**IAWA Journal - Volume 37(2)**

|  |  |
| --- | --- |
| **Author(s):** | Yegor Tarelkin; Claire Delvaux; Maaike De Ridder; Thomas El Berkani; Charles De Cannière; Hans Beeckman |
| **Title:** | **Growth-ring distinctness and boundary anatomy variability in tropical trees** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | S1-S7 |
| **Keywords:** |  |
| **Abstract:** |  |
| **DOI:** | [10.1163/22941932-90001675](http://dx.doi.org/10.1163/22941932-90001675) |

|  |  |
| --- | --- |
| **Author(s):** | Editors IAWA Journal |
| **Title:** | **Preliminary material** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 121-123 |
| **Keywords:** |  |
| **Abstract:** |  |
| **DOI:** | [10.1163/22941932-90001673](http://dx.doi.org/10.1163/22941932-90001673) |

|  |  |
| --- | --- |
| **Author(s):** |  |
| **Title:** | **Functional traits in wood anatomy** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 124-126 |
| **Keywords:** |  |
| **Abstract:** |  |
| **DOI:** | [10.1163/22941932-20160139](http://dx.doi.org/10.1163/22941932-20160139) |

|  |  |
| --- | --- |
| **Author(s):** | Hans Beeckman |
| **Title:** | **Wood anatomy and trait-based ecology** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 127-151 |
| **Keywords:** | wood anatomical features; forest ecology; tree performance; Functional traits; stress effects; traits database; global ecology |
| **Abstract:** | The largest part of forest biomass consists of wood. A global estimate of carbon stored in lignified tissues rises up to 400 Pg. Given these quantities, there is a growing interest of implementing wood research in diagnoses and evaluations of the carrying capacity of the global ecosystem and its forests. The question arises how disciplines like wood anatomy could respond to the increasing demands of a trait-based ecology, understood as a paradigmatic shift in addressing global changes. Dendrochronology and ecological wood anatomy, traditionally operating within the paradigm of species-based ecology, developed robust methods to address ecological questions. However, sampling strategies and database design will likely be different when wood traits are to be used to study individual tree performance, including responses to stress.Aiming at optimally involving wood research in trait-based ecology, some trait concepts are analysed. The value of the IAWA standard lists of wood anatomical features as starting points for trait databases is recognized. A summary of the functionality of wood is given to inform the trait-research community of basic aspects of tree performance. The time dimension is highlighted, as well as the foundations for understanding bio-hydraulics, bio-mechanics and metabolism of wood and relevant traits.Guidelines are given for sampling strategies and database concepts. Prospects of time axis construction and system integration are discussed, as well as the importance of standardizing for size. |
| **DOI:** | [10.1163/22941932-20160127](http://dx.doi.org/10.1163/22941932-20160127) |

|  |  |
| --- | --- |
| **Author(s):** | Shan Li; Frederic Lens; Susana Espino; Zohreh Karimi; Matthias Klepsch; H. Jochen Schenk; Marco Schmitt; Bernhard Schuldt; Steven Jansen |
| **Title:** | **Intervessel pit membrane thickness as a key determinant of embolism resistance in angiosperm xylem** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 152-171 |
| **Keywords:** | xylem; vessel element; intervessel pit membrane; embolism resistance; bordered pit; angiosperms; intervessel wall; Air-seeding |
| **Abstract:** | Pit membranes in bordered pits between neighbouring vessels play a major role in the entry of air-water menisci from an embolised vessel into a water-filled vessel (*i.e*., air-seeding). Here, we investigate intervessel pit membrane thickness (TPM) and embolism resistance (P50, *i.e*., the water potential corresponding to 50% loss of hydraulic conductivity) across a broad range of woody angiosperm species. Data on TPM and double intervessel wall thickness (TVW) were compiled based on electron and light microscopy. Fresh material that was directly fixated for transmission electron microscopy (TEM) was investigated for 71 species, while non-fresh samples were frozen, stored in alcohol, or air dried prior to TEM preparation for an additional 60 species. TPM and P50 were based on novel observations and literature. A strong correlation between TPM and P50 was found for measurements based on freshly fixated material (*r* = 0.78, *P* >0.01, n = 37), and between TPM and TVW (*r* = 0.79, *P* >0.01, n = 59), while a slightly weaker relationship occurred between TVW and P50 (r = 0.40, P >0.01, n = 34). However, non-fresh samples showed no correlation between TPM and P50, and between TPM and TVW. Intervessel pit membranes in non-fresh samples were c.28% thinner and more electron dense than fresh samples. Our findings demonstrate that TPM measured on freshly fixated material provides one of the strongest wood anatomical correlates of droughtinduced embolism resistance in angiosperms. Assuming that cellulose microfibrils show an equal spatial density, TPM is suggested to affect the length and the shape of intervessel pit membrane pores, but not the actual pore size. Moreover, the shrinking effect observed for TPM after dehydration and frost is associated with an increase in microfibril density and porosity, which may provide a functional explanation for embolism fatigue. |
| **DOI:** | [10.1163/22941932-20160128](http://dx.doi.org/10.1163/22941932-20160128) |

|  |  |
| --- | --- |
| **Author(s):** | Martina Lazzarin; Alan Crivellaro; Cameron B. Williams; Todd E. Dawson; Giacomo Mozzi; Tommaso Anfodillo |
| **Title:** | **Tracheid and pit anatomy vary in tandem in a tall *Sequoiadendron giganteum* tree** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 172-185 |
| **Keywords:** | Allometric scaling; margo; hydraulic resistance |
| **Abstract:** | Across land plants there is a general pattern of xylem conduit diameters widening towards the stem base thus reducing the accumulation of hydraulic resistance as plants grow taller.In conifers, xylem conduits consist of cells with closed end-walls and water must flow through bordered pits imbedded in the side walls. As a consequence both cell size, which determines the numbers of walls that the conductive stream of water must cross, as well as the characteristics of the pits themselves, crucially affect total hydraulic resistance. Because both conduit size and pit features influence hydraulic resistance in tandem, we hypothesized that features of both should vary predictably with one another. To test this prediction we sampled a single tall (94.8 m) *Sequoiadendron giganteum* tree (giant sequoia), collecting wood samples from the most recent annual ring progressively downwards from the tree top to the base. We measured tracheid diameter and length, number of pits per tracheid, and the areas of pit apertures, tori, and margos. Tracheid diameter widened from treetop to base following a power law with an exponent (tracheid diameterstem length slope) of approximately 0.20. A similar scaling exponent was found between tracheid length and distance from tree top. Additionally, pit aperture, torus, and margo areas all increased (again with a power of ~0.20) with distance from tree top, paralleling the observed variation in tracheid diameter and length. Pit density scaled isometrically with tracheid length. Within individual tracheids, total permeable area of pits, measured as the sum of the margo areas, scaled isometrically with lumen area. Given that pores of the margo membrane are believed to increase in parallel with membrane area, from a strictly anatomical perspective, our results support the interpretation that pit resistance remains a relatively constant fraction of total resistance along the hydraulic pathway. |
| **DOI:** | [10.1163/22941932-20160129](http://dx.doi.org/10.1163/22941932-20160129) |

|  |  |
| --- | --- |
| **Author(s):** | Veronica De Micco; Angela Balzano; Elisabeth A. Wheeler; Pieter Baas |
| **Title:** | **Tyloses and gums: a review of structure, function and occurrence of vessel occlusions** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 186-205 |
| **Keywords:** | embolism; woundwood; protective layer; heartwood; Compartmentalization |
| **Abstract:** | Vessel occlusion through tyloses or gums is a natural phenomenon occurring with aging and heartwood formation, and in sapwood in response to vessel embolism. These types of vessel occlusion play a crucial role to limit the spread of pathogens and wood decay organisms, also as part of compartmentalization after wounding. In the sapwood, they can be considered to be an effective stress response.Here we review the literature on tyloses and gums in hardwoods, starting with the detailed 19th century account on tyloses by Hermine von Reichenbach. The structural diversity of tyloses (from thin-walled to sclerotic) and gum deposits is highlighted and illustrated. Our understanding of the development of vessel occlusions through vessel contact cells of the ray and axial parenchyma has greatly increased over the last decades, also thanks to ultrastructural and immunocytological studies. We critically discuss the postulated relationships between vessel-to-ray parenchyma pit size and vessel size and the incidence of either tyloses or gums and review the occurrence of these types of vessel occlusions in extant and fossil dicots. All factors identified in the literature as stimuli for vessel occlusion probably act through vessel embolism as a single direct trigger. Attempts in the literature to relate vessel occlusion with mechanisms of vessel refilling and embolism repair are controversial and invite more experimental research. |
| **DOI:** | [10.1163/22941932-20160130](http://dx.doi.org/10.1163/22941932-20160130) |

|  |  |
| --- | --- |
| **Author(s):** | Achim Bräuning; Maaike De Ridder; Nikolay Zafirov; Ignacio García-González; Dimitar Petrov Dimitrov; Holger Gärtner |
| **Title:** | **Tree-ring features: indicators of extreme event impacts** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 206-231 |
| **Keywords:** | Missing rings; earlywood vessels; white rings; traumatic ducts; frost rings; flood rings; extreme events; light rings; reaction wood |
| **Abstract:** | Wood anatomical features may be visible on the microscopic as well as on the macroscopic scale. While the former can often be quantified by detailed wood anatomical analyses, the latter are often treated as qualitative features or as binary variables (present/absent). Macroscopic tree-ring features can be quantified in terms of frequency, intensity, or classified according to their position within a tree ring, like intra-annual density variations (IADFs) in conifers or frost rings in earlywood or latewood. Although some of these tree-ring features, like *e.g.* missing rings or IADFs are often seen as anomalies, hampering dendrochronologists to perform proper crossdating of tree-ring series, many of these properties are formed under extreme environmental stress or heavy impact, and could mark these extreme events by the manifestation in the wood anatomical structures throughout the lifespan of trees. The described tree-ring features form discrete time-series of extreme events. For example, flood rings may be marked by lunar-shaped earlywood vessels or enlarged latewood vessels in ring-porous oaks. White earlywood rings and light rings indicate reduced cell wall thickness and lignification occurring in very cold years. Frost rings result from cambial cell death during abrupt cooling events in the growing season. Missing rings and IADFs are mainly caused by drought events. Characteristic variations in earlywood vessel size, shape, or number in ring-porous oak species are markers for flood events, defoliation, heat stress, or drought. Traumatic resin ducts may be triggered by a range of biotic or environmental stressors, including wounding, fires or mechanical factors. Reaction wood is indicative of mechanical stress, often related to geomorphic events. In many cases anatomical responses are unspecific and may be caused by different stressors or extreme events. Additionally, the sensitivity of trees to form such features may vary between species, or between life stages within one species. We critically evaluate the indicative value of different wood anatomical tree-ring features for environmental reconstructions. |
| **DOI:** | [10.1163/22941932-20160131](http://dx.doi.org/10.1163/22941932-20160131) |

|  |  |
| --- | --- |
| **Author(s):** | V. De Micco; F. Campelo; M. De Luis; A. Bräuning; M. Grabner; G. Battipaglia; P. Cherubini |
| **Title:** | **Intra-annual density fluctuations in tree rings: how, when, where, and why?** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 232-259 |
| **Keywords:** | double rings; intra-annual density fluctuations (IADFs); boreal climate; Mediterranean ecosystems; Cambial activity; temperate zones; tropics; false rings |
| **Abstract:** | Intra-annual density fluctuations (IADFs) in tree rings are generally considered structural anomalies caused by deviations from the “normal course” of xylogenesis during the growing season. This definition is based on the bias that, under “normal conditions”, cambial activity stops once a year. Each tree ring can thus be dated to one calendar year, which is one of the principles of dendrochronology. The formation of IADFs can be triggered directly by environmental changes, especially in precipitation and temperature, that affect cambial activity and cell differentiation. It can also be the result of limited photosynthesis, due to defoliation induced by biotic or abiotic constraints.Often indicated with alternative terms, IADFs were first described in the 1930s, and recently reported for many trees and shrubs from different ecosystems throughout the world, particularly for Mediterranean species. Different types of IADFs have been detected; their formation and structural properties depend on many factors including tree genotype, age, size, rooting depth, habitat, soil, climate, photosynthetic activity, and allocation strategies. Whether IADFs affect the adaptive capability of plants remains, however, unclear.We provide an overview of the main anatomical features of IADFs and their occurrence in tree rings from various environments and climatic regimes. We propose a simplified way of classifying them and discuss the hypotheses about their functional role and the factors triggering their formation. To understand the ecological role of IADFs better, we recommend a multidisciplinary approach, involving wood anatomy, dendroecology, and stable isotopes, which has already been applied for Mediterranean species. We conclude by considering that IADFs appear to be the “rule” rather than “anomalies” in some ecosystems where they help plants cope with fluctuating environmental conditions. Moreover, their anatomical structure represents a valuable proxy of past climatic conditions at a sub-seasonal resolution and may be relevant to adapt hydraulic functioning of living trees to changing climatic conditions. |
| **DOI:** | [10.1163/22941932-20160132](http://dx.doi.org/10.1163/22941932-20160132) |

|  |  |
| --- | --- |
| **Author(s):** | Klemen Novak; Martin De Luis; Jožica Gričar; Peter Prislan; Maks Merela; Kevin T. Smith; Katarina Čufar |
| **Title:** | **Missing and dark rings associated with drought in *Pinus halepensis*** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 260-274 |
| **Keywords:** | false ring; Aleppo pine; dark ring; missing ring; intra-annual density fluctuation; Spain; wood formation |
| **Abstract:** | The responses of the vascular cambium and tracheid differentiation to extreme drought in Aleppo pine (*Pinus halepensis* Mill.) were investigated. The research focused on the drought year of 2005, in the primary study area at Maigmo (MAI) in southeastern Spain, with comparisons in Jarafuel (JAL) and Guardamar (GUA). The climate in this region is typically warm and dry with hot summers. Wood formation throughout the 2005 growing season was studied in transverse microtome sections and integrated with a retrospective dendrochronological analysis of crossdated increment cores collected in 2009. For most anatomical sections collected throughout the growing season at MAI, the vascular cambium appeared to be dormant as indicated by the low number of cells per radial file. Occasionally, immature xylem derivatives were observed during the growing season but without production of an annual ring. In increment cores collected at MAI, the 2005 position in the annual ring series contained either a narrow ring of both earlywood and latewood (47% of samples), a narrow ring of apparent latewood with no earlywood (13%), or a missing ring (50%). We introduce the term “dark ring” to refer to those annual rings of apparent latewood with no earlywood. For trees at JAL, the 2005 ring had below-average width and contained both earlywood and latewood. At GUA, the trees produced the widest 2005 ring of all three sites and mainly contained an intra-annual density fluctuation (IADF). The IADF was formed after cambial reactivation in the autumn. Although dark rings, IADFs, and especially missing rings complicate dendrochronological analysis, these anatomical features may provide an additional proxy record from which to infer climate variability and change in the past. |
| **DOI:** | [10.1163/22941932-20160133](http://dx.doi.org/10.1163/22941932-20160133) |

|  |  |
| --- | --- |
| **Author(s):** | Yegor Tarelkin; Claire Delvaux; Maaike De Ridder; Thomas El Berkani; Charles De Cannière; Hans Beeckman |
| **Title:** | **Growth-ring distinctness and boundary anatomy variability in tropical trees** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 275-294 |
| **Keywords:** | wood anatomy; increment core; Democratic Republic of the Congo; branch; Growth rings; phenology |
| **Abstract:** | The phenomenon of distinct, absent or indistinct growth rings is a highly variable feature used for wood identification and a wide range of tree-ring studies. Causes for its variability are not yet fully understood. There is also a lack of consensus within the scientific community about how distinct and indistinct tree rings should be defined and classified. We use a selection of 103 Central African rainforest trees to analyse the anatomy of growth-ring boundaries of 103 Central African rainforest species and assessed the influence of the climate, tree organ and leaf shedding behaviour on growth-ring distinctness and anatomy. We observed a high variability of tree-ring boundaries anatomy and distinctness within and among individuals and species. Although, for some semi-deciduous species, higher incidence of distinct growth rings appears to be related with a more pronounced seasonal climate, no general trends are observed for the assembly of studied species. Growth rings are variable within individuals depending on the considered organ: trunks tend to show more distinct rings than branches. Growth-ring distinctness is difficult to implement as a trait to measure tree performance when only based on abrupt changes in fibre size and cell wall thickness. From the potential growth-ring markers identified in the IAWA list of hardwood features, those applying to vessel and parenchyma density and distended rays appear to be more useful in tropical trees than abruptly flattened latewood fibres or abrupt changes in vessel diameter. |
| **DOI:** | [10.1163/22941932-20160134](http://dx.doi.org/10.1163/22941932-20160134) |

|  |  |
| --- | --- |
| **Author(s):** | Ignacio García-González; Manuel Souto-Herrero; Filipe Campelo |
| **Title:** | **Ring-porosity and earlywood vessels: a review on extracting environmental information through time** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 295-314 |
| **Keywords:** | Quercus; Dendrochronology; tree ring; climategrowth relationships; quantitative wood anatomy; ecological wood anatomy |
| **Abstract:** | Many anatomical features in trees result from their reaction to fluctuating environmental conditions, and some can be measured and dated. Recently, quantitative wood anatomy has been used to build time series, and consequently to study the responses of trees through time. This involves the application of dendrochronological techniques, although some methodological adaptations are necessary when using anatomical variables. Until now, the study of continuous anatomical series has proven to be very promising when applied to the earlywood vessels of ring-porous trees, due to their great physiological relevance.In this paper, we review the main aspects that must be considered when building continuous series of earlywood vessel features of ring-porous trees as compared to ‘classical’ dendrochronology. We first discuss the procedures for building individual series and chronologies, starting with the selection of variables, examining their statistical properties, and assessing how crossdating and detrending should be adapted. We also show that time series of earlywood vessels usually exhibit a low common signal, but in contrast are strongly related to climate, and often reveal responses not recorded by the classical dendrochronological variables.In addition, we deal with the optimization of environmental signals, by first evaluating multiple potential variables to be used, and indicate how to reduce their number according to the relations among them. As earlywood variables are basically determined by vessel number or vessel size, we discuss the search for the most appropriate variable to characterize vessel number, as well as the advantage of progressively selecting earlywood vessels attending to their size and position.Finally, we extend the application of these methodologies to diffuse-porous species as compared to ring-porous trees, and show that the climatic signal contained in their anatomical features is also relevant, provided that vessels are carefully selected upon their location within the ring. |
| **DOI:** | [10.1163/22941932-20160135](http://dx.doi.org/10.1163/22941932-20160135) |

|  |  |
| --- | --- |
| **Author(s):** | Peter Kitin; Ryo Funada |
| **Title:** | **Earlywood vessels in ring-porous trees become functional for water transport after bud burst and before the maturation of the current-year leaves** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 315-331 |
| **Keywords:** | vessel maturation; phenology; Deciduous; ring-porous; xylem formation; earlywood; Kalopanax; tree ring; functional ecology |
| **Abstract:** | This paper reviews the development of xylem vessels in ring-porous dicots and the corresponding leaf phenology. Also included are our original observations on the time-course of vessel element growth, secondary wall deposition, and end wall perforation in the deciduous hardwood *Kalopanax septemlobus*. Different patterns of xylem growth and phenology serve different strategies of the species for adaptation to seasonal climates. Trees with ring-porous xylem form wide earlywood vessels (EWV) in spring and narrow latewood vessels in summer. The wide EWV become embolized or blocked with tyloses by the end of the growing season while the narrow vessels may remain functional for many years. The co-occurrence of wide and narrow vessels provides both efficiency and safety of the water transport as well as a potentially longer growing season. It has for a long time been assumed that EWV in ring-porous hardwoods are formed in early spring before bud burst in order to supply sap to growing leaves and shoots.However, the full time-course of development of EWV elements from initiation of growth until maturation for water transport has not been adequately studied until recently. Our observations clarify a crucial relationship between leaf maturation and the maturation of earlywood vessels for sap transport. Accumulated new evidence shows that EWV in branches and upper stem parts develop earlier than EWV lower in the stem. The first EWV elements are fully expanded with differentiated secondary walls by the time of bud burst. In lower stem parts, perforations in vessel end walls are formed after bud burst and before the new leaves have achieved full size. Therefore, the current-year EWV network becomes functional for water transport only by the time when the first new leaves are mature. |
| **DOI:** | [10.1163/22941932-20160136](http://dx.doi.org/10.1163/22941932-20160136) |

|  |  |
| --- | --- |
| **Author(s):** | Kyriaki Giagli; Jožica Gričar; Hanuš Vavrčík; Ladislav Menšík; Vladimír Gryc |
| **Title:** | **The effects of drought on wood formation in *Fagus sylvatica* during two contrasting years** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 332-348 |
| **Keywords:** | water availability; Air temperature; vessel characteristics; cambium; European beech |
| **Abstract:** | We studied the effect of local weather conditions on intra-annual wood formation dynamics and wood structure of European beech (*Fagus sylvatica* L.) from a temperate location in the Czech Republic in two consecutive years, 2010 and 2011, characterized by different amounts of precipitation. Microcores were taken at weekly intervals and transverse sections of cambial and xylem tissue were prepared for light microscopic observation. Air temperature and soil moisture content were measured daily at the research plot. Tree-ring formation patterns and vessel features showed different responses to climatic factors in the two years. In 2010, the onset of cambial cell production occurred almost 10 days later than in 2011, when a considerably reduced amount of rainfall was already observed in the winter and spring months, as shown in Standardized Precipitation Index (SPI) values. Lack of precipitation in 2011 caused premature cessation of cambial cell division and markedly narrower annual xylem increments. Vessel density and water conductive area were higher in 2011 than in 2010. Average vessel size in general did not change. In response to local weather conditions, beech controls its hydraulic conductivity mainly by changing the number of vessels and tree growth rate, followed by vessel size. The lower sensitivity of vessel diameter to hydrological alterations confirms previous studies by other authors. |
| **DOI:** | [10.1163/22941932-20160137](http://dx.doi.org/10.1163/22941932-20160137) |

|  |  |
| --- | --- |
| **Author(s):** | Jožica Gričar; Peter Prislan; Martin De Luis; Klemen Novak; Luis Alberto Longares; Edurne Martinez del Castillo; Katarina Čufar |
| **Title:** | **Lack of annual periodicity in cambial production of phloem in trees from Mediterranean areas** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 349-364 |
| **Keywords:** | Norway spruce (Picea abies); cambium, Mediterranean & temperate climate; Aleppo pine (Pinus halepensis); growth ring boundary; European beech (Fagus sylvatica); Scots pine (Pinus sylvestris) |
| **Abstract:** | Annual periodicity of cambium production of xylem and phloem cells has rarely been compared in trees from different environments. We compared the structure of cambium and the youngest xylem and phloem increments in four tree species, *Fagus sylvatica, Picea abies, Pinus sylvestris* and *Pinus halepensis*, from nine temperate and Mediterranean sites in Slovenia and Spain. In *Picea abies, Pinus sylvestris* and *Fagus sylvatica* from temperate locations in Slovenia, xylem and phloem growth ring boundaries could be identified. In *Fagus sylvatica* growing at two elevations on Moncayo mountain, Spain, phloem increment consisted of only early phloem. In *Pinus sylvestris* from the same two sites, growth ring boundaries were not as clear as in temperate Slovenian sites. In some cases we could identify phloem growth ring boundaries but in others it was very doubtful, which could be explained by collapse of the outermost early phloem sieve cells. In *Pinus halepensis* from all sites, we could only distinguish between collapsed and non-collapsed phloem, while phloem rings could not be identified. Widths of the youngest phloem and xylem annual increments could only be compared when phloem increments could be clearly defined, as with *Picea abies, Fagus sylvatica* and *Pinus sylvestris* from temperate sites. The visibility of the growth ring boundary in phloem was not related to the width of annual radial growth. The correlation between xylem and phloem ring widths was high, but moderate between the number of dormant cambial cells and xylem ring and phloem ring widths. Based on the structure of the youngest phloem increments, we concluded that there is no typical annual periodicity in cambial production of phloem cells in trees from certain Mediterranean sites. This may be due to continuous yearlong cell production and the absence of true cambium dormancy, at least on the phloem side, under mild winter conditions. |
| **DOI:** | [10.1163/22941932-20160138](http://dx.doi.org/10.1163/22941932-20160138) |

|  |  |
| --- | --- |
| **Author(s):** | Editors IAWA Journal |
| **Title:** | **Wood Anatomy News** |
| **Source:** | IAWA Journal, Volume 37, Issue 2 |
| **Publication Year:** | 2016 |
| **Pages:** | 365-367 |
| **Keywords:** |  |
| **Abstract:** |  |
| **DOI:** | [10.1163/22941932-90001674](http://dx.doi.org/10.1163/22941932-90001674) |