Trees (2017) 31:377–378
DOI 10.1007/s00468-017-1544-4

EDITORIAL

Editorial note for the special section on 'Tree-Ring Research in Asia' of TREES: structure and function

Eryuan Liang[1,2] · Achim Bräuning[3]

Received: 14 March 2017 / Accepted: 15 March 2017 / Published online: 23 March 2017

What are main drivers of wood formation along different elevations in mountain regions of Asia under different climatic regimes? How do growth responses to climate respond to climatic change? And how does direct human impact in the hydrological cycle alter the growth response of affected trees? Among others, these important questions were intensively discussed at the 4th International Conference of the Asian Dendrochronology Association (ADA) held in Kathmandu, Nepal, during 9–12 March 2015. The conference was attended by around 150 participants form 26 countries, and some of the published papers were shared with a special issue of the journal *Dendrochronologia* (Pourtahmasi et al. 2017). The current issue of *Trees—Structure and Function* presents a selection of articles that addresses aspects of environmental changes on various functional aspects of trees.

Two papers that have already been published during 2016 studied wood formation and its dependence on environmental forcing in completely different plant functional types and ecosystems. Growing in the Asian monsoon climate of the subtropical hills of eastern India, the common and economically important pine species, *Pinus kesya*, shows a high frequency of Intra-Annual Density Fluctuations (IADFs) in the earlywood, but to a lesser extent also in the latewood. Singh et al. (2016) are able to assign these features to short-term fluctuations in precipitation. While latewood IADFs are formed by earlywood-like tracheids with wide cell lumen formed during periods with excessive rainfall in the late growing season, earlywood IADFs are triggered by deficient moisture availability during the early growing season around May, after tree growth has been activated by precipitation in the pre-monsoon season in April. Interestingly, years with IADF formation in earlywood seem to correspond to years with crop failure due to early summer drought; however, these indications need further verification by longer data records.

As a pioneering study on xylogenesis in alpine shrubs, Li et al. (2016) analysed wood formation processes in *Rhododendron* shrubs on the Tibetan plateau at an elevation of 4.400 m. a.s.l. The onset of xylogenesis started at minimum air temperatures of $2.6 \pm 0.6\,°C$, and minimum and mean air temperatures during the 1–4 days before sampling correlated significantly with growth rates. Ring width most strongly correlated with the duration of the cell enlargement phase during cell differentiation, whereas the whole duration of the xylem growth period was not related to final ring width. The study shed light on the important question as to why shrubs are able to grow successfully high above the upper limit of trees, whose minimum temperature requirements for growth initiation are in the order of 4–5 °C.

Three articles studied tree growth-climate relationships along elevation or latitudinal gradients in High Asia. Huo et al. (2017) investigated changes in growth rate and climate response of five sites of *Picea schrenkiana* in the Tian Shan in far-western China along an elevation difference of more than 1300 m. Annual precipitation at 1.850 m elevation in this semi-arid region is around 500 mm. Tree-growth patterns and climate responses clearly differed

✉ Achim Bräuning
achim.braeuning@fau.de

1 Key Laboratory of Alpine Ecology and Biodiversity, Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, China

2 CAS Center for Excellence in Tibetan Plateau Earth Sciences, Beijing, China

3 Institute of Geography, Friedrich-Alexander University Erlangen-Nürnberg, Erlangen, Germany

between sites above around 2500 and below 2000 m elevation: high-elevation sites showed a positive influence of summer (Jun–Aug) temperature on annual growth rates, whereas autumn precipitation and current summer moisture conditions had a positive influence on ring width at lower-elevation sites. In the Qilian Mountains of north China, Gao et al. (2017) compared growth responses to climate of *Picea crassifolia* growing on north-facing slopes and *Juniperus przewalskii* on south-facing slopes. For both species, sites in elevations of ca. 2850 and 3100 m elevation were compared. While the spruce chronologies showed similar growth patterns in both altitudes and growth patterns of high-elevation sites of both species were significantly correlated, the low-elevation juniper site showed contrasting growth patterns and negative correlations to summer season temperatures, indicating a growth-limiting impact of drought stress at this site. In northeast Asia, Wang et al. (2017) investigated spatio-temporal variations in climate–growth relationships of Korean pine (*Pinus koraiensis*) at six sites along a latitudinal transect of its distribution. Temperature is a major limiting factor for the radial growth of Korean pine; however, recent climate warming is changing the growth responses at different sites of its distribution in different ways. Tree growth increased in response to the warming in recent decades at two southern and high-altitude sites, but remained constant at two low-altitude sites at its central distribution, and decreased at its northern margin. Hence, warming-induced drought stress is causing divergent growth responses of Korean pine to recent climate warming in northeast Asia.

One paper of this issue investigated the heterogeneous stem radial growth of *Populus euphratica* and its correlation with hydrology and climate factors in Ejina Oasis in Northwest China. Riparian forests in Northwest China are extremely vulnerable to the increasing pressures from human activity and climate change. Peng et al. (2017) developed 28 tree-ring chronologies of *P. euphratica* in the lower reaches of the Heihe River. Three hydrologic periods were identified in a regime-shift analysis: a natural runoff period from 1954 to 1989, a degradation period from 1990 to 2002, when excessive upstream withdrawals of runoff decreased water inflow to the oasis, and a recovery period from 2003 to 2010, when water allocation projects restored flow rates. The radial growth of poplar trees showed decreasing and increasing trends in the degradation and recovery periods, confirming that the runoff-recharged hyporheic groundwater depth was a major factor in controlling the growth *P. euphratica*. Thus, it is important to allocate water between the middle and lower reaches to mitigate adverse effects of low runoff on tree growth.

Finally, one paper proposed a new method for removing age-related growth trends in tree-ring series. Zhang and Chen (2017) used the ensemble empirical mode decomposition (EEMD) method for tree-ring width detrending by decomposing a non-stationary time series into its intrinsic variations and its mean trend. This method produced similar detrended chronologies compared with traditional methods like linear and exponential curves and spline smoothing detrending, that possibly remove parts of low-frequency climate signals contained by the raw tree-ring data. However, in comparison with the traditional methods, the so-called end effect which might introduce artificial trends in the youngest parts of a tree-ring chronology was alleviated by the EEMD method. Hence, it is a potential alternative detrending approach for preserving low-frequency climate signals tree-ring chronology development.

References

Gao L, Gou X, Deng Y, Yang M, Zhang F (2017) Assessing the influences of tree species, elevation and climate on tree-ring growth in the Qilian Mountains of northwest China. Trees. doi:10.1007/s00468-015-1294-0

Huo Y, Gou X, Liu W, Li J, Zhang F, Fang K (2017) Climate–growth relationships of Schrenk spruce (*Picea schrenkiana*) along an altitudinal gradient in the western Tianshan mountains, northwest China. Trees. doi:10.1007/s00468-017-1524-8

Li X, Rossi S, Liang E, Camarero JJ (2016) Temperature thresholds for the onset of xylogenesis in alpine shrubs on the Tibetan Plateau. Trees 30:2091–2099. doi:10.1007/s00468-016-1436-z

Peng X, Xiao S, Cheng G, Xiao H, Tian Q, Zhang Q (2017) Human activity impacts on the stem radial growth of *Populus euphratica* riparian forests in China's Ejina Oasis, using tree-ring analysis. Trees. doi:10.1007/s00468-015-1287-z

Pourtahmasi K, Zhang Q, Dawadi B (2017) Asian Dendrochronology Association (ADA) 2015. Dendrochronologia 41:1. doi:10.1016/j.dendro.2016.11.003

Singh ND, Yadav RR, Venugopal N, Singh V, Yadava AK, Misra KG, Singh TB, Sanjita C (2016) Climate control on ring width and intra-annual density fluctuations in *Pinus kesiya* growing in a sub-tropical forest of Manipur, Northeast India. Trees 30:1711–1721. doi:10.1007/s00468-016-1402-9

Wang X, Zhang M, Ji Y, Li Z, Li M, Zhang Y (2017) Temperature signals in tree-ring width and divergent growth of Korean pine response to recent climate warming in northeast Asia. Trees. doi:10.1007/s00468-015-1341-x

Zhang X, Chen Z (2017) A new method to remove the tree growth trend based on ensemble empirical mode decomposition. Trees. doi:10.1007/s00468-015-1295-z