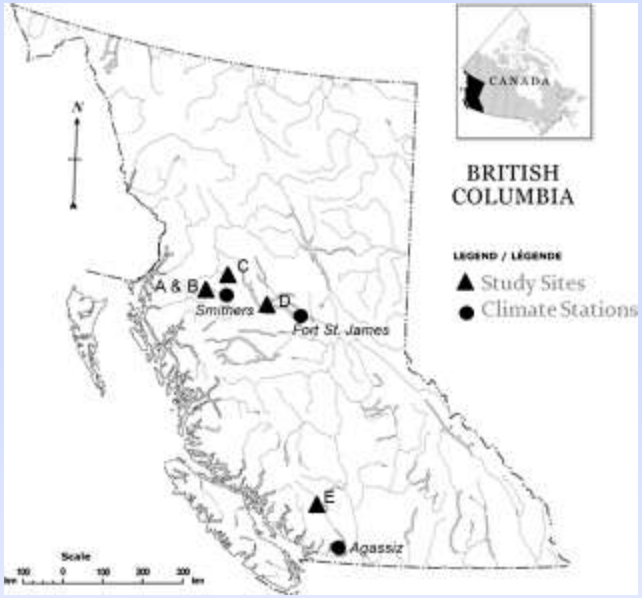
Can we predict future softwood quality?

from climate models

The objectives of this study were to investigate the relationships between climate and wood anatomical development, and to use the relationships identified to predict certain wood quality attributes in interior British Columbia forest stands. L. J. Wood et. al. used an Itrax Multiscanner to establish time-series of Maximum – mean and minimum density and a SilviScan instrument to measure micro fibril angle (MFA) at four different sites of Douglas-fir and spruce forests. They concluded that there was a strong correlation between tree growth and climate at the northern interior sample sites which permitted a successful reconstruction of ring-width, maximum density and MFA, however with some exceptions. Correlation analysis demonstrated that most cell wall thickening, and consequently, density variables for both Douglas-fir and spruce stands in the interior of BC were positively correlated to increases in mean summer temperatures. There were a few instances where it was evident that another variable was more important to radial development, but summer temperature was the primary variable involved in wood formation in these stands over the last 50–100 years.



Predicting softwood quality attributes from climate data in interior British Columbia, Canada

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Reconstructions of summer temperature
at the third pole

Long-term summer temperature records are important for climate studies on the Tibetan Plateau (TP). In this work H. Liang et. al used an Itrax Multiscanner to measure tree-ring maximum latewood density (MXD) to develop a well-replicated regional chronology back to the year 1630 for the southeastern Tibetan Plateau. The MXD chronology was positively related to the observed August mean minimum temperatures (AMMT) in the period 1961–2011. Therefore, the AMMT was reconstructed from the MXD chronology. The reconstruction explained 42.6% of the total variance in the observed AMMT. During the past 382 years, warm periods were found during 1646–1694, 1770–1805, 1930–1971 and 1992–2011, and cold periods were found during 1630–1645, 1695–1749, 1806–1825, 1889–1929 and 1972–1991. Extremely cold summers (≤mean − 2 SD) occurred in the years 1701, 1777, 1810, 1817, 1835, 1843, 1857, 1871, 1911, 1914, 1915, 1939, 1983 and 1984, whereas the warm summers occurred in the years 1786, 1788, 2003, 2004 and 2005. They suggested that a possible reason for the strong AMMT(representing night-time temperature) MXD correlation was that night-temperature was more important than day temperature in affecting radial cell enlargement and size and thus it determined the secondary growth rate of xylem cells.

Dendrochronologia 37 (2016) 1–8

A 382-year reconstruction of August mean minimum temperature from tree-ring maximum latewood density on the southeastern Tibetan Plateau, China

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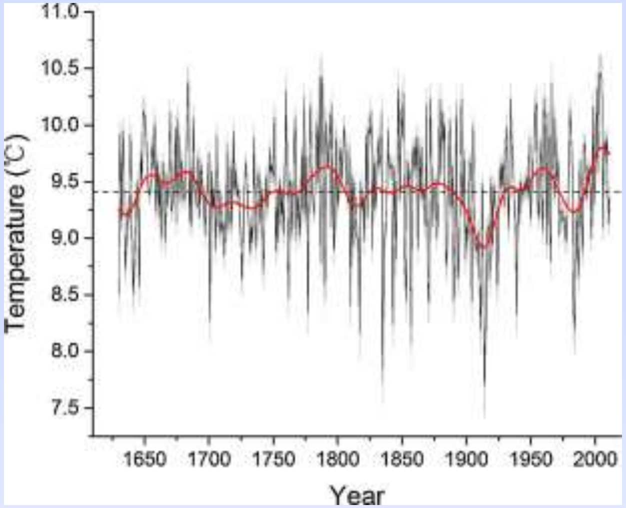
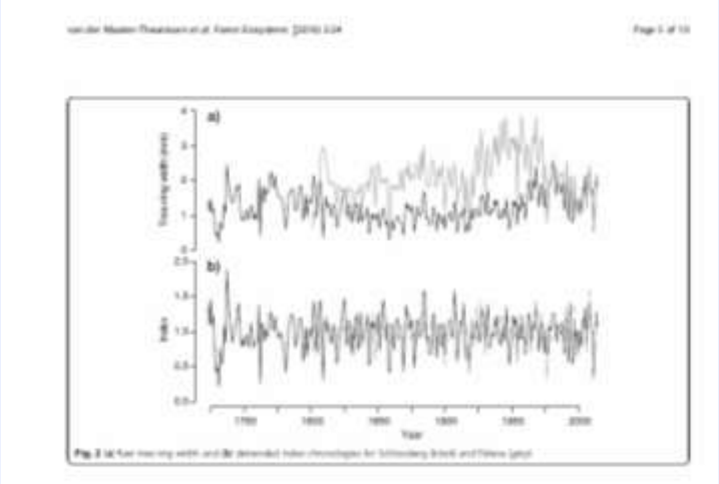


The reconstructed AMMT over the period 1630–2011 (the bold black curve). The red line is the 11-year Fast Fourier Transformation filter; the shaded area behind the AMMT curve represents the 95% confidence interval. The dashed line indicates the long-term mean value of the reconstructed AMMT.

Drought sensitivity of Beech
on shallow chalk soil

M. Van der Maatens-Theunissen and co-worker used the Itrax Multiscanner to compare the climate sensitivity of European beech (Fagus sylvatica L.) in two forest nature reserves in northeastern Germany. The one reserve, Schlossberg, was characterized by shallow chalk soils, whereas in the other reserve, Eldena, soils were deeper and more developed. Little is known about the drought sensitivity of beech on shallow chalk soils. The authors collected increment cores at both research sites and established climate-growth relationships. Inter tree variability was assessed by employing linear mixed effect models. They had expected to find distinctively higher drought sensitivity at Schlossberg due to the limited water availability, but found only marginal differences in growth responses. At both sites, drought is the major climatic factor driving tree growth.



Forest Ecosystem DOI 10.1186/s40663-016-0083-6

Drought sensitivity of beech on a shallow chalk soil in northeastern Germany – a comparative study

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Intra-annual density fluctuations
Where does in come from?

Intra-annual density fluctuations (IADFs) in tree-rings can imprint environmental conditions within the growing season and most of the research on IADFs has been focused on their climatic signal. However, to our knowledge, the genetic influence on the frequency and type of IADFs has not been evaluated. To understand if the genotype can affect the formation of IADFs M. Klisz and co-workers have used a common garden experiment using eight families of *Larix decidua* established in two neighboring forest stands in northern Poland. Four types of IADFs were identified using X-ray density profiles (Itrax Multi scanner): latewood-like cells within earlywood (IADF-type E), latewood-like cells in the transition from early- to latewood (IADF type E+), earlywood-like cells within latewood (IADF-type L), and earlywood-like cells in the border zone between the previous and present annual ring (IADF-type L+).

The most frequent fluctuation was E+ and L types on both sites. The most important factors in the formation of IADFs were the site and year, the last one reflecting the variable climatic conditions, with no significant effect of the family.

Frontiers in Plant Science doi: 10.3389/fpls.2016.00691

Does the Genotype Have a Significant Effect on the Formation of Intra-Annual Density Fluctuations? A Case Study Using *Larix decidua* from Northern Poland

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What is the major influence of tree growth
north, south, wet or dry?

Northern treelines are expected to reflect a strong summer temperature signal as they are generally cold-limited. Ring width data from northern treelines, and in particular Scots pine (*Pinus sylvestris* L.) from Fennoscandia, have thus frequently been used to build long chronologies in order to reconstruct climatic conditions of the past centuries.
In this preliminary study Lange and co-workers investigated the hypothesis that microsite differences (in terms of water availability) influence tree growth by addressing the questions whether and to what extent microsite conditions (dry, wet, both at a northern and a southern location near the treeline) cause differences in (i) growth performance, (ii) climate–growth relationships (they expected dry sites being correlated negatively with summer temperature or positively with summer precipitation) and (iii) stability of climate–growth relationships. An Itrax Multiscanner was used to establish the growths parameters from 82 samples of Scots pine from four different microsites in northern Finland.
Preliminary results suggest that differences in growth performance exist among the investigated dry, wet, northern and southern sites. When calculated over the entire period, main climate–growth correlations are similar between all microsites. But only in the northern sites, stable climate–growth correlations exist (July temperature). The results concerning growth performance seem to be explicable through varying (micro-)site conditions, while the main trigger for the fading climate–growth relationships remains unclear for now.

Tree Rings in Archaeology, Climatology and Ecology, Volume 14. Scientific Technical Report 16/04, GFZ German Research Centre for Geosciences, p. 93-101. doi: 10.2312/GFZ.b103-16042.

Can microsite effects explain divergent growth in treeline Scots pine?

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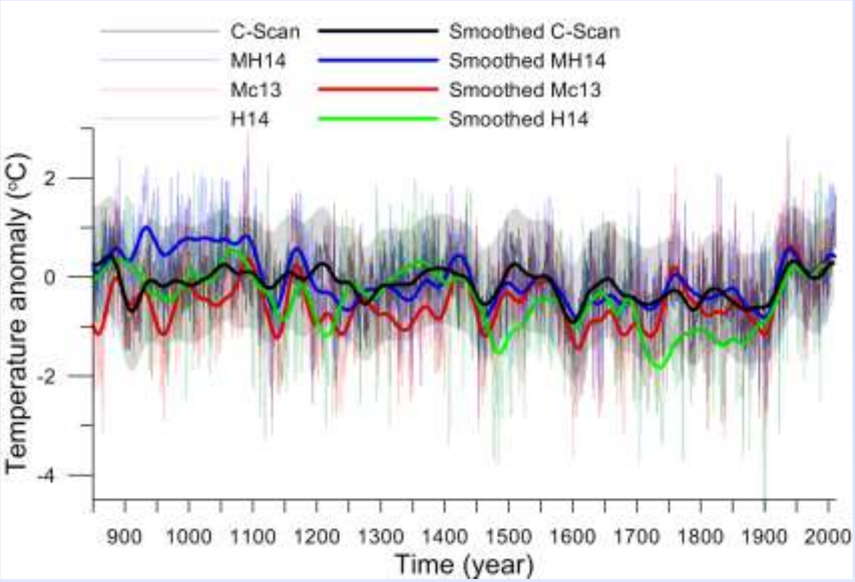
The last 1000 years of Scandinavian climate
have now been updated

P Zang et. al have presented a new Scots pine tree-ring density-based reconstruction of warm-season (April–September) temperatures for central Scandinavia back to 850 AD, extending the previous reconstruction by 250 years. This so called C-Scan is based on samples collected in a confined mountain region, adjusted for their differences in altitude and local environment, and standardised using the new RSFi algorithm to preserve low-frequency signals. In C-Scan, the warm peak of Medieval Climate Anomaly (MCA) occurs ca. 1000–1100 AD, and the Little Ice Age (LIA) between 1550 and 1900 AD. Moreover, during the last millennium the coldest decades are found around 1600 AD, and the warmest 10 and 30 years occur in the most recent century. The new data-set is based on MXD (maximum latewood density) data recorded by the Itrax Multiscanner. Compared to the previous reconstruction, G11, the issue of biases arising from samples from different locations was appropriately addressed and corrected using the mean-adjustment method. C-Scan is largely based on high-quality tree-line samples collected from a smaller area.



Comparison of temperature anomalies (from 1961–1990 period) inferred by four temperature reconstructions covering the whole last millennium: C-Scan (April–September, this study, black), MH14 (June–July, MXD, blue, Matskovsky and Helama, 2014), Mc13 (June– August, multi-proxy, red, McCarroll et al., 2013) and H14 (May–September, MXD, green, Helama et al., 2014). Bold curves show the variability after 51-year Gaussian filtering. The black shading indicates the total uncertainty of C-Scan (including chronology uncertainty and reconstruction calibration uncertainty), as expressed as 2 times the standard error.

Clim. Past, 12, 1297–1312, 2016 doi:10.5194/cp-12-1297-2016

1200 years of warm-season temperature variability in central Scandinavia inferred from tree-ring density.

Peng Zhang[1], HansW. Linderholm[1], Björn E. Gunnarson[2], Jesper Björklund[3], and Deliang Chen[1]
1Regional Climate Group, Department of Earth Sciences, University of Gothenburg, Gothenburg, Sweden
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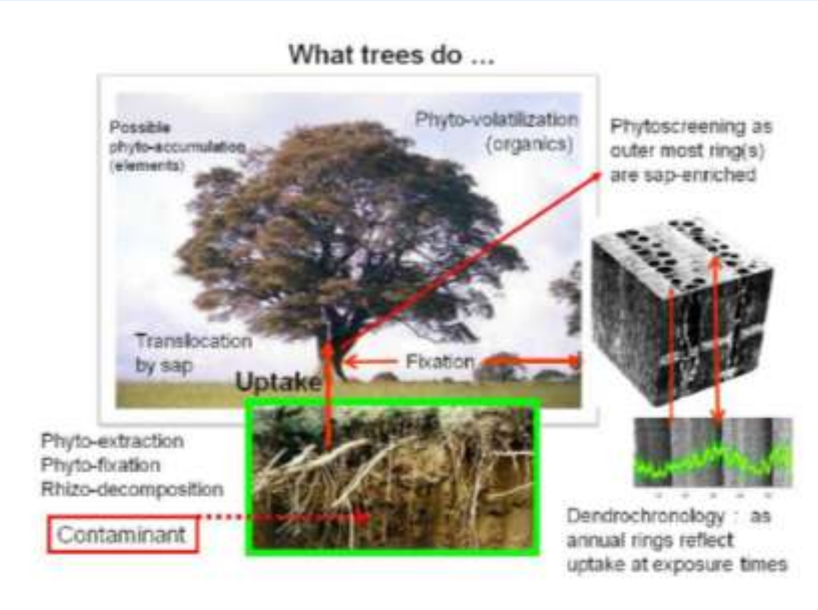
3Swiss Federal Research Institute WSL, Birmensdorf, Switzerland

Dendrochemistry and Phytoforensics

Applications where Itrax Multiscanner makes a difference!

Because plants evolved to be extremely proficient in mass transfer with their surroundings and have survived as Earth's dominant biomass, plants also accumulate and store certain contaminants from their surroundings, acting as passive samplers. Novel applications and analytical methods have been used to gain information about a wide range of contaminants in the biosphere soil, water, and air, along with available information on both past (dendrochemistry) and present (phytoscreening) contaminants. Collectively, these sampling approaches provide rapid, inexpensive, ecologically friendly, and overall "green" tools that are termed "phytoforensics".
Application of Phytoforensics on wood was pioneered by J. C. Balouet and J. Burken. The combination of high resolution radiography and micro XRF, as provided by the Itrax Multiscanner instrument, became a perfect match for these types of forensic investigations. A large number of cases concerning pollutions have been investigated by phytoforensic methods and where contaminants in wood tissues where traced back to calendar years thanks to high resolution radiography and micro-XRF



POLLUTION INVESTIGATION BY TREES (PIT) METHODOLOGICAL GUIDE August 2015

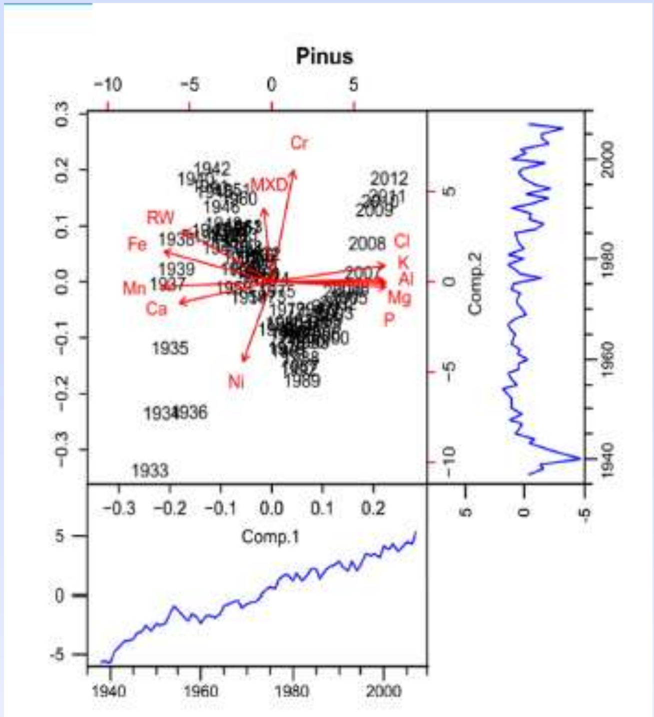
Étude réalisée pour le compte de l'ADEME par
Chris BALOUET, et Michel CHALOT

N° de contrat 1072C0020, en date du novembre 2010
Coordination technique : Hélène ROUSSEL – Sites et Sols Pollués – Direction exécutive – Programmes – ADEME (Angers)

Dendrochemistry

what can it tell us?

Elemental analysis of annually resolved tree-rings constitutes a promising biological proxy for reconstructions of environmental conditions and pollution history. However, several methodological and physiological issues have to be addressed before sound conclusions can be drawn from dendrochemical time series. For example, radial and vertical translocation processes of elements in the wood might blur or obscure any dendrochemical signal. In this study, T. Schamweber and co-workers tested the degree of synchronism of elemental time series within and between trees of one coniferous (Pinus sylvestris L.) and one broadleaf (Castanea sativa Mill.) species growing in conventionally managed Forests without direct pollution sources in their surroundings. Itrax Multiscanner was used to establish time series of relative concentrations of elements (Mg, Al, P, Cl, K, Ca, Cr,Mn, Fe and Ni) as well as ringwidth (RW) and maximum latewood density (MXD) Both species show clear intra-annual fluctuations with increased element concentrations in the latewood for most elements. Only the macronutrients Ca and K show a different intra-annual trend which is similar in both species. For Pinus two principal components could be identified, with Ca, Mn, Fe and RW (negative loadings) separated from Cl, K, Al, Mg and P (positive loadings) by the first PC (63% variance explained) and MXD and Cr separated from Ni according to their loadings on the second PC (14% variance explained).



The time-path for Pinus Sylvestris in the PC1 – PC2 space formed from element recorded by XRF together with ringwidth (RW) and maximum latewood density (MXD).

Science of the Total Environment xxx (2016) xxx–xxx

Common trends in elements? Within- and between-tree variations of wood-chemistry measured by X-ray fluorescence — A dendrochemical study

Tobias Scharnweber [a], Andrea Hevia [b], Allan Buras [a], Ernst van der Maaten [a], Martin Wilmking[a]

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[b] Forests and Wood Technology Research Centre – CETEMAS, Finca Experimental La Mata s/n, 33825 Grado, Asturias, Spain

How forest industry
can benefit from density measurements

Numerous studies have considered the effects of initial planting spacing on wood properties but little is known about the properties of trees grown from dense natural regeneration and the effects of early release from competition. In this study A. D. Cameron and co-workers examined 40-year-old Sitka spruce (Picea sitchensis (Bong.) Carr.) trees originating from regeneration with an initial density ~27,000 stems ha^{-1}. Treatments were a control of natural regeneration with no interventions and regeneration re-spaced to two metres (height ~1.6 m). Density, ringwidth (as measured by Itrax Multiscanner) and strength measurements were made on the juvenile and mature wood. The control trees revealed a uniformity of properties across the juvenile and mature wood zones, unlike the respaced treatment. Re-spaced trees appear to adapt to their new environment by producing more thin-walled conductive tissue and lowering overall cell wall density that continues from the juvenile to mature wood.

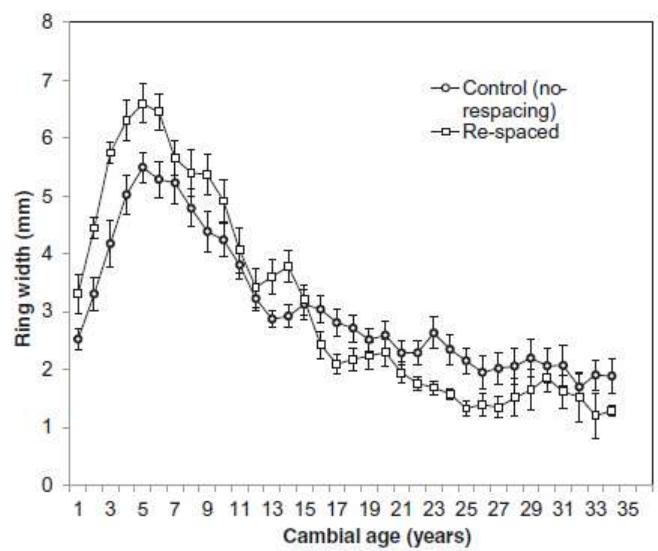


Fig. 2 Variation in mean ring width with ring number from the pith from two stands of Sitka spruce; control treatment of naturally regenerated Sitka spruce without re-spacing and re-spaced to 2-m square spacing when 1.5-m average height (*Bars* ±1 s.e.)

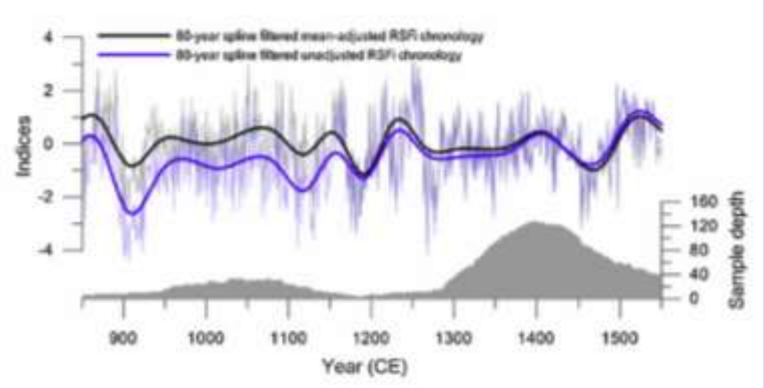
Annals of Forest Science (2015) 72:99–107 DOI 10.1007/s13595-014-0402-4

Effect of early release from intense competition within high density natural regeneration on the properties of juvenile and mature wood of 40-year-old Sitka spruce (Picea sitchensis (Bong.) Carr.)

Andrew D. Cameron & Barry A. Gardiner & James Ramsay & Tom A. Drewett
Department of Forestry, Institute of Biological and Environmental Sciences, University of Aberdeen
Forest Research, Northern Research Station
Centre for Timber Engineering, Edinburgh Napier University

How warm was Scandinavia 1000 years ago?

P. Zhang et. al. analysed maximum latewood density (MXD) of Pinus sylvestris L. (Scots pine), from deadwood (dry) and subfossil wood (from lakes) collected along an elevation gradient in and close to the central Scandinavian Mountains, in the province of Jämtland, Sweden. Focusing on two common time periods (900–1150 CE and 1300–1550 CE), the mean absolute MXD of deadwood samples (Itrax Multi scanner) showed an inverse relationship with elevation, i.e. the absolute MXD decreases with elevation. A mean-adjusting method was developed to overcome this bias, and its usefulness was demonstrated by comparing two chronologies built on mean-adjusted and unadjusted MXD samples. It was concluded that unadjusted samples from different elevations with inhomogeneous temporal distribution can distort the long-term trend in a final chronology, while this bias can be alleviated if mean-adjusted samples are used.



Comparison of the mean-adjusted RSFi chronology (black) and the unadjusted RSFi chronology (blue). Light curves indicate the interannual variability, and the bold curves show the 80-year spline smoothed variability. The gray shading indicates the sample depth.

Trees (2015) 29:1259–1271 DOI 10.1007/s00468-015-1205-4

The influence of elevational differences in absolute maximum density values on regional climate reconstructions

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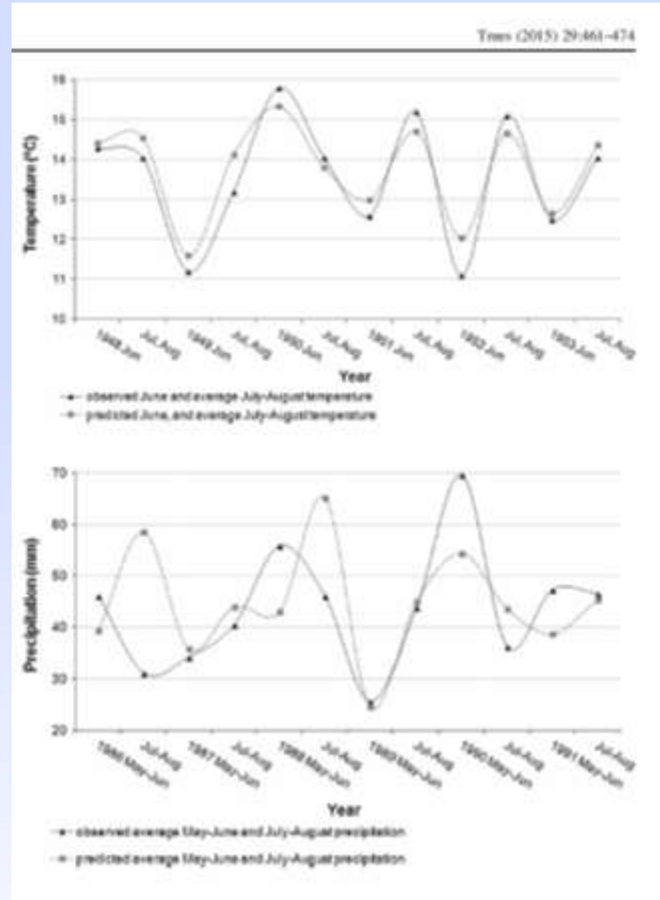
[2]Swiss Federal Research Institute WSL, Birmensdorf, Switzerland

Intra-annual climate reconstructions

From high resolution dendro-radiography

L.J. Woods and D. J. Smith sampled drillcores from wood at six sites in northern British Columbia. Spruce trees were collected from the Smithers area, whilst Douglas-fir trees were sampled at the northern latitudinal extent of their range near Babine and Francois Lakes, and at a precipitation-limited site near Valemount. The wood cores were analysed by an ITRAX Multi scanner in combination with Windendro software, and by the SilviScan system located at the Australian Commonwealth Scientific and Research Organization. A mean June temperature proxy record dating to 1805 was constructed from spruce ring width (RW) and a July–August mean temperature proxy record for Smithers extending from 1791 to 2006 was constructed from the spruce maximum density (MXD) chronologies. Douglas-fir RW, spruce minimum density (MND), and Douglas-fir maximum cell-wall thickness (XCWT) chronologies were used to reconstruct a May–June precipitation record extending from 1820 to 2006, and a July– August total precipitation record for Fort St. James that extends from 1912 to 2006. They concluded that a combination of multivariate and single-variate analyses provides detailed insights into seasonal radial growth characteristics. These findings allowed for the reconstruction of intra-seasonal climate variables that reflected physiological responses to climate at different times throughout the growing season.



Tr es (2015) 29:461–474 DOI 10.1007/s00468-014-1124-9

Intra-annual dendroclimatic reconstruction for northern British Columbia, Canada, using wood properties

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