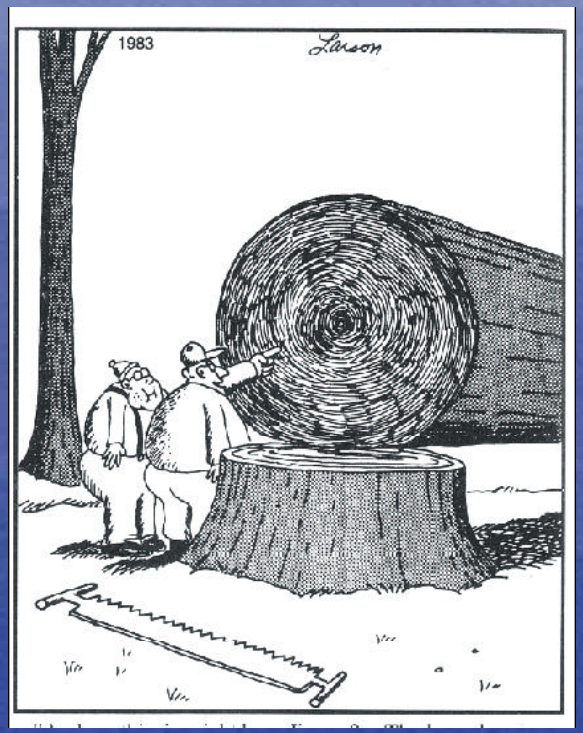
Climate-growth relationship in *Pinus sylvestris* along west-east and coast-inland gradients

PPS Arctic



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Project background

- IPY, PPS arctic (*P*resent day processes, *P*ast changes, and Spatiotemporal variability of biotic, abiotic and socio-environmental conditions and resource along and across the *A*rctic delimitation zone)
- Canada, Russia, Norway, UK, Sweden, USA
- Multidisciplinary
- **PPS Norway**
  - **Structure dynamics, and regeneration capacity of the arctic-boreal transition zone**
  - **Spatiotemporal characterisation and monitoring of the arctic-boreal transition zone**

INTERNATIONAL POLAR YEAR 2007 2008

PPS Arctic

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Main object, PhD

Through analyses of ecological factors controlling Scots Pine distribution at the forest-tundra Transition zone, characterize past and ongoing changes in Northern Norway and Kola Peninsula.

Five planned papers

- **Climate-growth relationships in *Pinus sylvestris* along coast- inland gradients.**
- Structural divergence in the arctic-boreal transition between different climate regions.
- *Pinus Sylvestris* age structure variation along spatial and temporal scales in northern Norway and north-western Russia.
- Tree recruitment capacity across the treeline zone: climate driven spatial and temporal variation.
- 50 years of treeline change in Khibiny Mountains.

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Introduction height and diameter growth

- Height and diameter growth holds innate logs of past climate, thereby possible to asses future tree growth
- We focus on recent time i.e. last 10-15 years along longitudinal and coast-inland gradients in N Norway and NW Russia

Analyzing

- Height diameter growth relation among sites and between years
- Relation between monthly climate and growth
- How the growth response to these factors vary across west-east and coast-inland gradients

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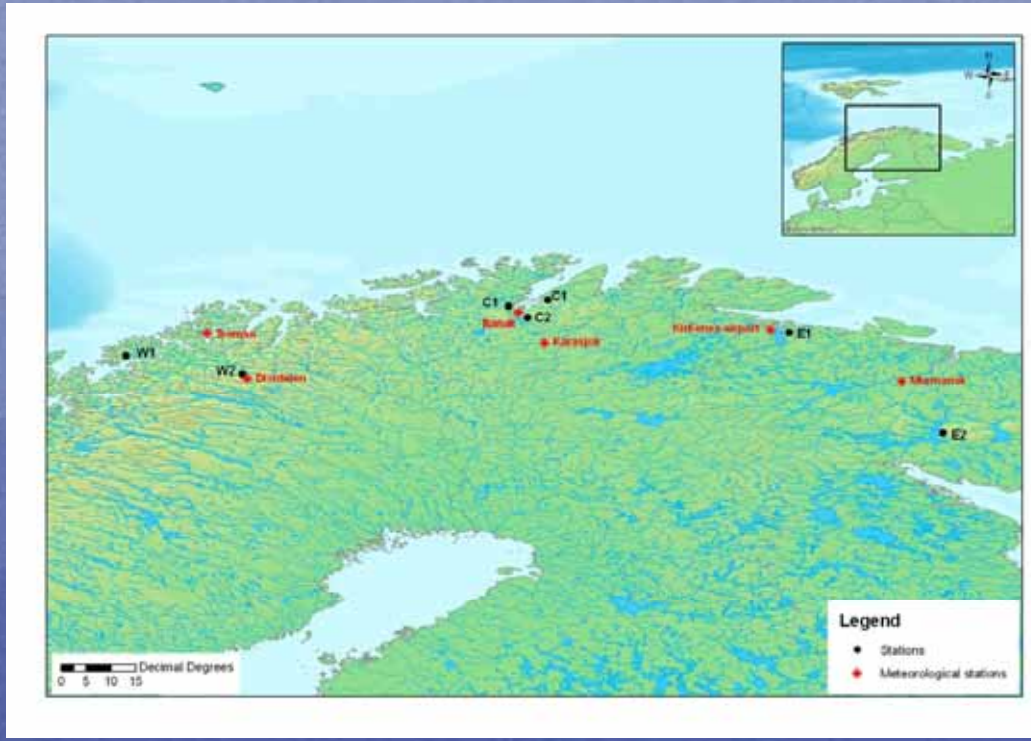
Aims

- *i)* detect if various climatic influences result in unlike responses of height and diameter growth
- *ii)* determine if the growth responses of height and diameter differ between months
- *iii)* determine the dependency on climatic factors of *Pinus sylvestris* growth across the coast-inland gradients

Study sites

- Investigations in two dimensions
  - Longitudinal (Atlantic - polar air masses)
  - Coast - inland
- Six open woodland sites
- Located between forest and treeline



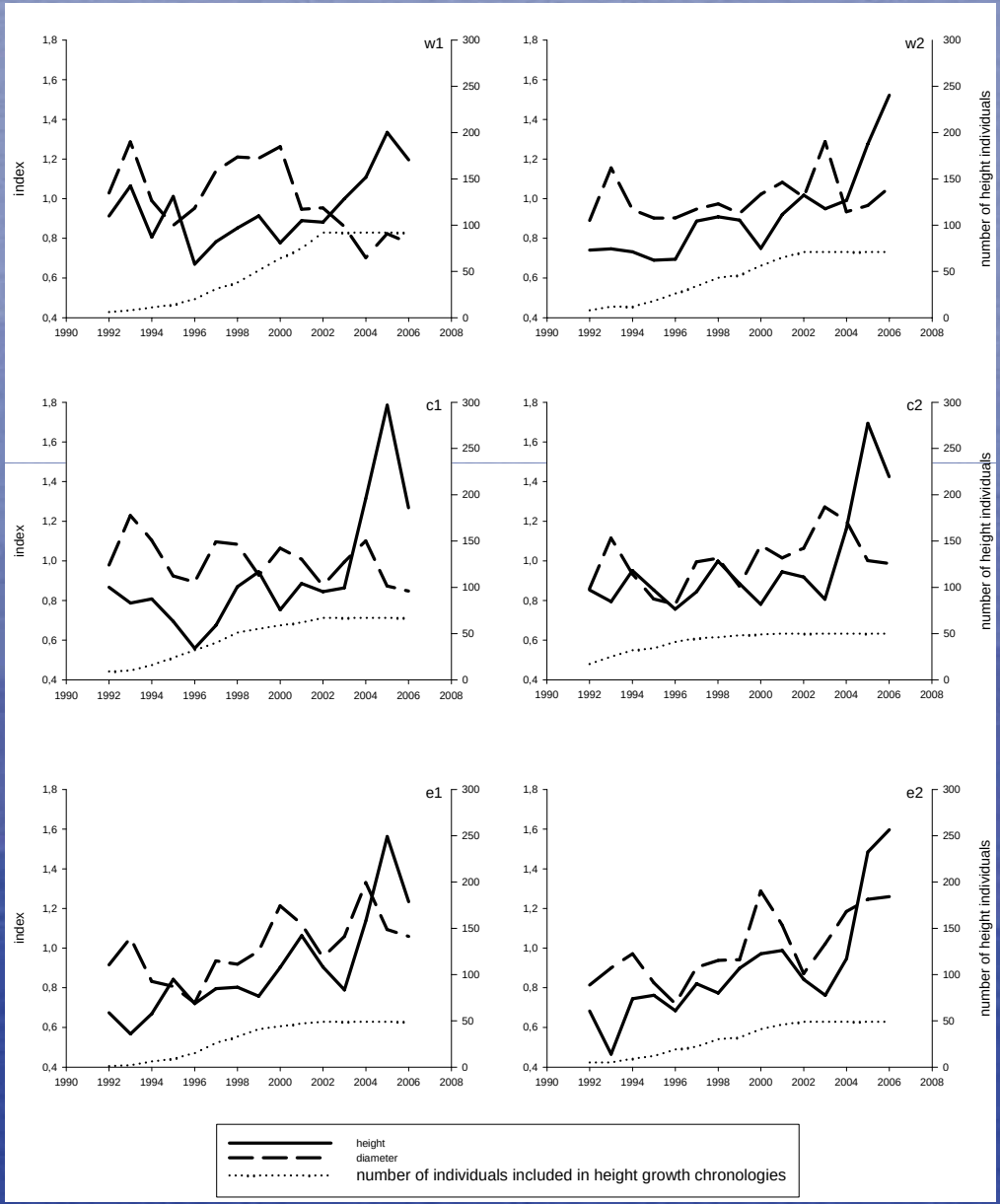
Field methods

- Height growth
  - Saplings (15-200 cm) of *Pinus sylvestris*
  - No signs of reduced vitality, straight unbroken stem
  - Annual height growth was identified by yearly branch growth
  - Measured with a cm ruler to nearest 0,5 cm
- Diameter growth
  - Adult trees, in undisturbed patch
  - Increment borer
  - Two cores from each tree were taken at breast height (130 cm above the ground) in opposite direction

Statistics

- Height and diameter growth relations within and between sites examined with Pearson's correlation analysis
- Climate-growth relationships examined by bootstrapped confidence intervals that estimate significant correlation coefficients, DendroClim 2002

Results height and diameter growth relations



- Height growth: correlates at all sites ($p<0.01$)
- Diameter growth: correlates at W2 and C2 ($p<0.05$), C2 and E1 ($p<0.05$), E1 and E2 ($p<0.01$)
- Height vs diameter: E2 ($p<0.01$)

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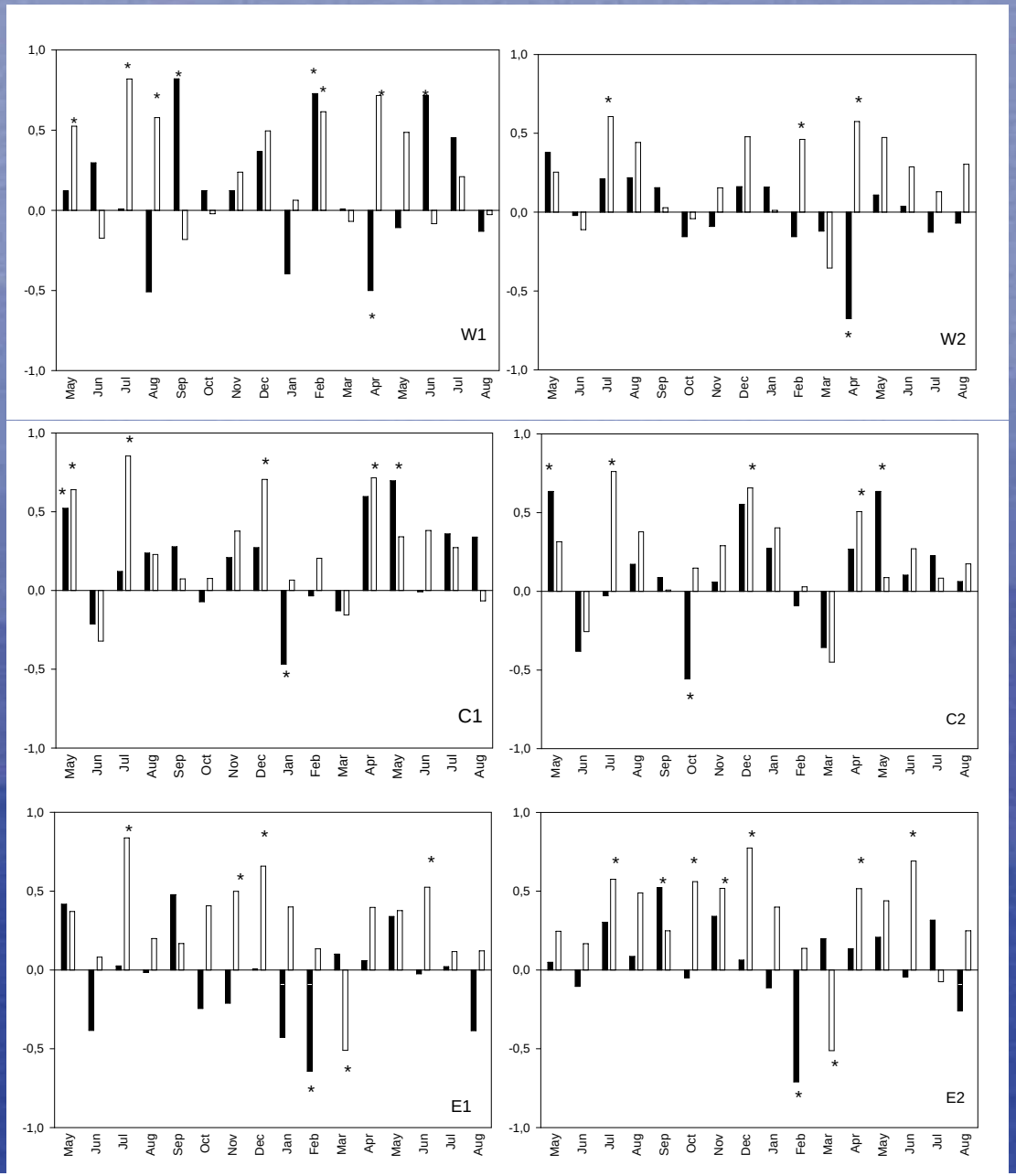
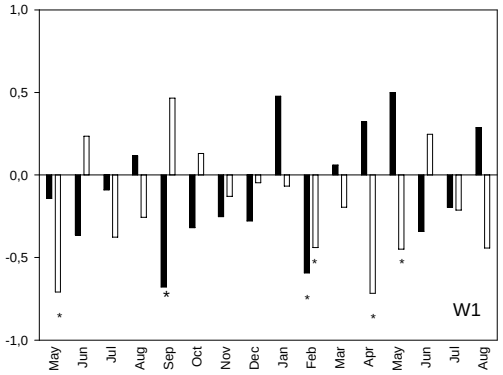
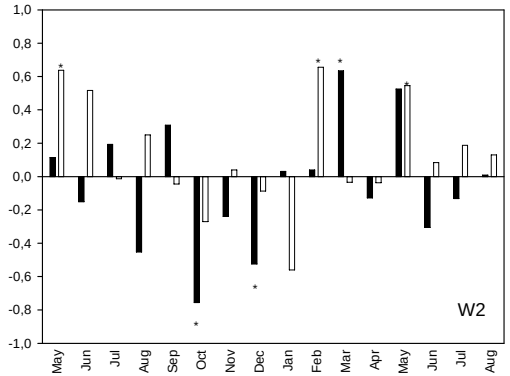
Results height growth -climate

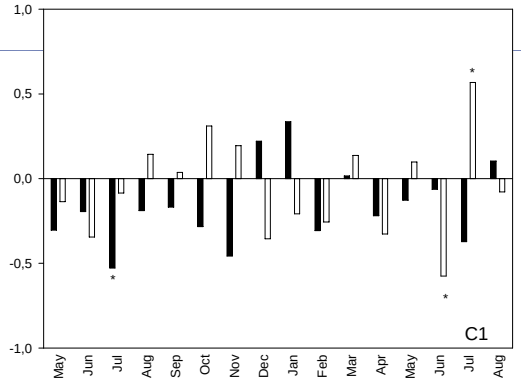


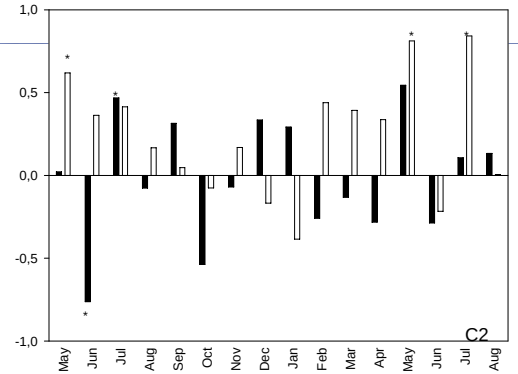
Height growth bootstrap correlation functions, index chronologies, monthly precipitation (filled bars) and mean monthly temperature (open bars)

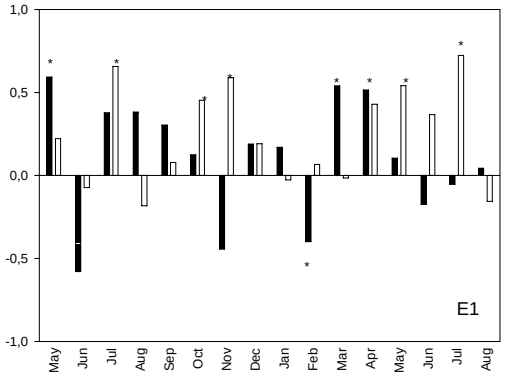
Results diameter growth-climate

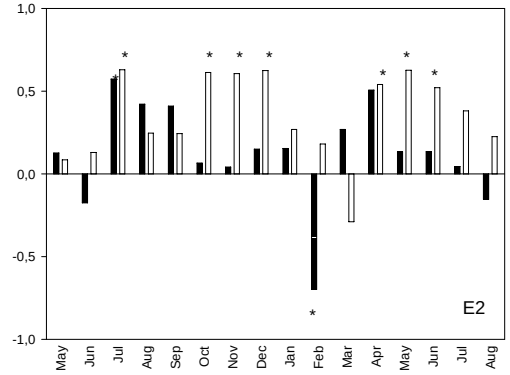












Diameter growth bootstrap correlation functions, index chronologies, monthly precipitation (filled bars) and mean monthly temperature (open bars)

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Discusion

- Temperature the is most growth-limiting factor
- Precipitation important both for height and diameter growth
- No difference in the rate of influence between coastal and inland sites
- If temperature and precipitation in winter rises, as predicted, these results indicate that there will be no change in growth of *Pinus sylvestris* at the northern distribution limit.

Thanks!

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