Carbon stocks and fluxes in a young Siberian larch (*Larix sibirca*) plantation in Iceland

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Icelandic Forest Research

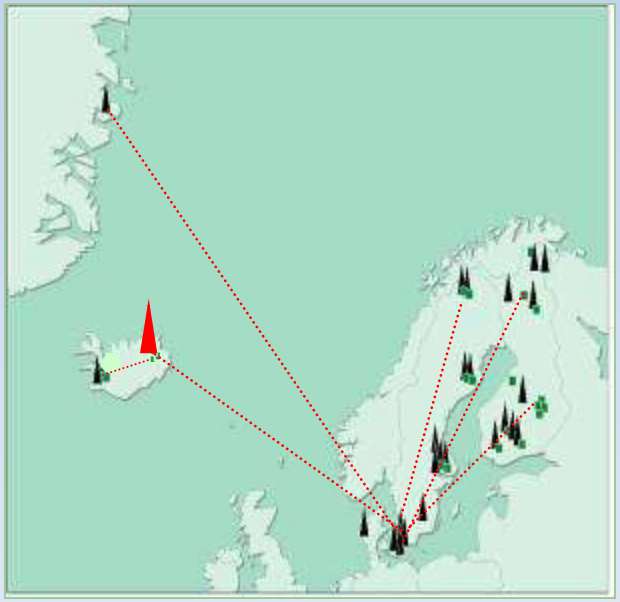
- A Ph.D project -

NECC

Nordic Centre for Studies of Ecosystem Carbon Exchange and its Interactions with the climate system
2003-2008
Sweden, Iceland, Denmark, Greenland and Finland

Main goal:

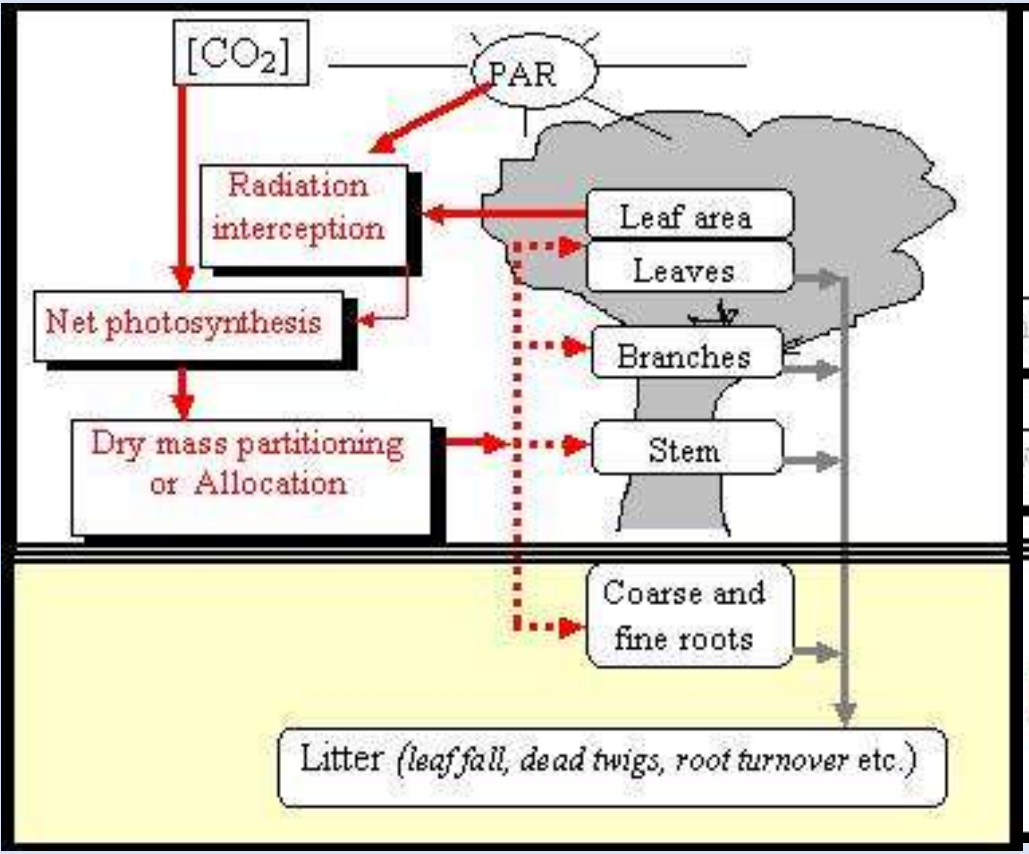
To obtain a better understanding of the factors regulating the carbon balance of typical sub-arctic and boreal ecosystems

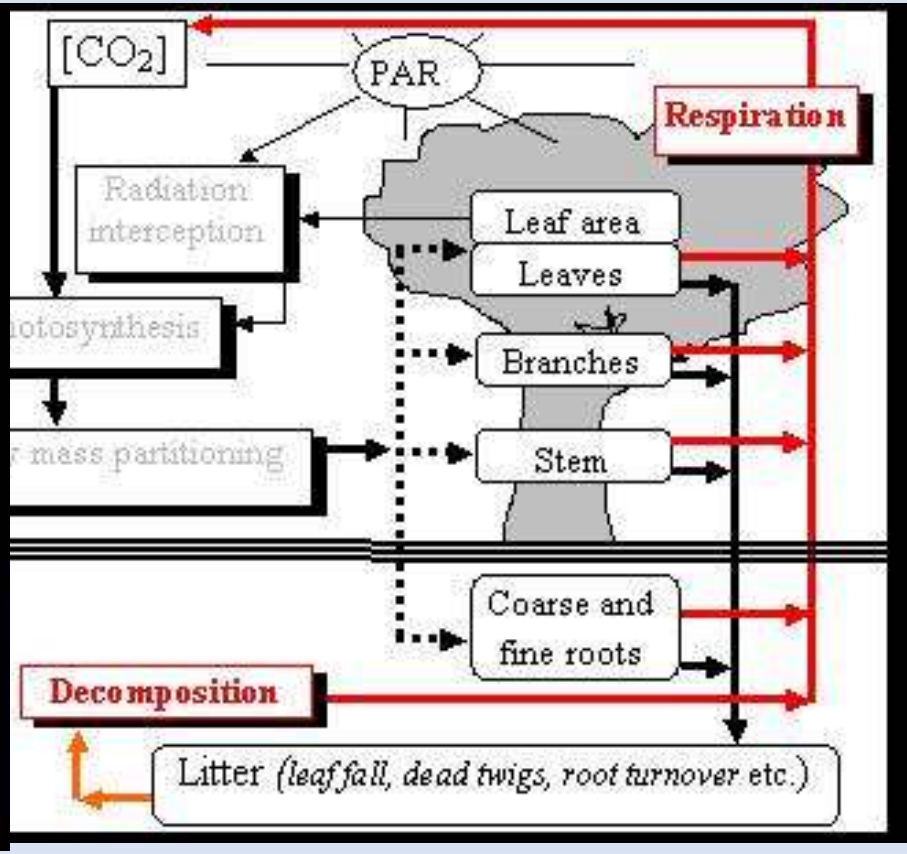


The carbon cycle at an ecosystem level

GPP Gross Primary Production

Ecosystem respiration **R_e**





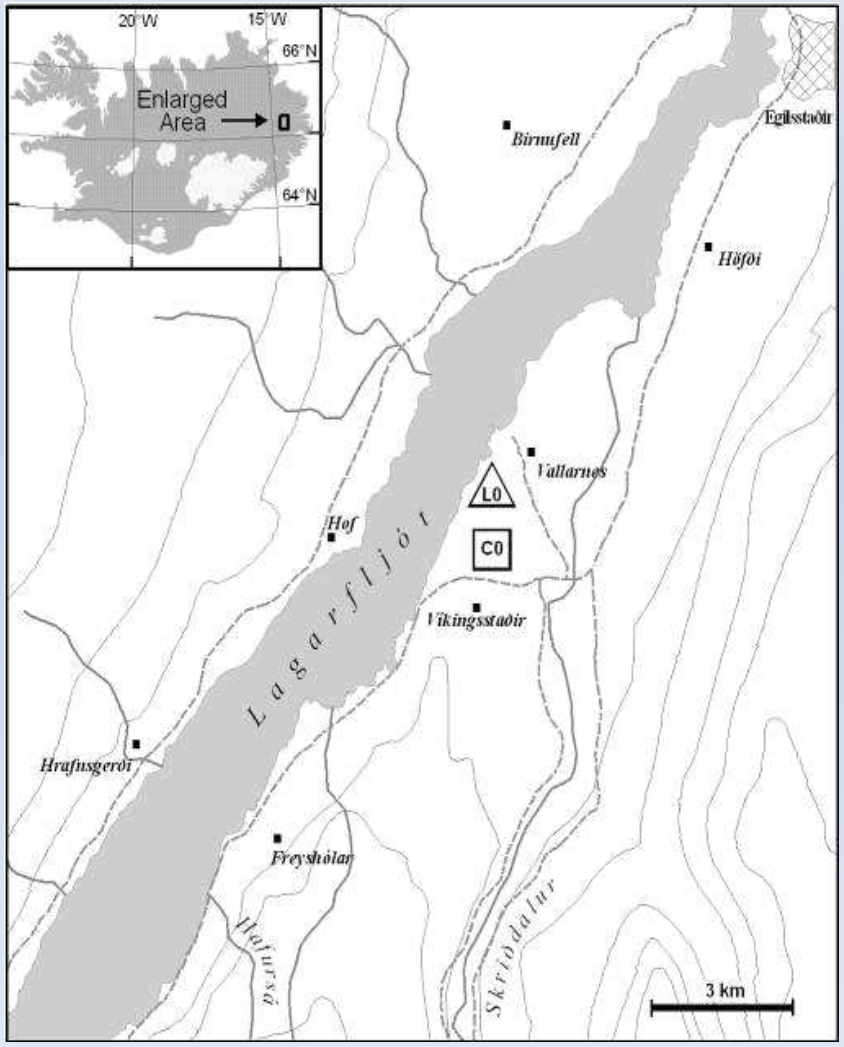
NEE or NEP

Objectives of the project

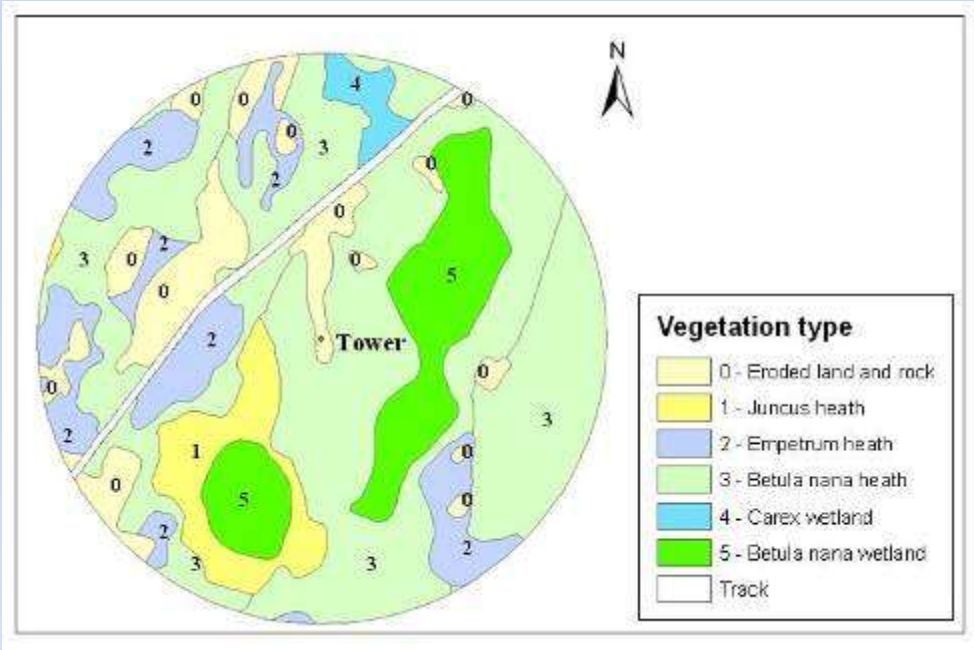
Evaluate the effect of afforestation on ecosystem carbon dynamics in Iceland

- Estimate the sink/source strength of a “Kyoto-forest” in Iceland
- Study which factors control the annual variation in GPP, R_e and NEE in a subarctic/boreal forest
- Estimate how much of the annual sequestration was stored in woody biomass, ground vegetation, litter and soil

The Experimental Site

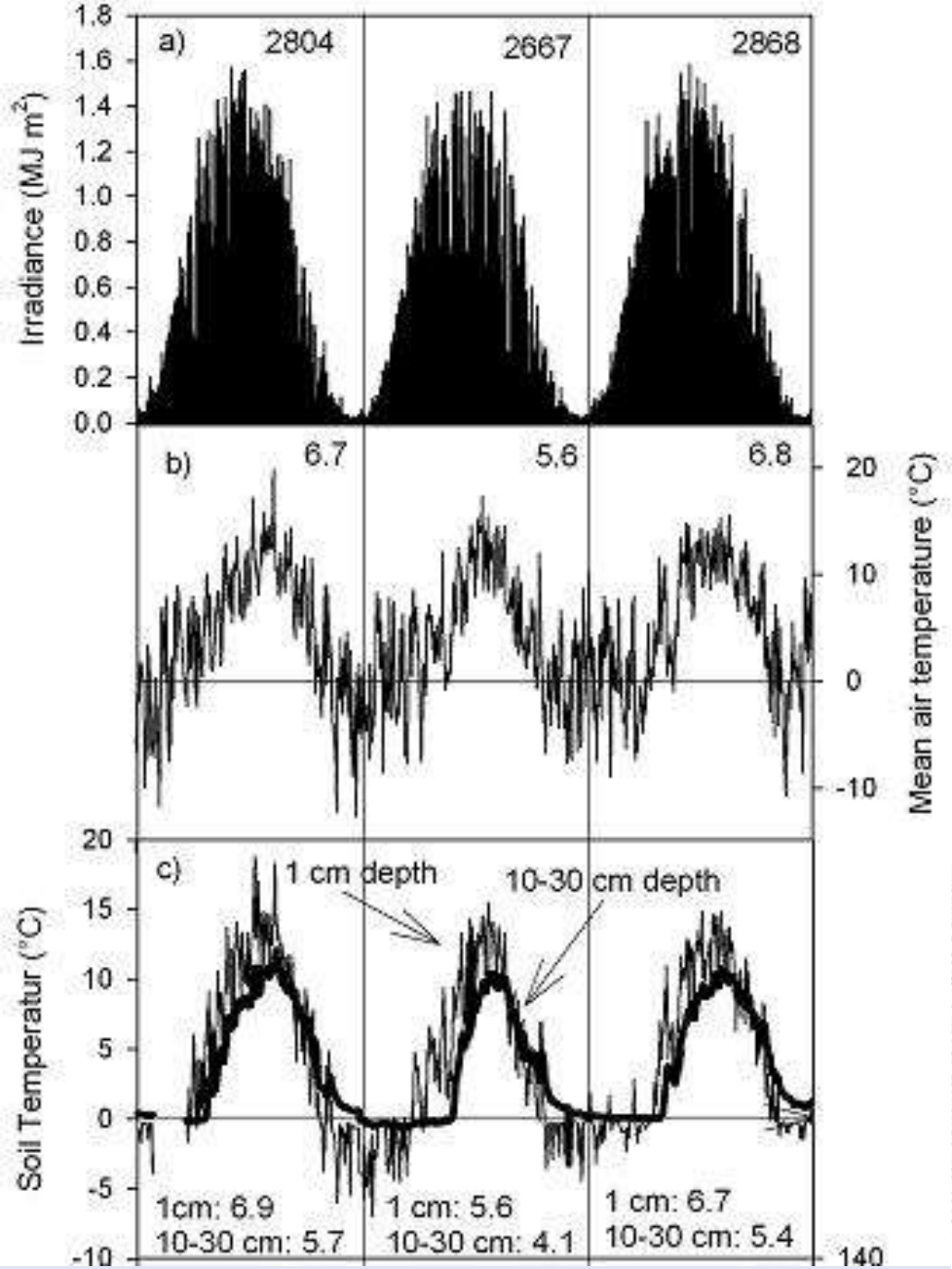


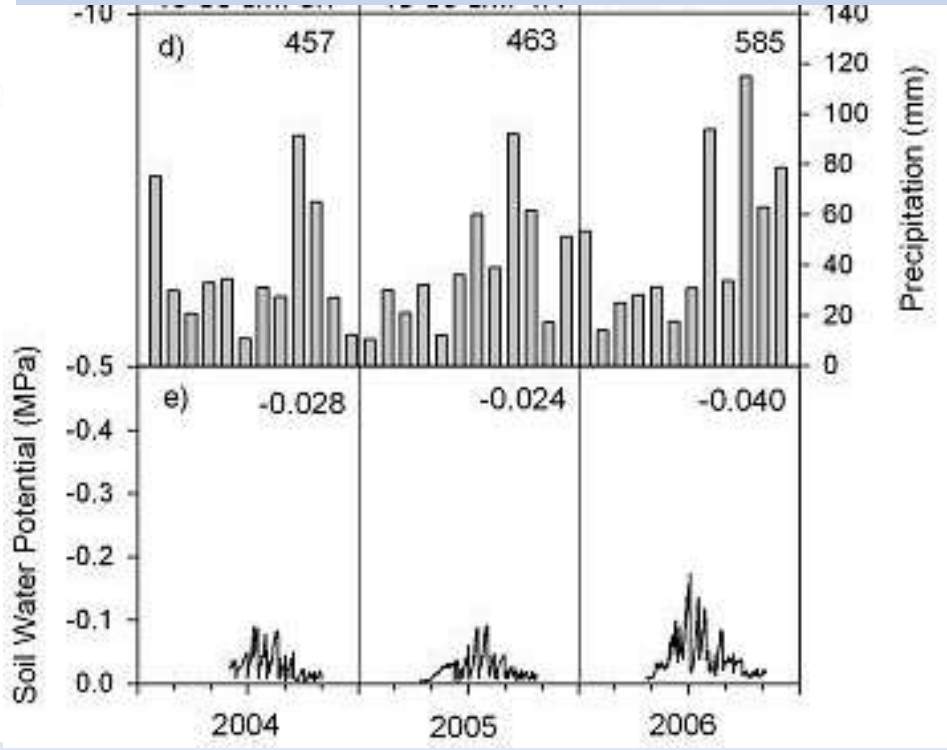
Vallanes



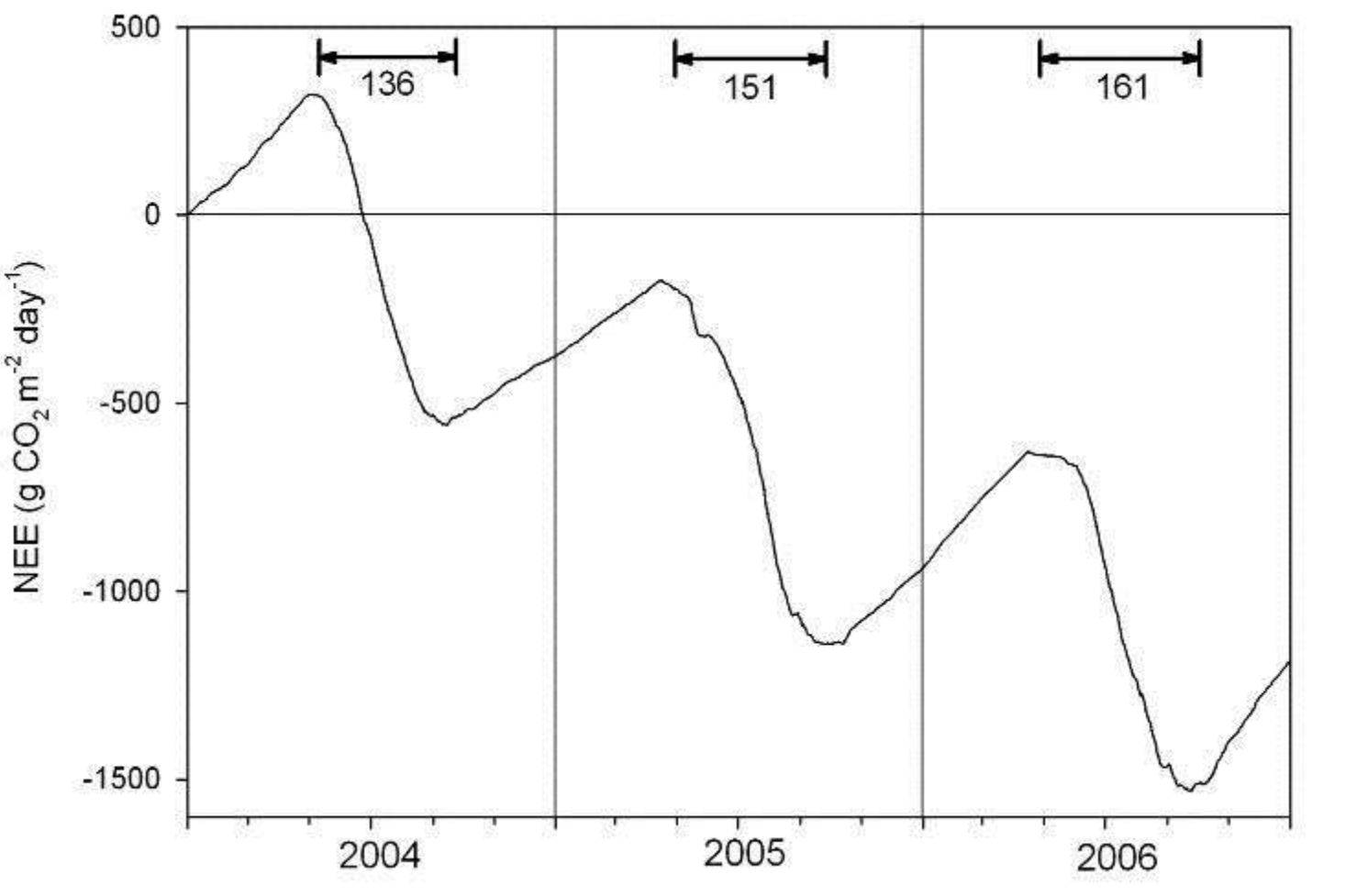
- Vallanes in eastern Iceland
- The study site is a 60 ha plantation on former heathland pasture.
- In 1992 the site was protected from grazing, plouged and planted with Siberian larch mixed with some lodgepole pine
- The soil type of Vallanes is Andosol

Environmental factors



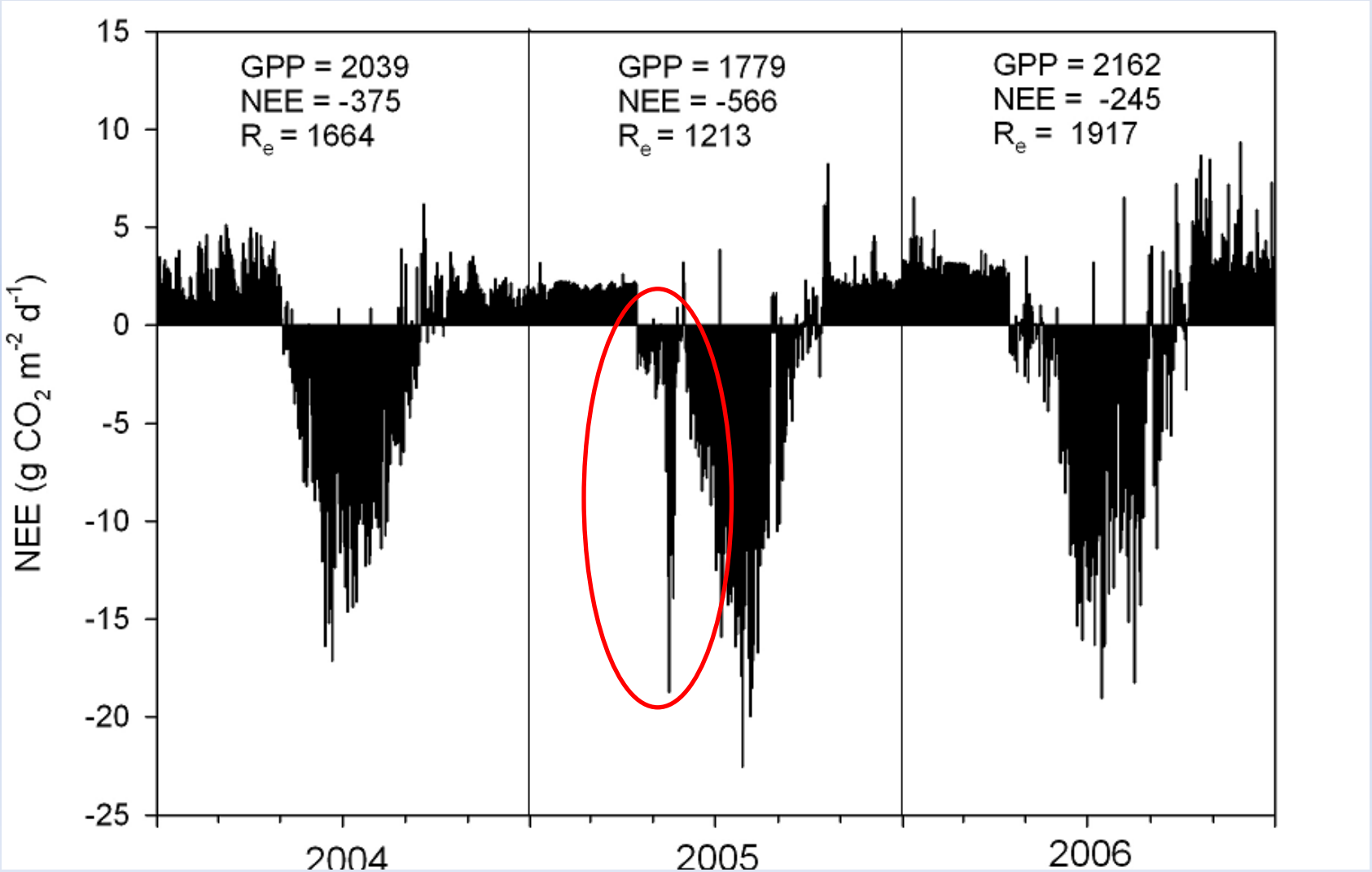


Cumulative carbon balance at Vallanes

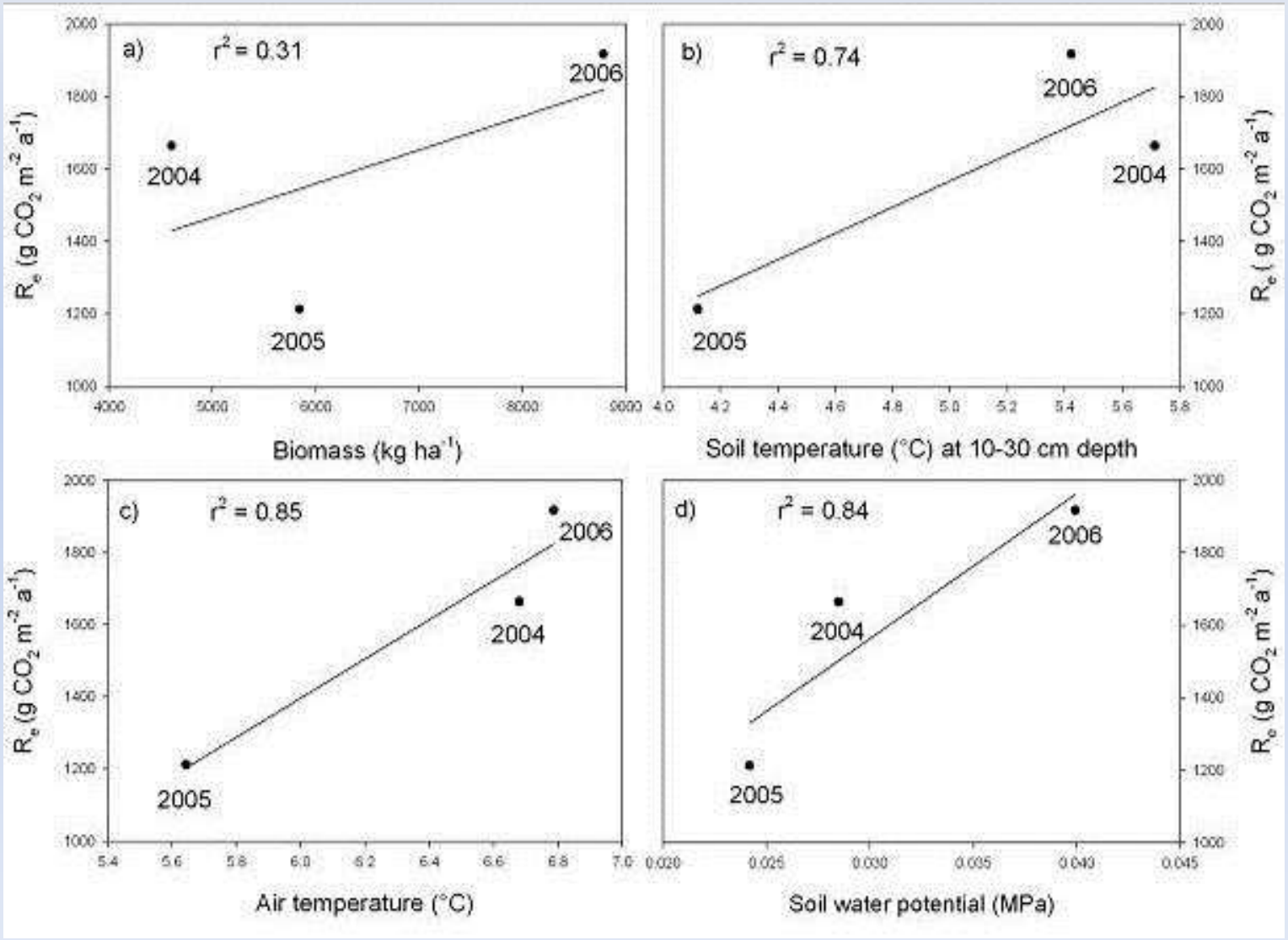


Sequestration of -1185 g CO_2 m^{-2}

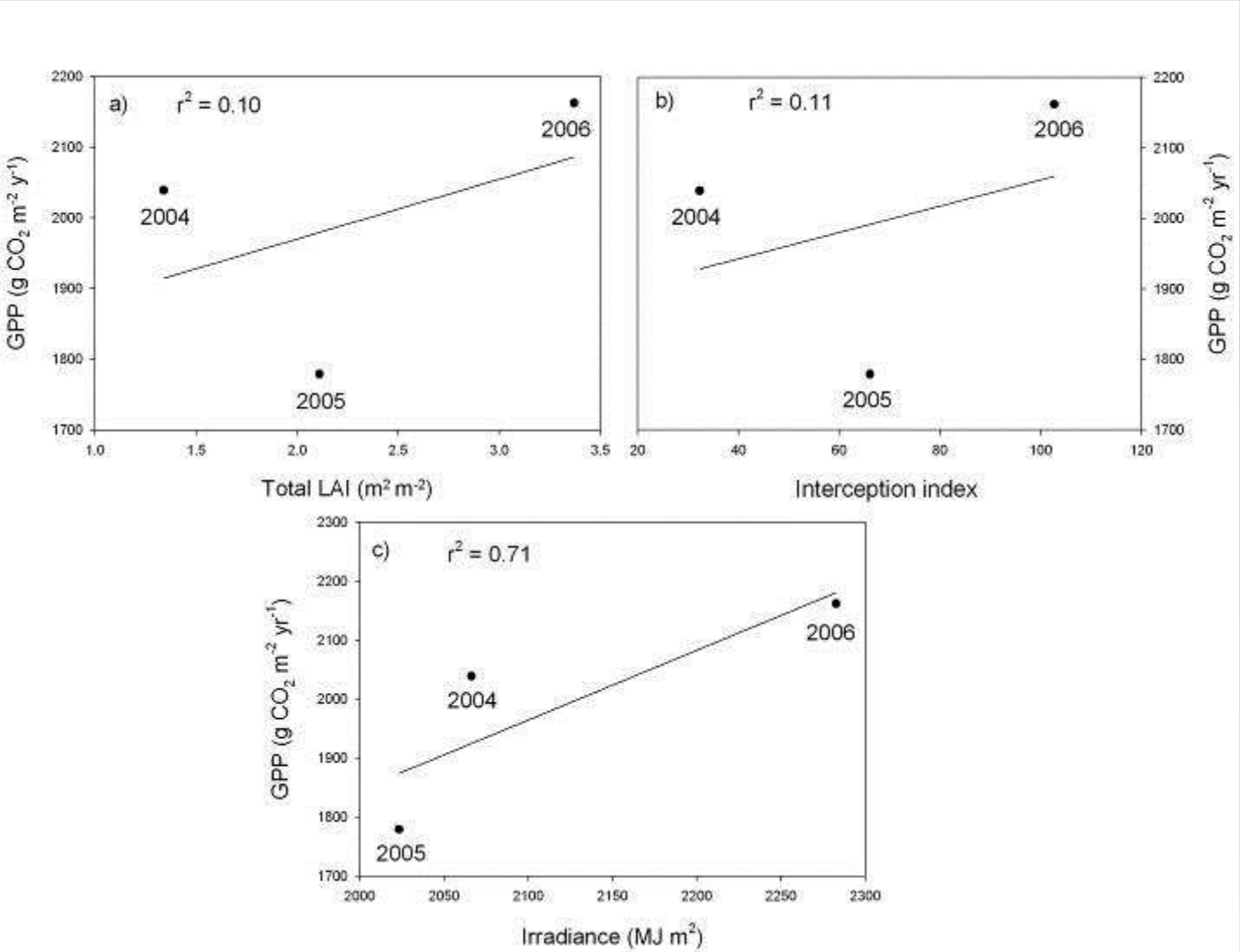
Annual sums for NEE, R_e, and GPP



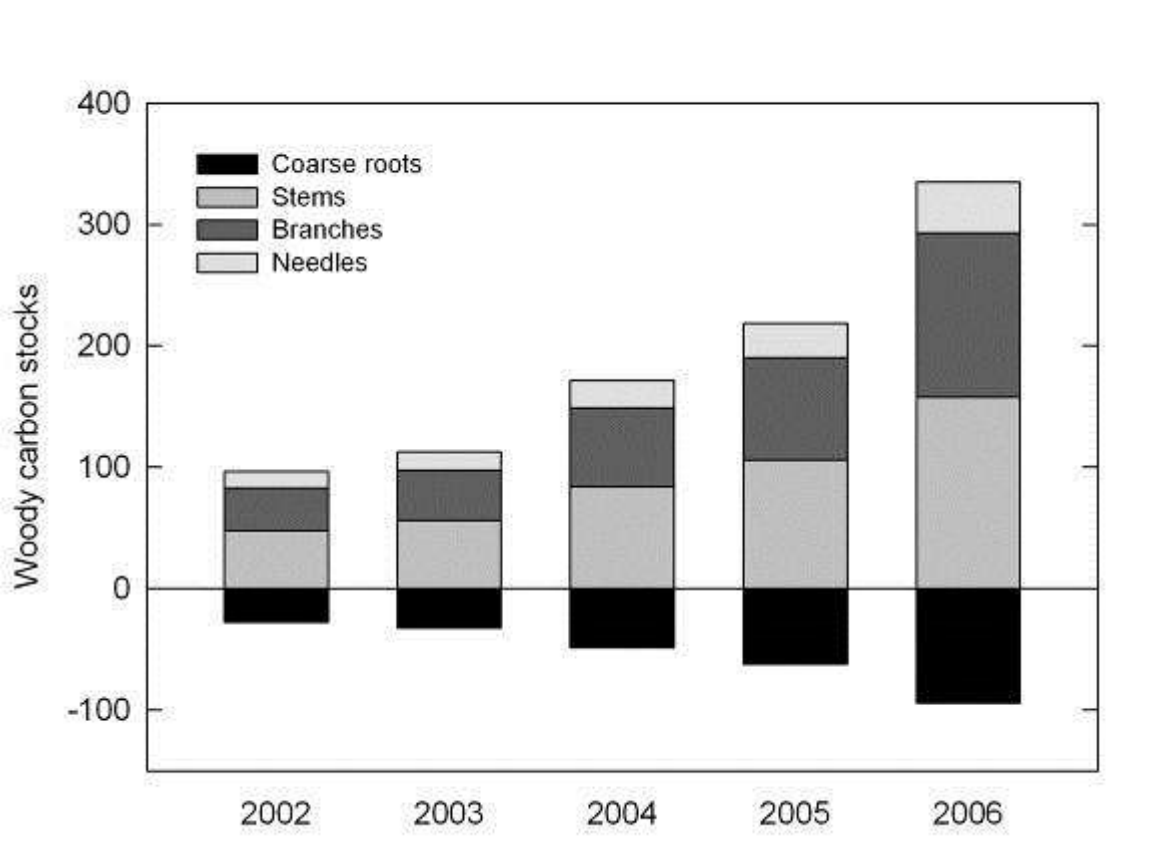
Annual variation in Re



Annual variation in GPP



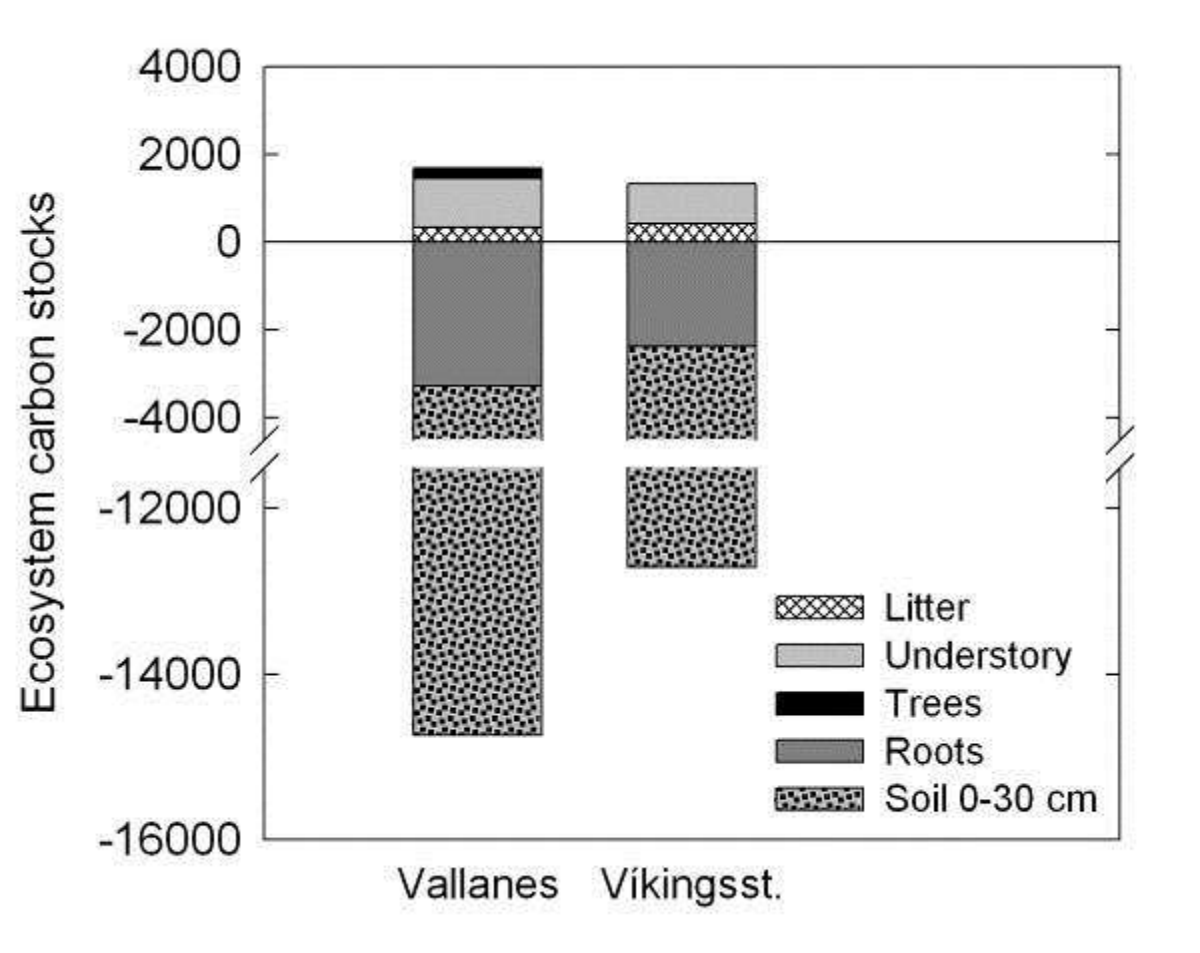
Stocks – trees and coarse roots



Mean annual increment <u>during the study time</u> was

-255 g CO_2 m^{-2} $year^{-1}$, or 65% of the ecosystem NEE for the same period

Carbon stocks of various components in Vallanes and Víkingsstaðir



Total C-stock change (NEP) was -672 g CO_2 m^{-2} $year^{-1}$

Conclusions on fluxes and stocks of the larch forest

- Both methods (flux and stock) indicate that the young larix site was a strong sink. However, both methods are accompanied with a random sampling error.
- NEE was stongly influenced by high inter-annual variability in environmental factors
- The annual variation in NEE was more affected by variation in R_e than in GPP
- The best parameters for annual R_e were mean annual air temperature and seasonal average soil water potential
- The best parameter for GPP was total irradiance during the growing season
- Major frost damage in spring 2005 greatly affected GPP in 2005
- Stock-change measurements supported the flux measurements
- The largest relative changes in the ecosystem C-stock occured belowground, in the fine root biomass and soil organic carbon

The future...

- In 2012: Start measurements at a new site in south-Iceland
- 70 ha of a 20 year old Populus stand on drained wetland

Thank you!