Multi-proxy reconstruction of precipitation extremes and its relationship with forest fire activity in southern and central Fennoscandia since AD 1500

Kristina Seftigen
Igor Drobyshev
Hans W. Linderholm
Mats Niklasson

Forskningsrådet Formas
GÖTEBORGS UNIVERSITET
RCG Regional Climate Group
SLU

Project description

This project aims to develop reconstructions of past summer precipitation extremes in southern and central Fennoscandia for the last 500 years, using precipitation sensitive Scots pine (*Pinus sylvestris*) and penduculate oak (*Quercus robur*) tree-ring chronologies. Spatial and temporal extents, durations and frequencies of past droughts will be estimated, and the relations of these events to forest fire activity explored. This will be done through joint analyses of instrumental climate data, regional tree-ring chronologies (including tree-ring width, density, and isotope chronologies), and analysis of a network of independently reconstructed forest fire histories.

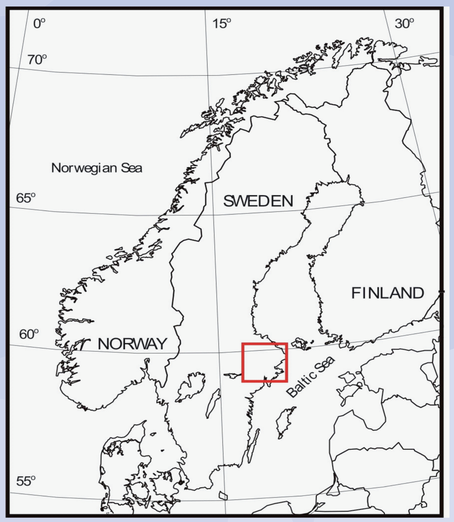

Figure 1. Map of Sweden showing locations of sampling sites. The sites are:
Putbergen[1] (*59°11´N, 16°55´E*),
Nämdö[2] (*59°11´N, 18°41´E*),
Saltsjöbaden[2] (*59°16´N, 18°18´E),*
Stockholm[3] (*59°09´N, 18°00´E*),
Tyresta[3] (*59°11'N, 18°16'E*).
(Data Contributors: [1] = Seftigen K. and Drobyshev I., [2] = Larsson, L., [3] = Linderholm, L.,).

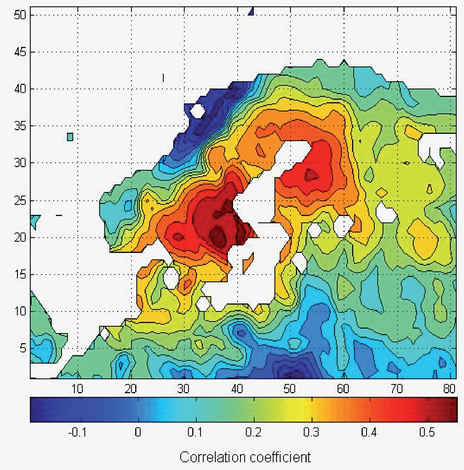

Figure 2. Spatial correlation between gridded mean May-June precipitation data (CRU TS2.1) and tree-ring PC1 scores for the time period 1901-1995.

In this **case-study** we examined the suitability of 5 tree-ring chronologies of *Pinus sylvestris* L. derived from east central Sweden (**Figure 1**), for use in summer precipitation reconstructions. Analyses of climate/growth relationship showed that, in general, mean May-June precipitation has a strong influence on pine growth (**Figure 2**). Based on these results an attempt was made to reconstruct the early summer precipitation for the region back to year 1735 (**Figure 3**). A prominent feature in the ~ 250-year reconstruction is the multi-decadal scale dry event covering the first half of the 19th Century. The wettest spell in the reconstruction period was observed during 1770-1800 (**Figure 4.**).

Since a significant proportion of the inter-annual precipitation variability over Fennoscandia is attributed to the dynamics of the North Atlantic Oscillation (NAO), a comparison was additionally made between our tree-ring data and monthly indices of NAO. The results showed a minor infuence (r = 0.3) of the atmospheric circulation (mean December-February NAO) on tree growth (**Figure 5.**).

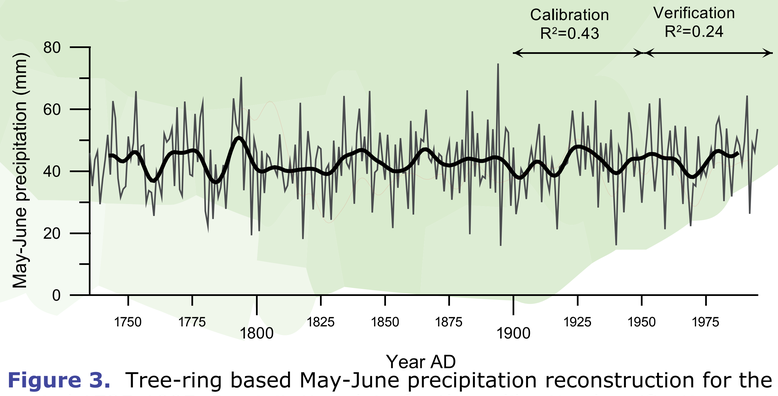

Figure 3. Tree-ring based May-June precipitation reconstruction for the period 1735-1995. Precipitation data for the calibration/ verification periods (1901-1950 and 1951-1995, respectively) were derived from Stockholm meteorological station. The thick black/red lines are the long-term trend (corresponding to a 10-year moving average) in the reconstructed/observed (Stockholm, 1786–2000) precipitation data.

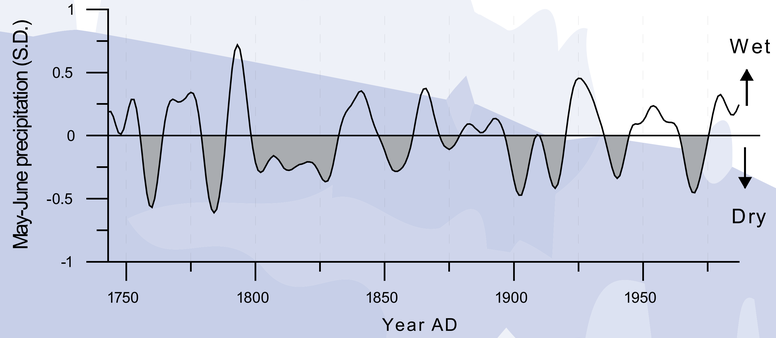

Figure 4. Reconstructed Stockholm precipitation (mean May-June) smoothed with a Gaussian filter (σ = 3). The horizontal line represents the 1735-1995 mean. Periods of above-average precipitation are shown in white while periods of below average precipitation are shown in grey.

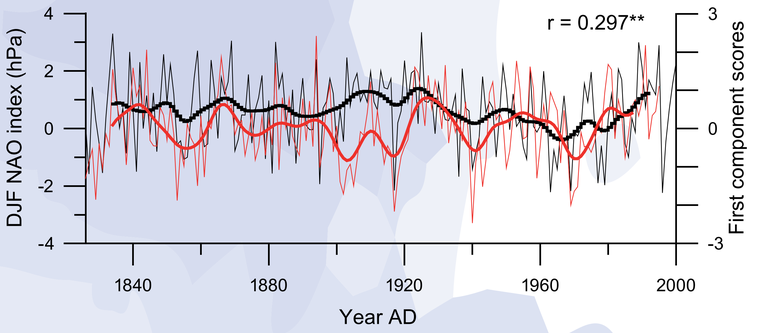

Figure 5. Tree-ring PC1 scores (red line) plotted against mean December - February NOA indices (black line).
** = significant at 0.01