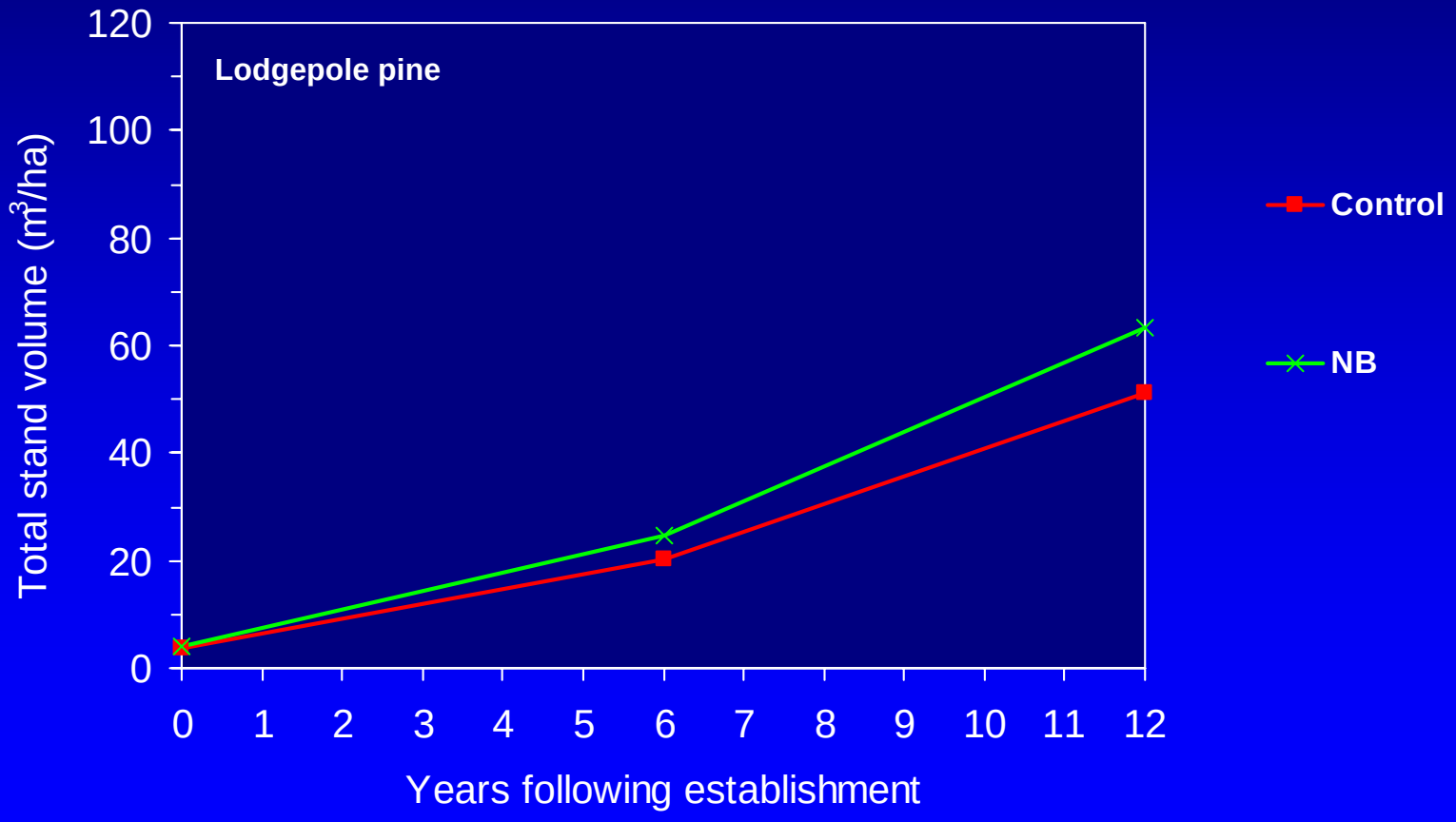

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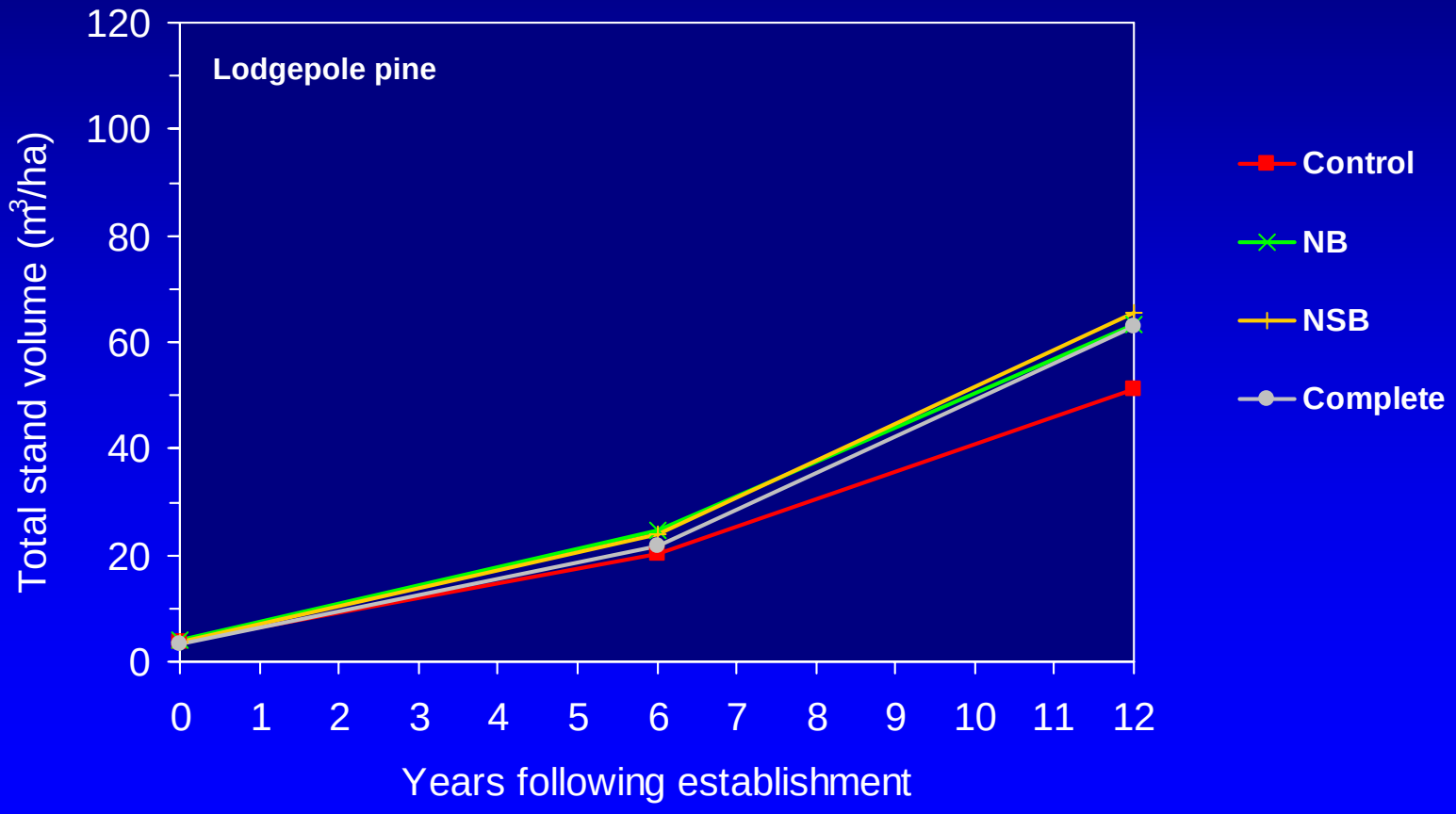

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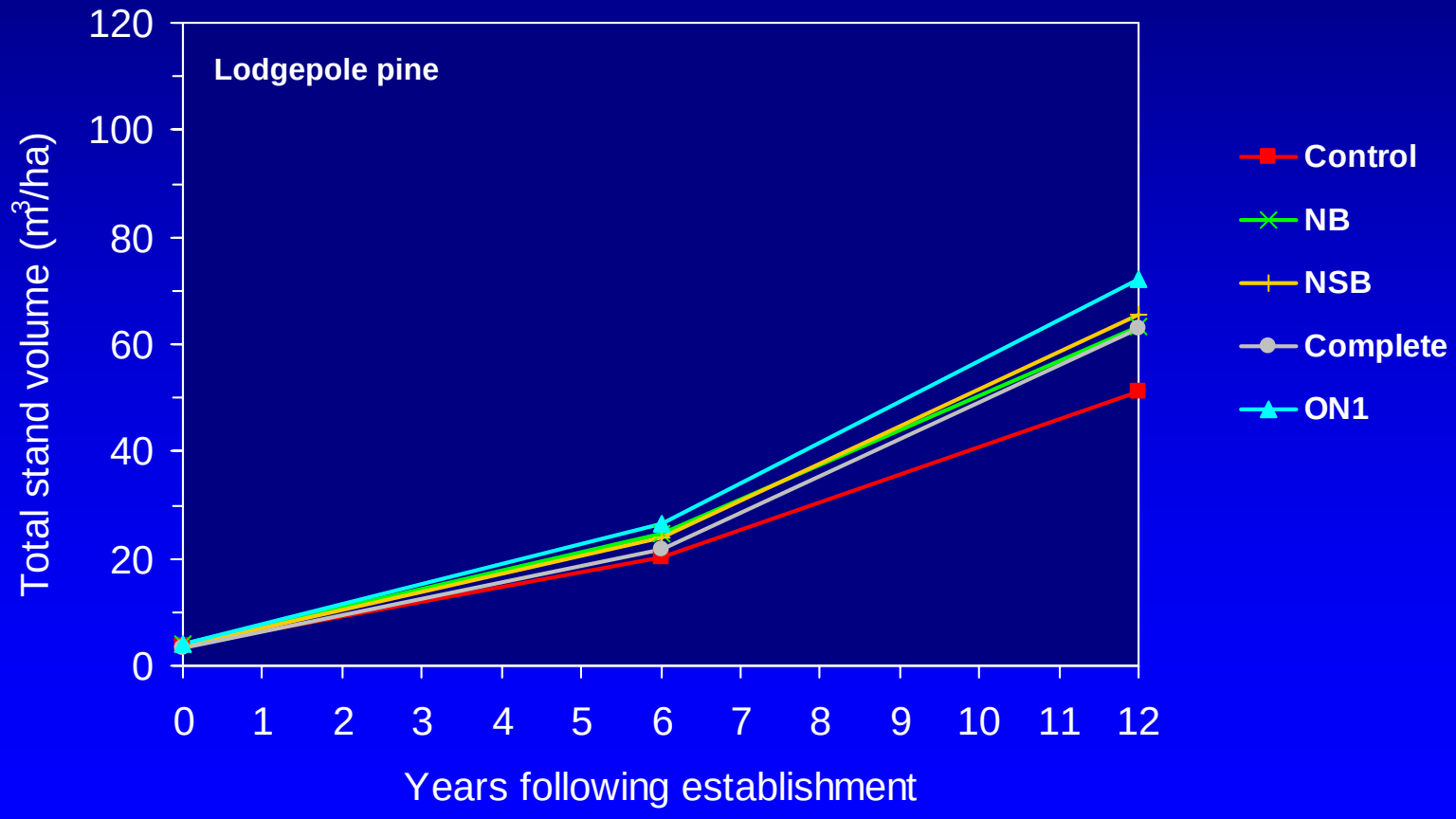

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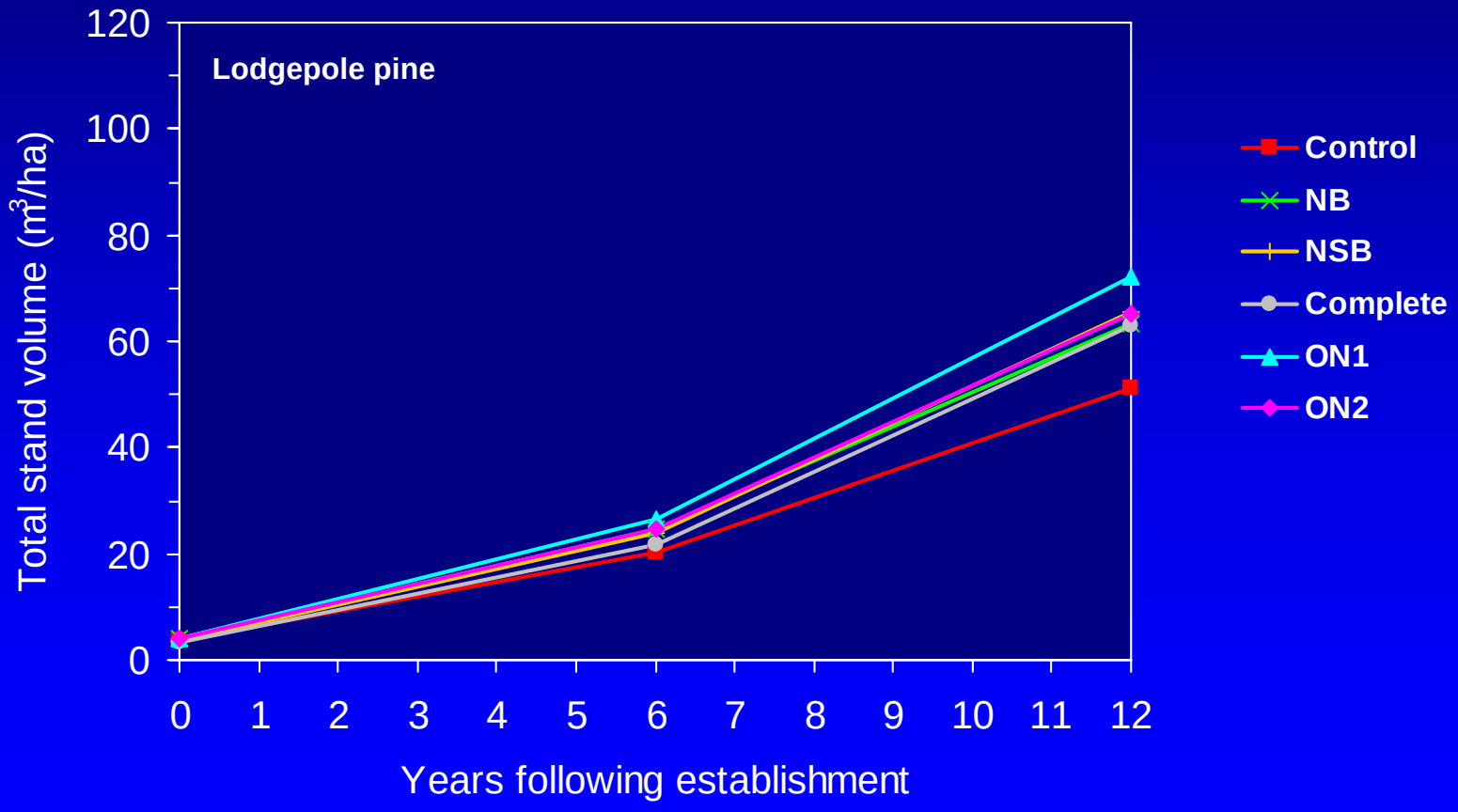

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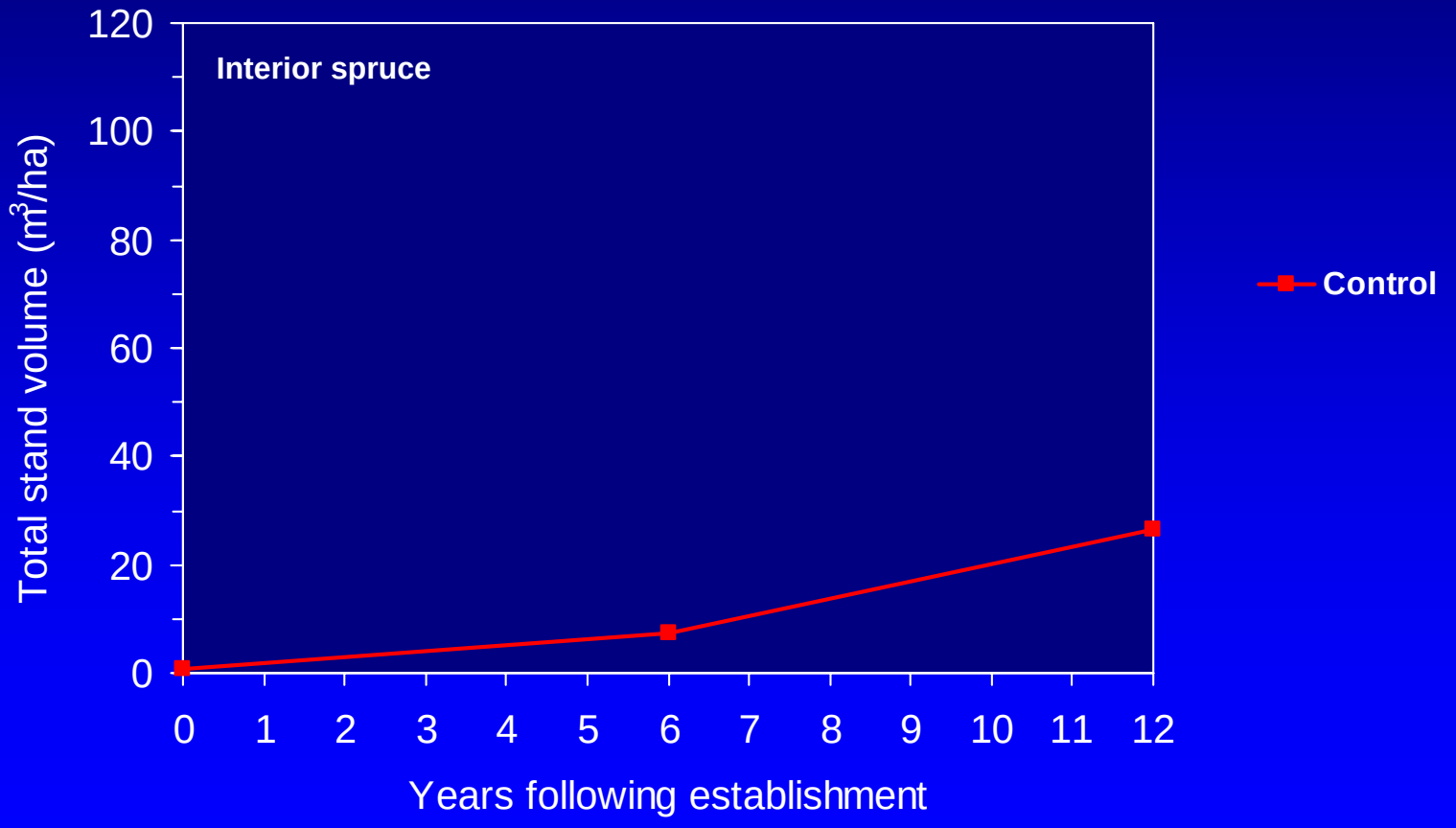

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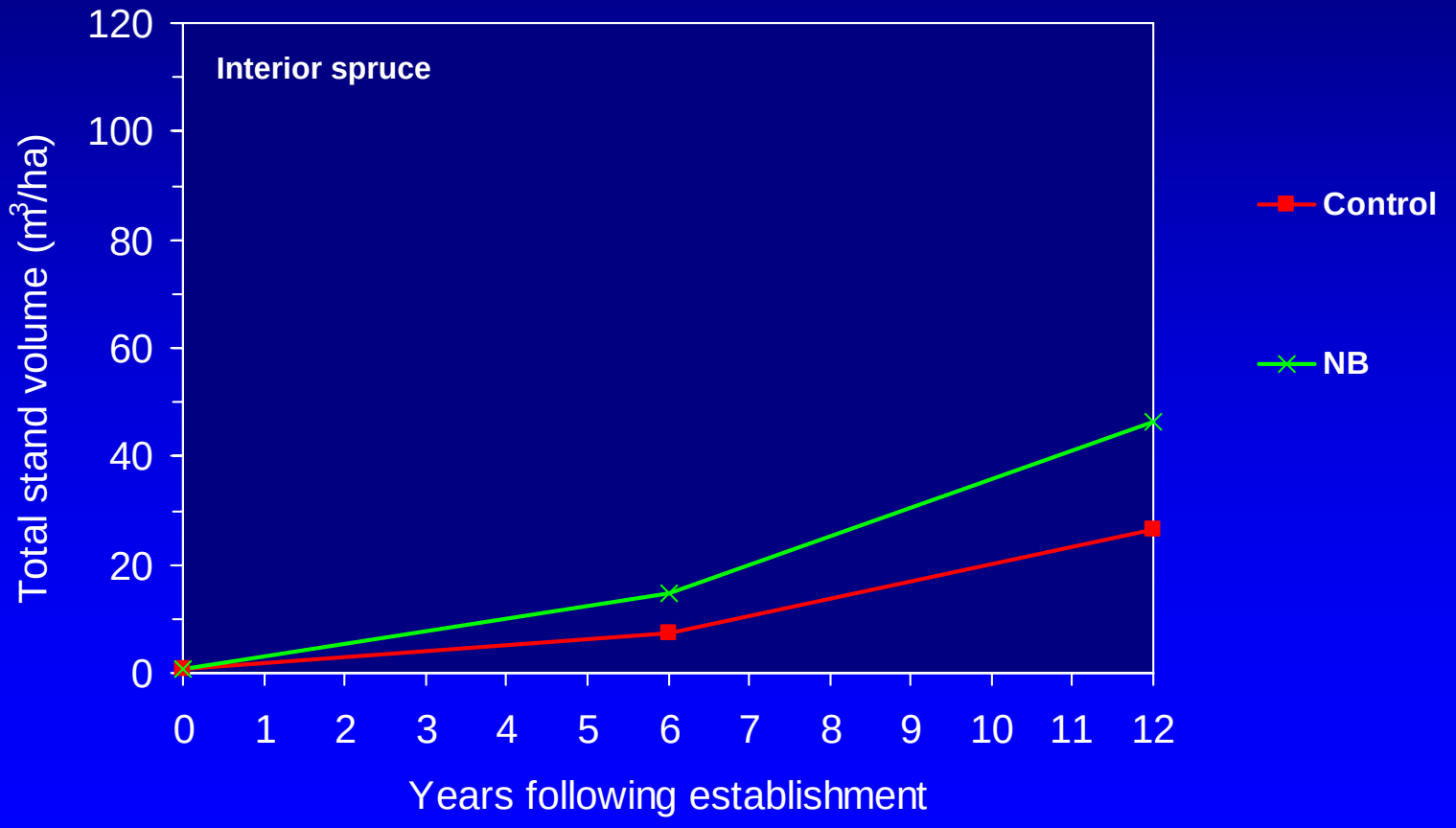

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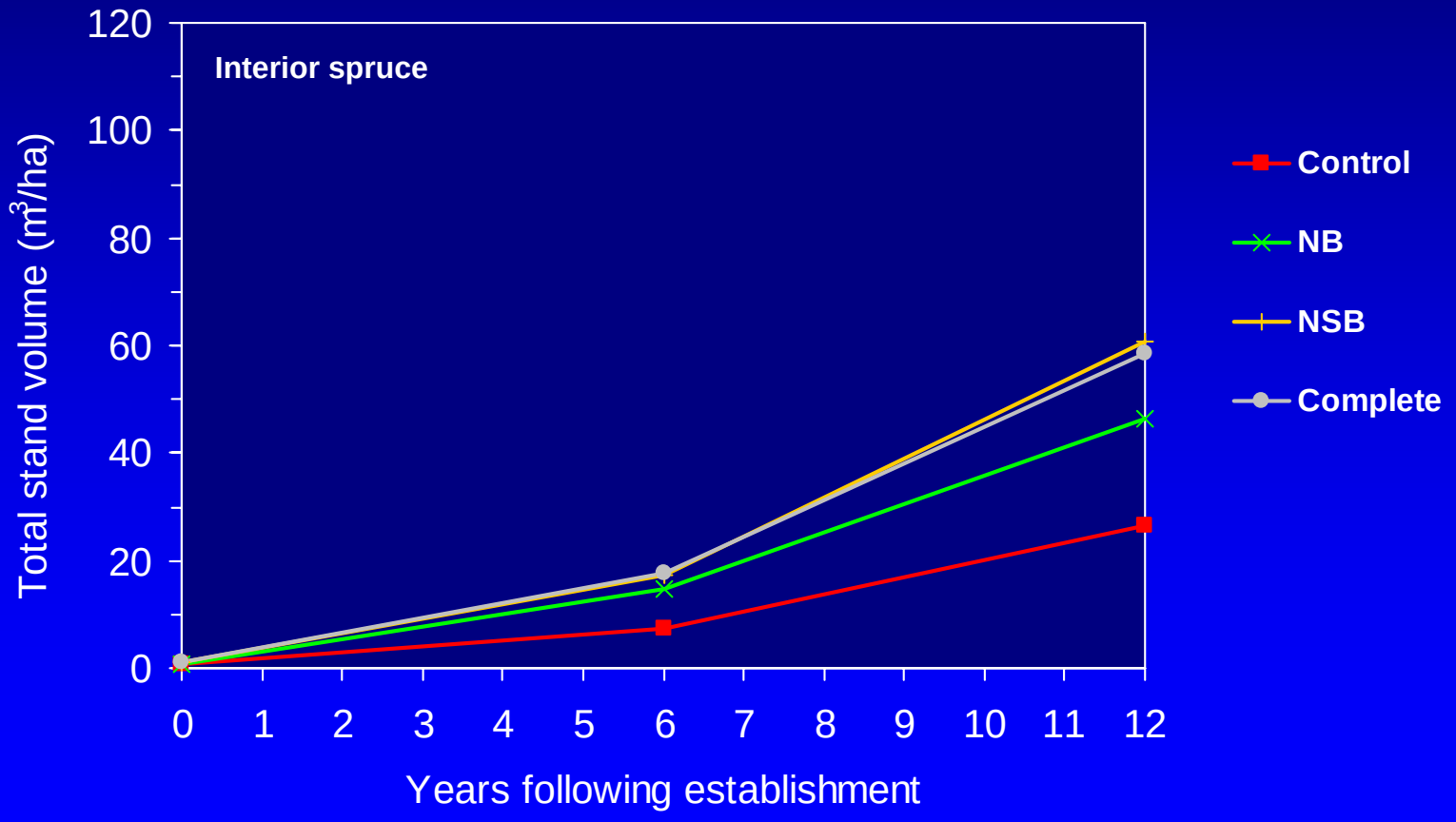

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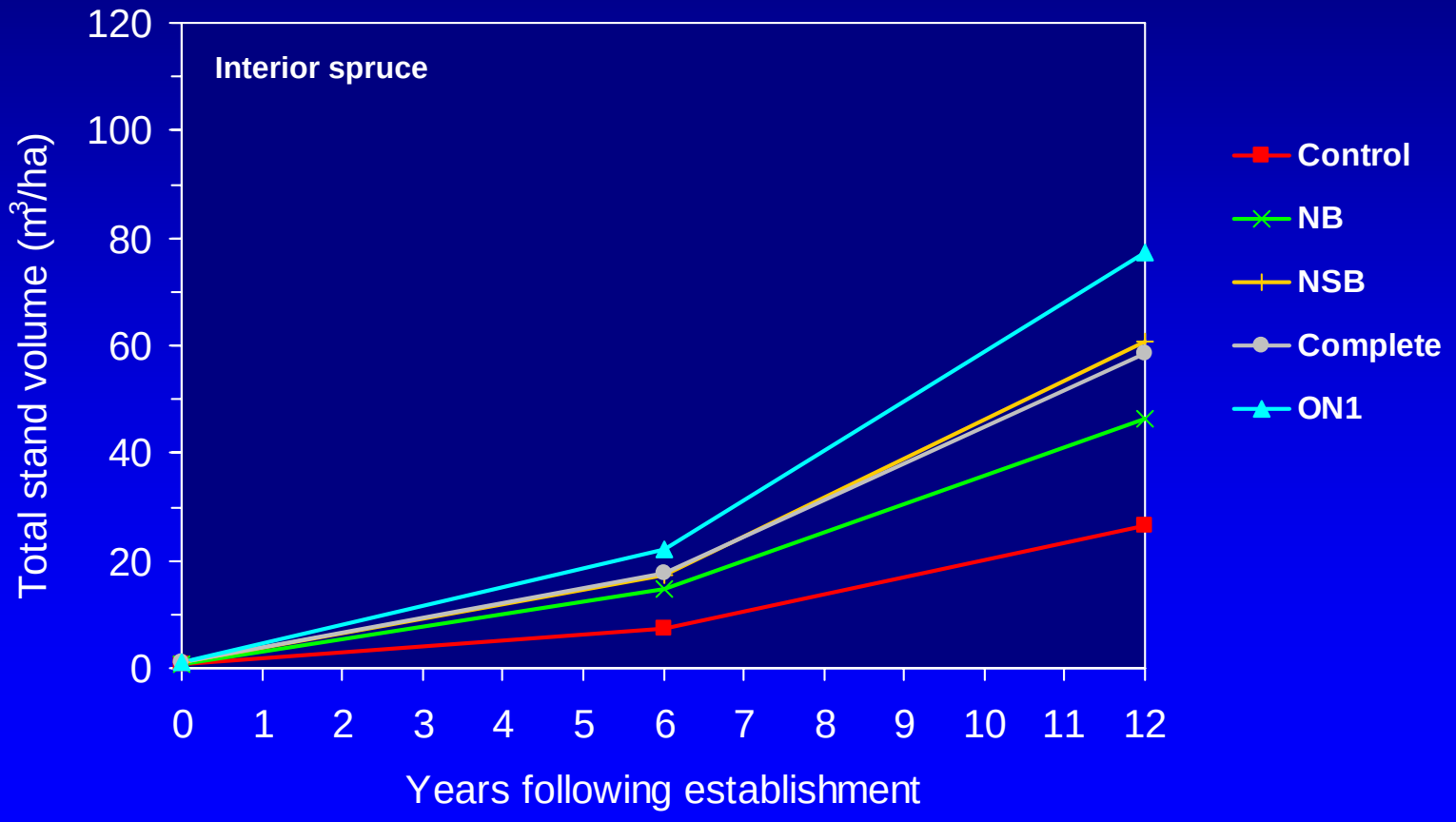

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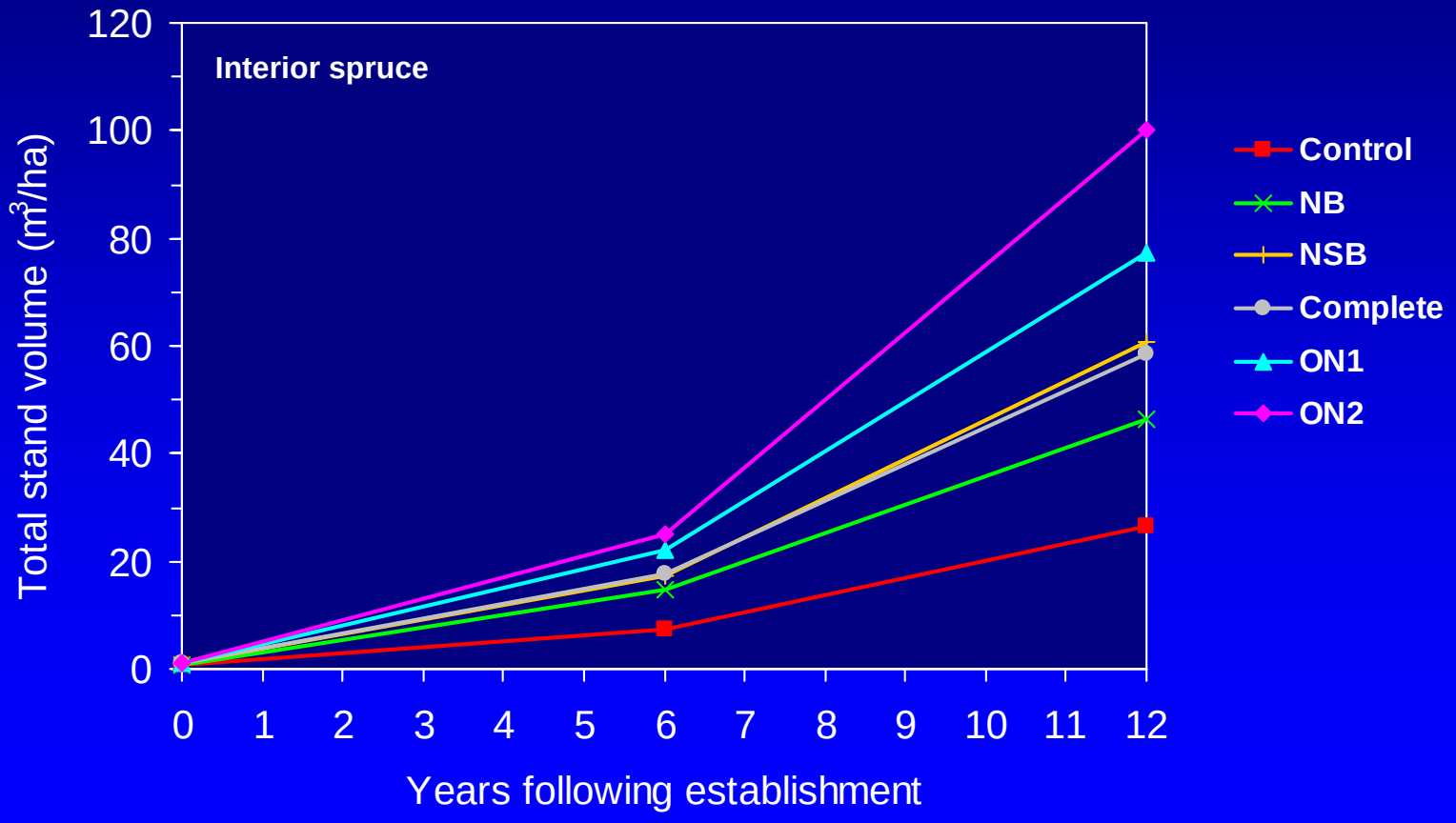
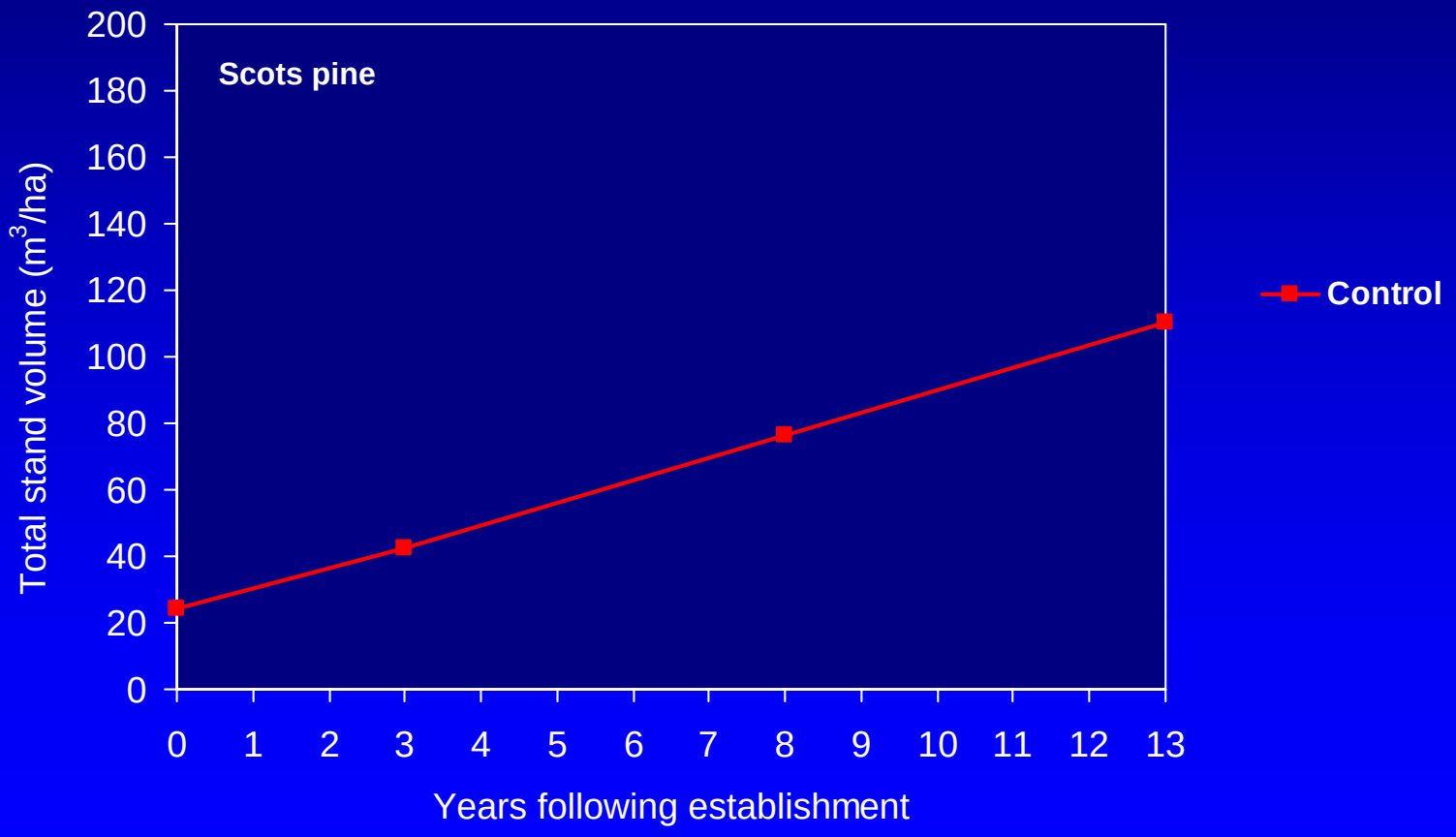


13-year stand volume development following different intensities of yearly fertilization

Scots pine (Tamm 1985)



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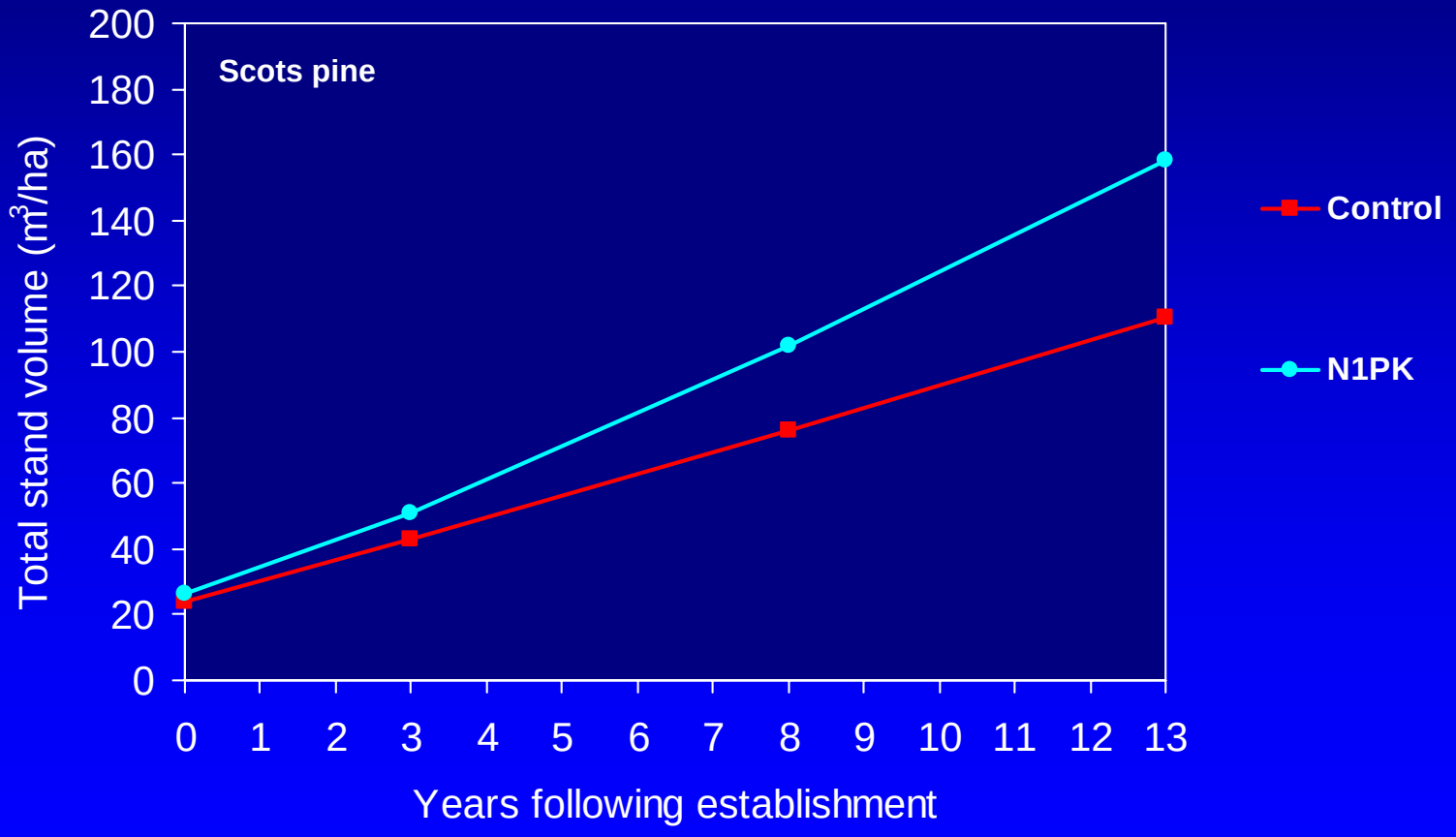

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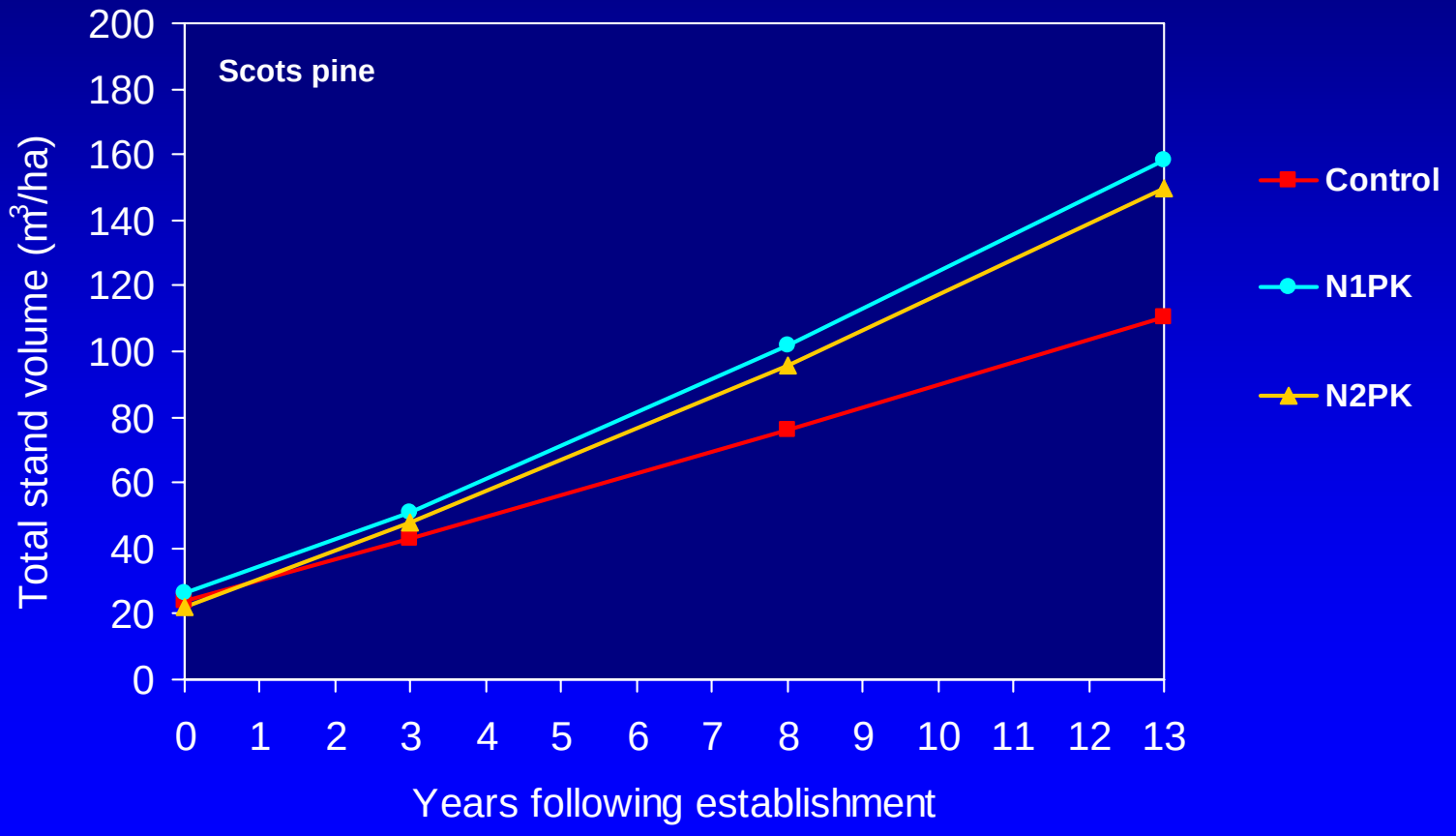

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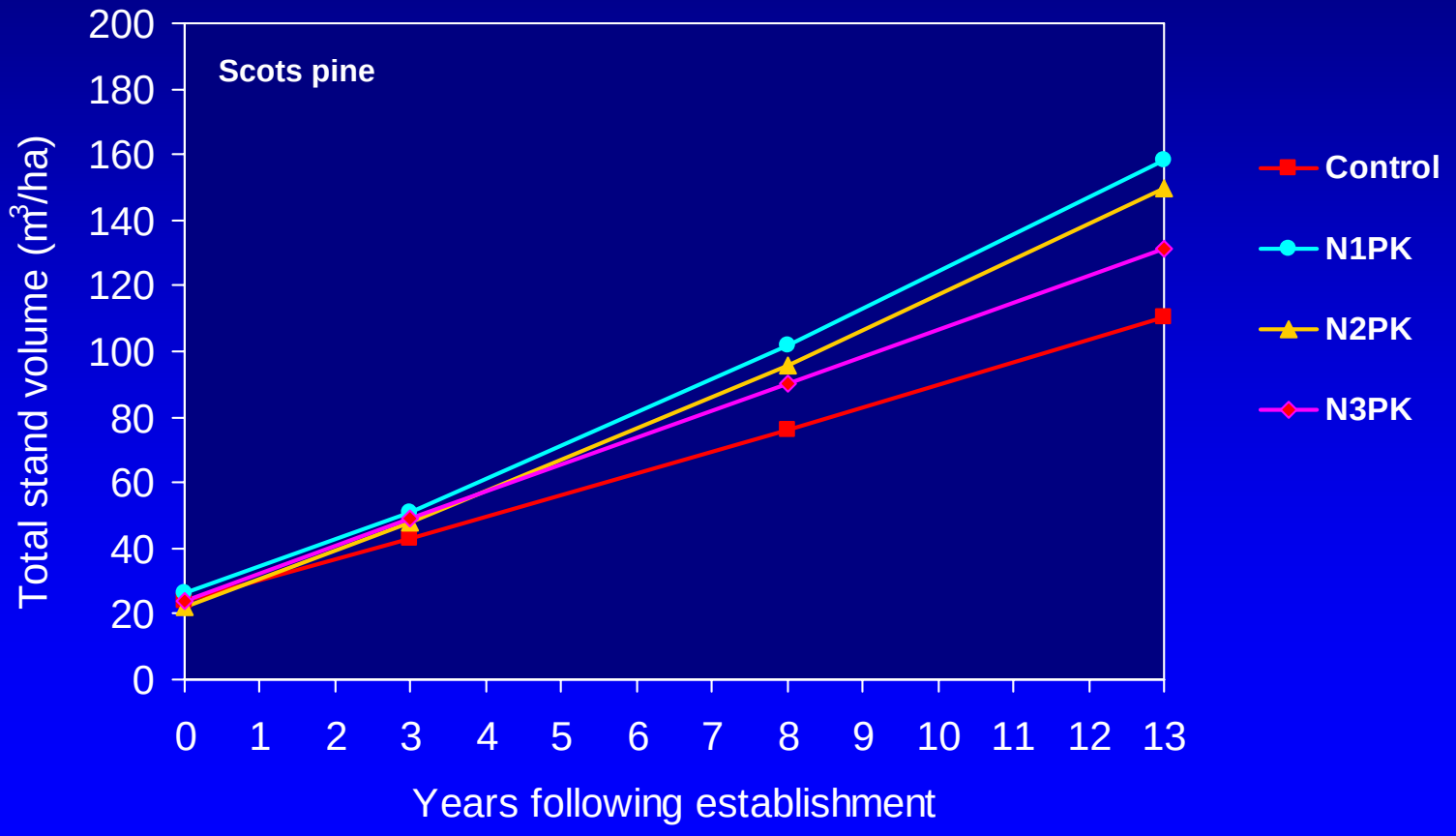

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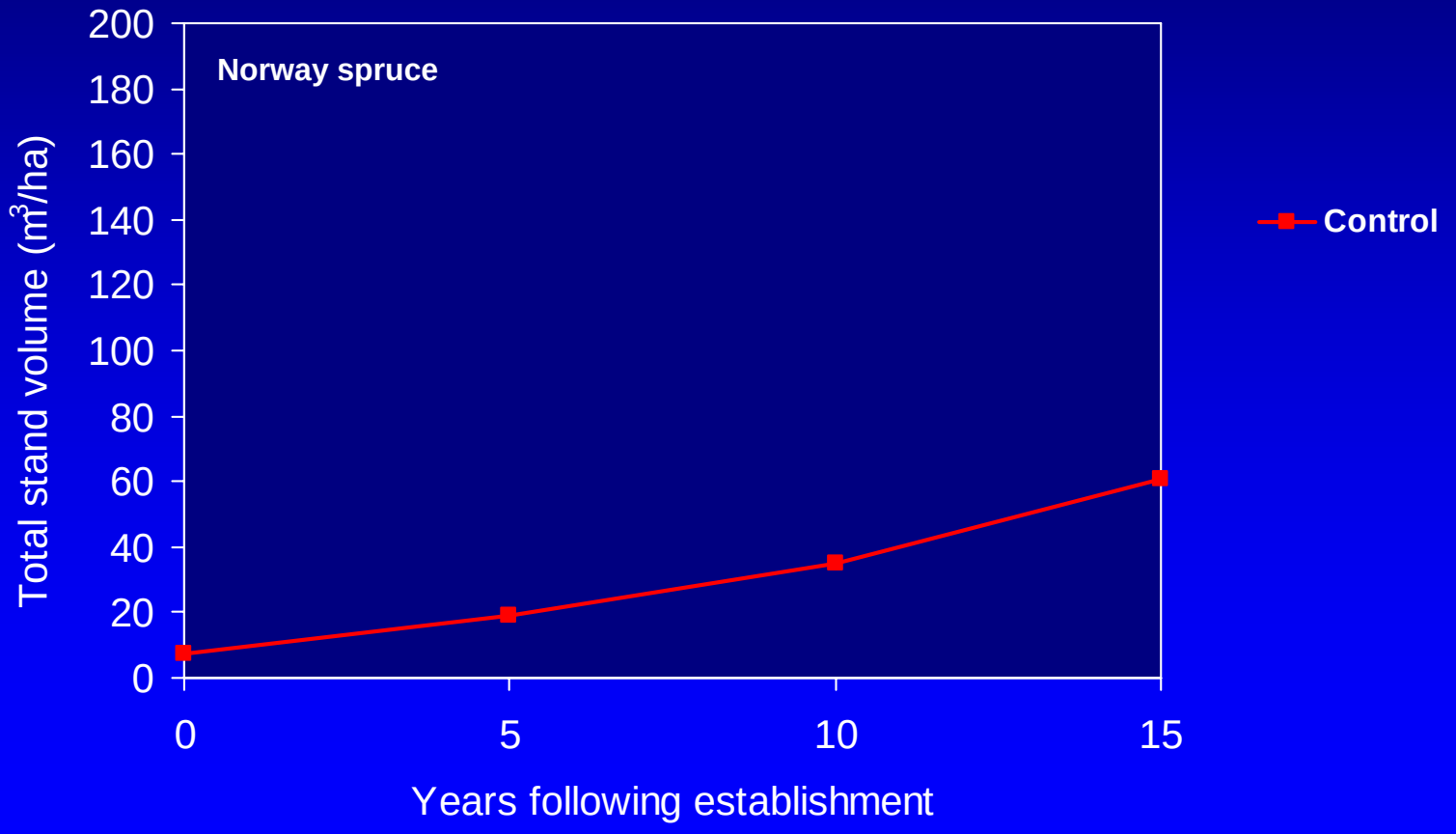

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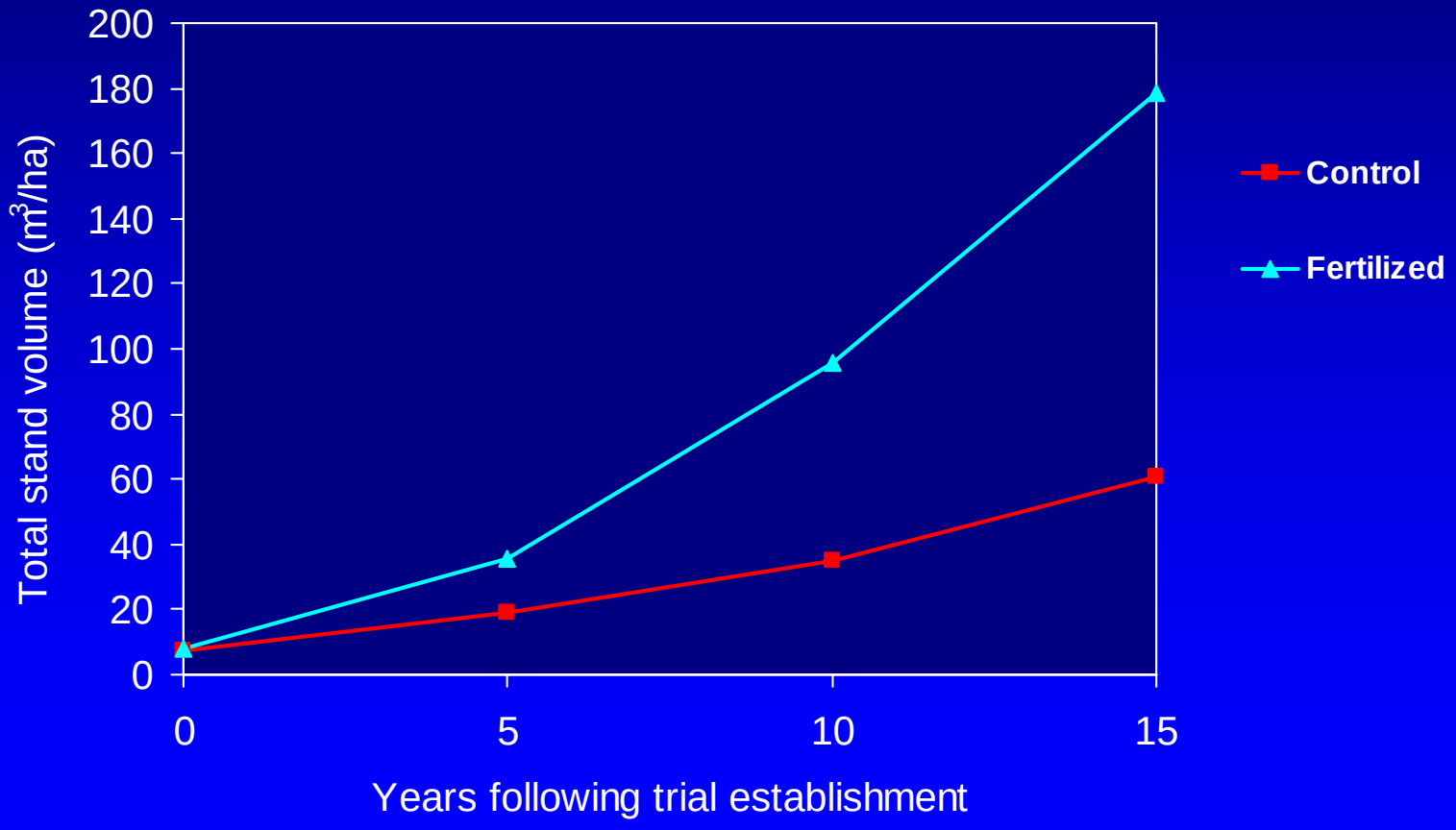
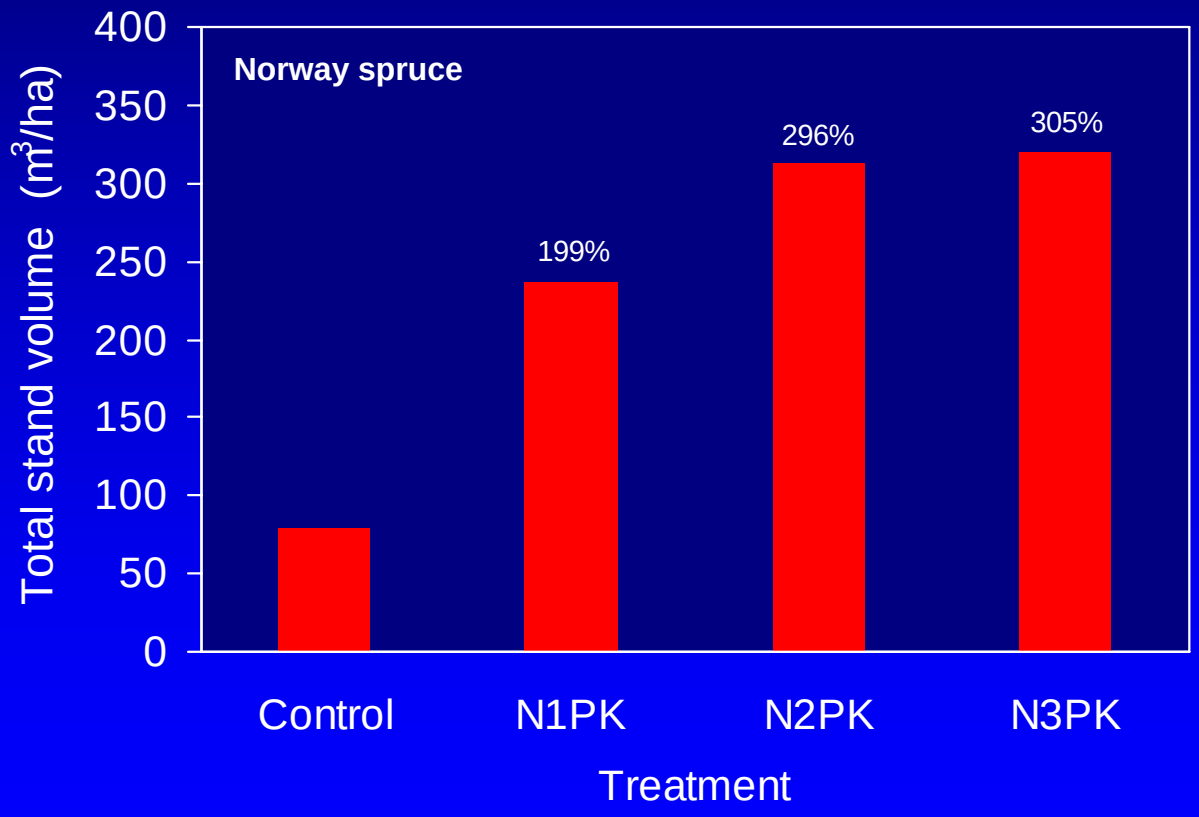


Effects of 20 years of annual fertilization on the growth of Norway spruce in central Sweden

Tamm (1991)



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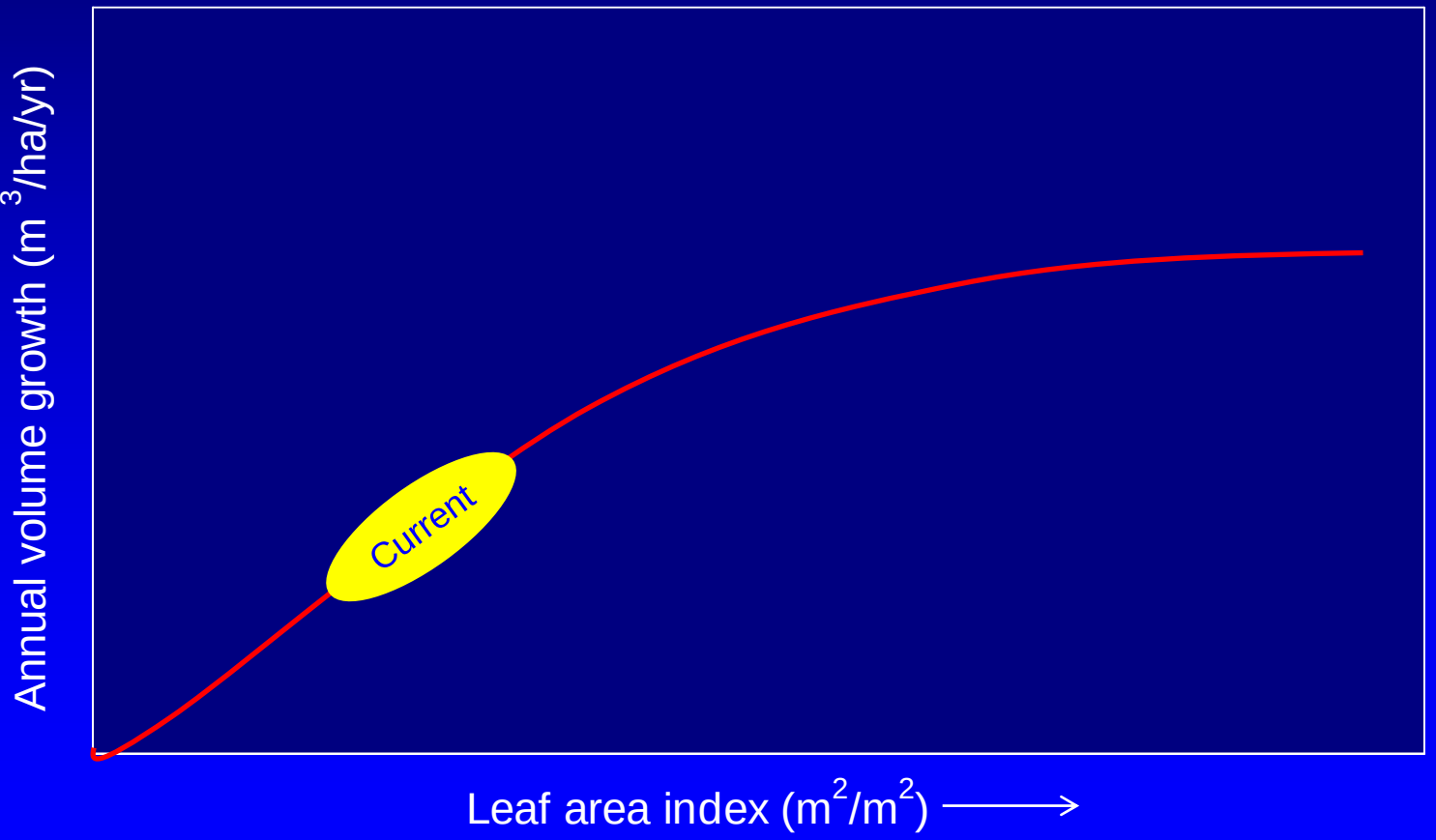

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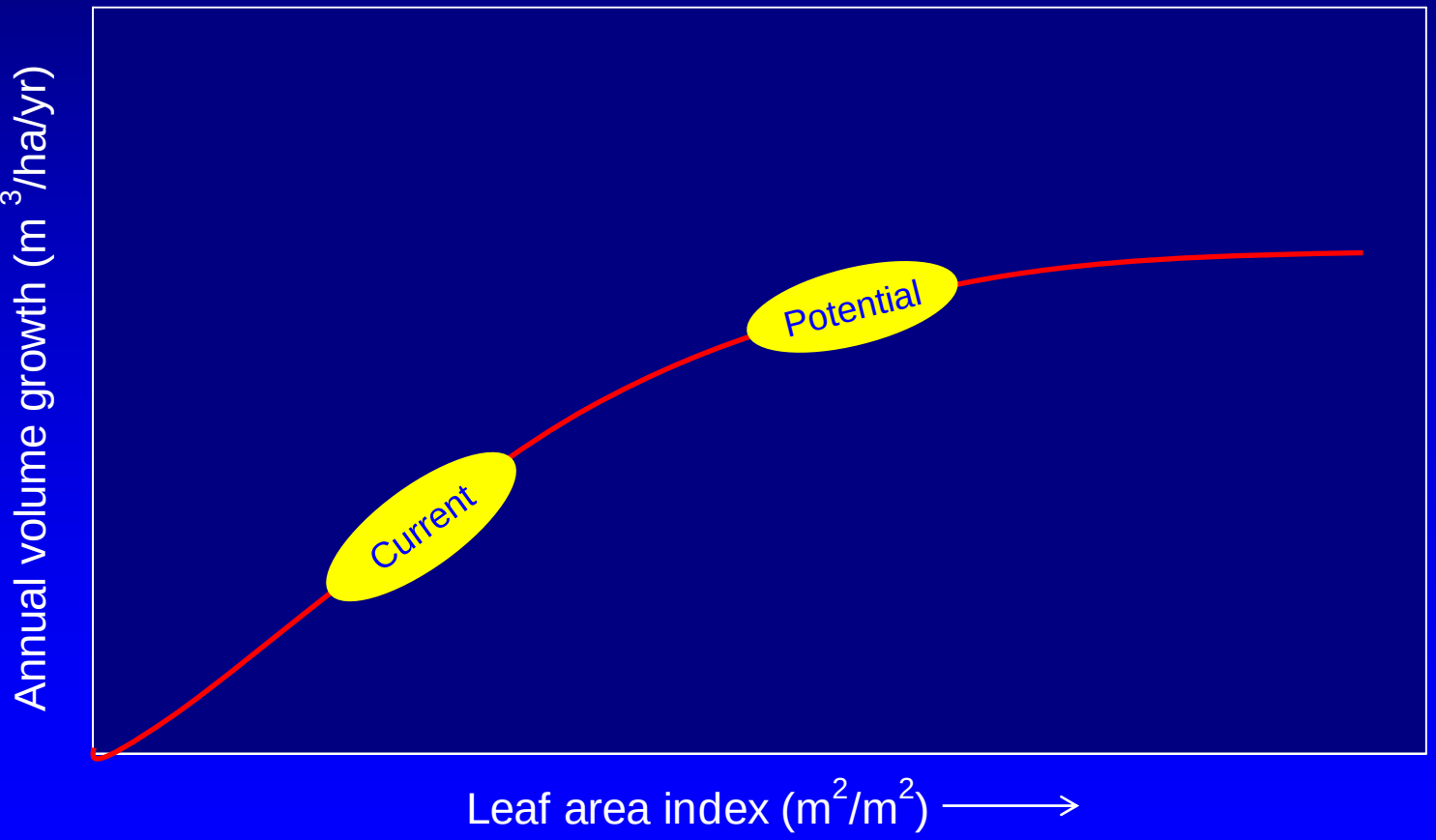

Leaf area index by treatment at year 12

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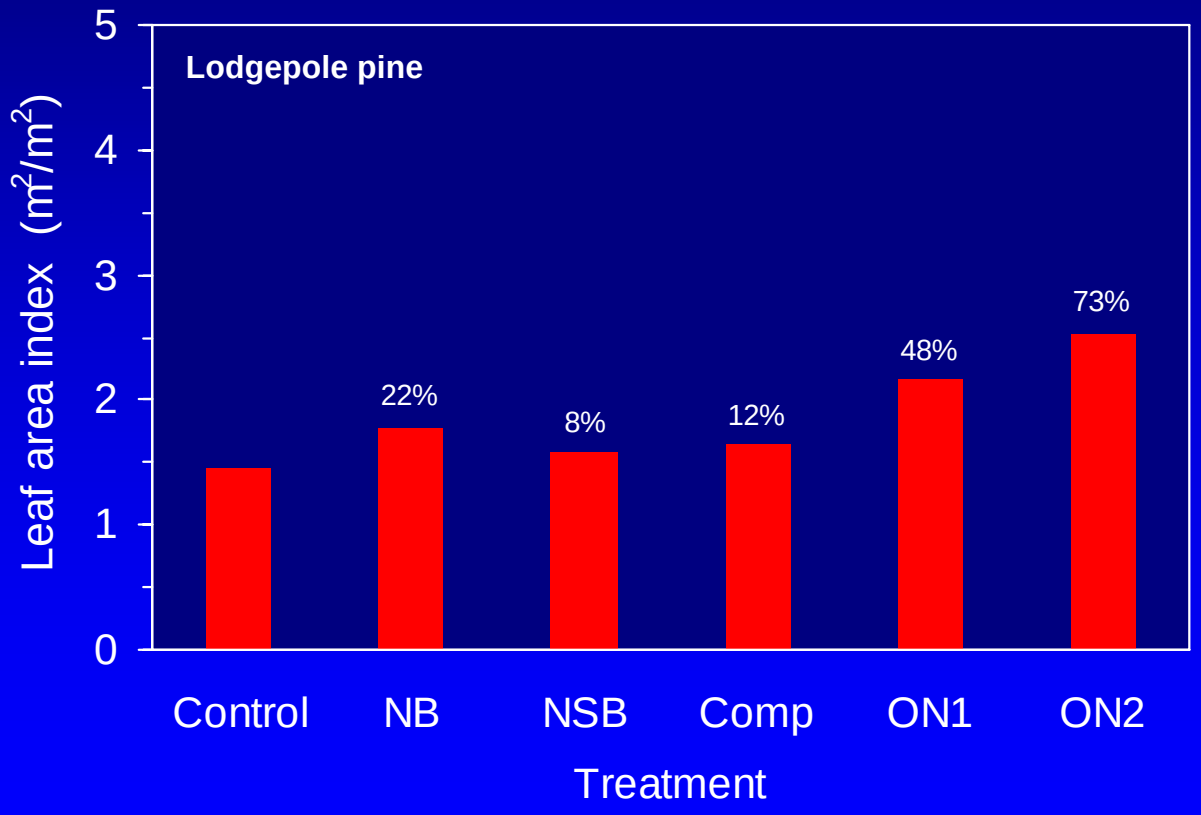

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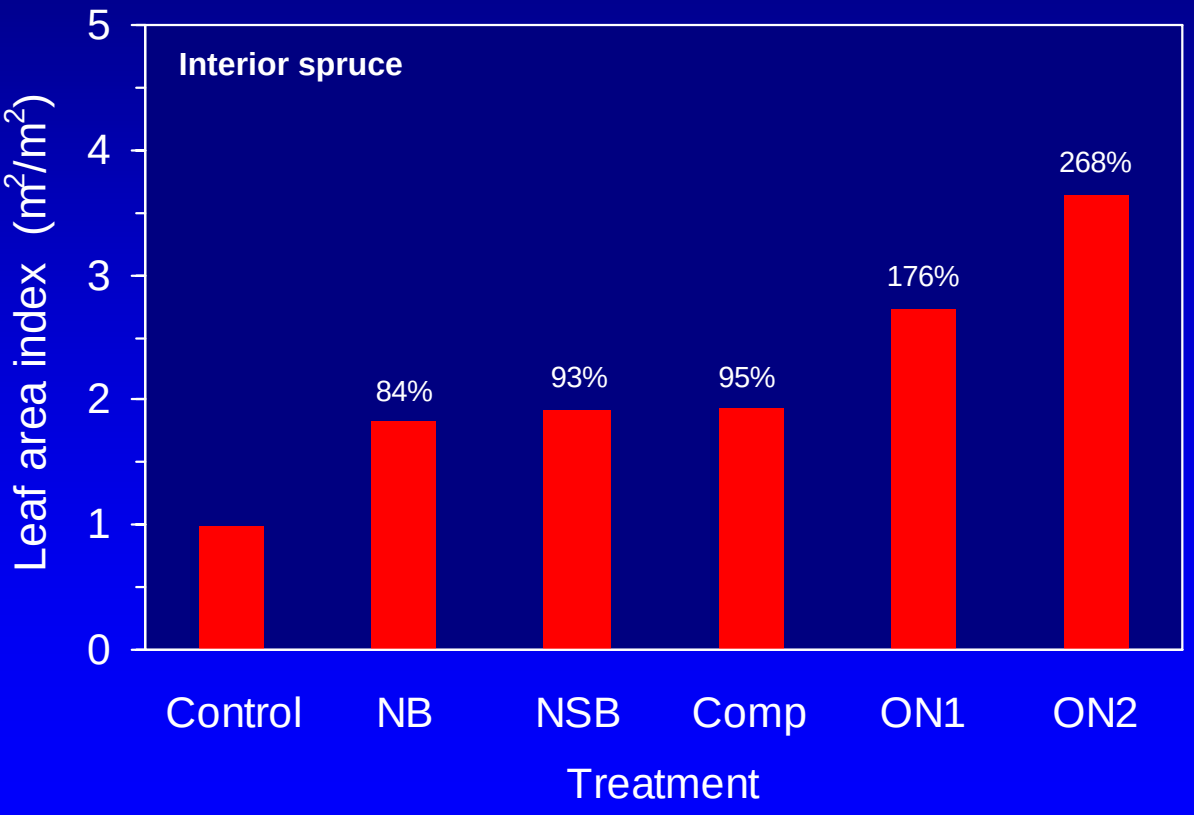

Modelling the effects of fertilizing interior spruce

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- Planted, 1100 tph
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- SI_{50} = 20 m
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- Yearly fertilization
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- Age of unfertilized and fertilized stands at minimum operability (250 m^3/ha merchantable volume)
- Merchantable volume of 45-year-old unfertilized and fertilized stands (30 years in future)

Stand age @ minimum operability (250 m^3/ha merchantable volume)

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Stand age @ minimum operability (250 m^3/ha merchantable volume)

- Periodic fertilization
  - Unfertilized ~ 54 years
  - Fertilized ~ 41 years
- Yearly fertilization

Stand age @ minimum operability (250 m^3/ha merchantable volume)

- Periodic fertilization
  - Unfertilized ~ 54 years
  - Fertilized ~ 41 years
- Yearly fertilization
  - Unfertilized ~ 54 years

Stand age @ minimum operability (250 m^3/ha merchantable volume)

- Periodic fertilization
  - Unfertilized ~ 54 years
  - Fertilized ~ 41 years
- Yearly fertilization
  - Unfertilized ~ 54 years
  - Fertilized ~ 35 years

Merchantable volume of 45-year-old stand (30 years in future)

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- Yearly fertilization
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  - Fertilized ~ 617 m^3/ha

Can fertilization increase above- and below-ground C sequestration?

Soil and bole carbon sequestration at year 12

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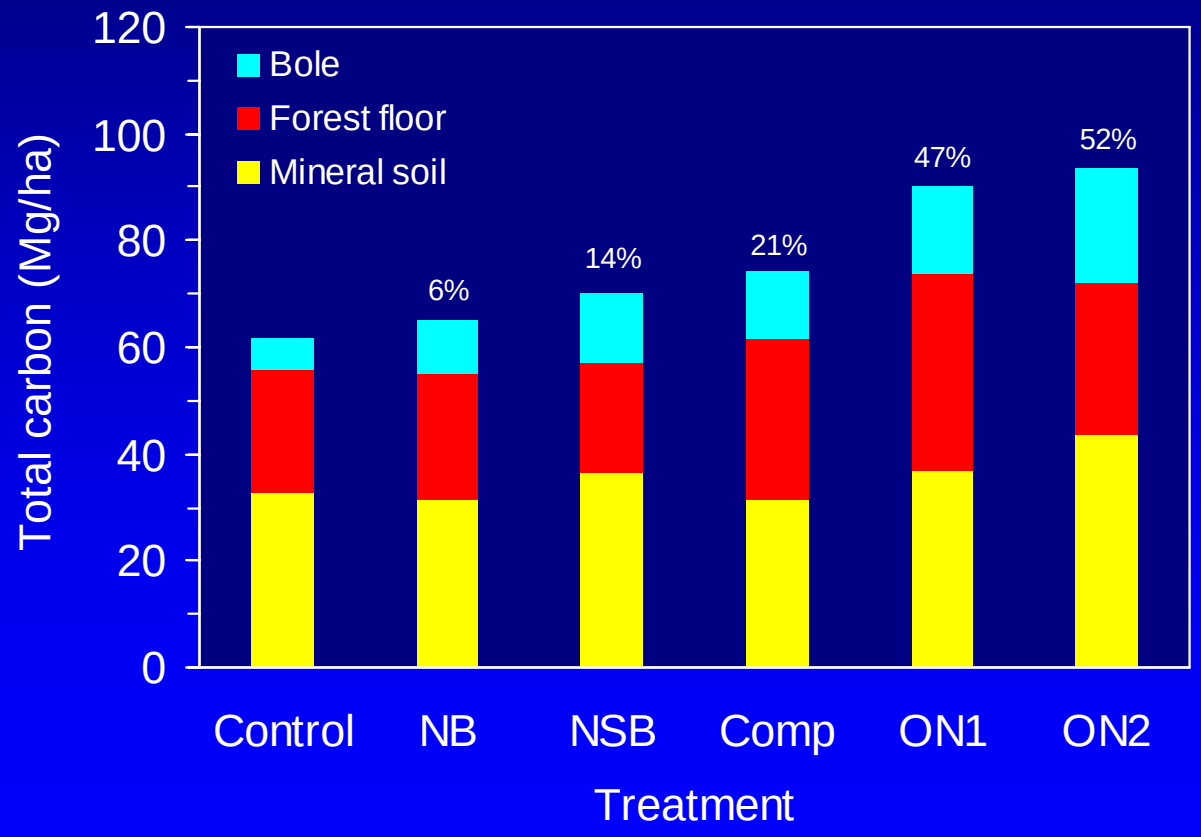

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- Young interior spruce plantations may be particularly well suited to “high input silviculture – potentially large effects on rotation length or harvest volume
- Intensive fertilization may increase above- and below-ground C sequestration
- Effects on wood quality was be evaluated
- Long-term ecological impacts of intensive fertilization must be documented

Funding

- BC Ministry of Forests & Range – Research Branch
- Forest Investment Account – Forest Science Program (Y092054)

Contact me

Rob Brockley

Kalamalka Forestry Centre, Vernon

(250) 260-4768

Rob.Brockley@gov.bc.ca