

This time span of their existence corresponded with the duration of a major part of copper-age in the region. Our results will help to improve the dating of other copper age sites in Slovenia and neighbouring regions, where wood for dating has not been preserved. The investigations have demonstrated that the archaeological wood is a highly revealing source of information, and also that further investigations are needed to take full advantage of it.

DE FRANCESCHI DARIO: USM 0203-UMR 5143 (Paléobiodiversité), Département Histoire de la Terre, Muséum National d'Histoire Naturelle, 8 rue Buffon 75005, PARIS, France - *Terminalioxylon* fossil woods from the Oligo-Miocene deposits of Baluchistan (Pakistan): palaeo-ecological implications (Paper)

Three silicified wood samples from the Sulaiman Range (Pakistan), from the lower member of the Chitarwata formation deposits are assigned to the fossil wood genus *Terminalioxylon* Schönfeld (1947) emend Mädel-Angeliewa, E. & Müller-Stoll, W.R. (1973). The Sulaiman woods are the first reports of this taxon in Pakistan. Our wood samples seem to be close to *Terminalia arjuna* Wight & Arn. and *T. tomentosa* Wight & Arn woods. This genus shows a very wide distribution in Asia, some species are present from Himalayas to Southeast Asia. They are mainly found in plains and in low elevation hills, especially in regions under a monsoon climate. The distribution of the Asian fossil woods of the genus *Terminalioxylon* covers approximately the modern distribution of *Terminalia* L. These species are large deciduous trees (20-30 m). *T. tomentosa* is widely distributed in sub-Himalayan region, in Burma and India up to Andamans and Nicobar, in moist deciduous forests. The three woods described here show more or less marked growth rings. One of them, with the more marked growth rings, theoretically corresponds to more contrasted seasons. The annual growth of this sample is very important (16-20 mm between two growth rings). This is rare, and found under tropics only on fast growing or emergent trees of high rainfall deciduous and evergreen forests. It reveals that this tree grew under very favourable water availability conditions. That means that water was abundant, at least during the growth season (moist season). As this area is today mostly covered by very scanty vegetation (steppe) in an arid zone, this study contributes to the knowledge of the palaeo-environment in this area during the Tertiary and is the beginning of a series documenting the very numerous fossil woods found in this range.

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Acacia mearnsii is a fast growing, cold tolerant tree species, which, in Brazil, is mostly planted in the state of Rio Grande do Sul. Its main product is tannin from the bark. The wood can be used for energy, cellulose, composite panels and as construction support. It is well adapted to degraded soils and can also be used for erosion control. This study aims to characterize wood of *Acacia mearnsii*, established in different soil types. Wood samples were collected from three seven-year-old trees grown in the following soil classes: Inceptisol; Ultisol; Entisol acid; Entisol eutrophic and Entisol dystrophic. Growth differences were presented in a preview Paper, in which plants from Entisol acid showed smaller average height and diameter when compared to other soils. Moreover, plants in Entisol eutrophic soils presented the best growth rates. Anatomical feature measurements, basic density, heat content, total extractives, lignin and wood holocellulose were determined for each tree. The wood of *Acacia mearnsii* had a basic density of 0.51 g/cm³. The content of total extractives, lignin and holocellulose were 6.5%, 18.7% and 74.9%, respectively. The superior wood and bark specific heat were 4537.6 cal/g and 4043.9 cal/g, respectively. Relevant differences among trees were not noticed. However, trees growing in Entisol acid soil presented the higher extractives content and holocellulose differing from trees over Ultisol. The growth rings were distinct through the thickening and radial flattening of the fibre walls. Preliminary analyses showed shorter and more frequent vessels in plants established in Entisol acid soil. These results are probably due to the stressed growing condition typical of low fertility, acid, and shallow soils of Entisol acid soil type.

DE MATTOS PATRÍCIA P.¹, SEITZ RUDI ARNO², DE SALIS SUZANA MARIA¹: ¹Embrapa Florestas, Estrada da Ribeira, km 111, caixa postal 319, 83411-000, Colombo/PR, Brazil; ²Universidade Federal do Paraná, Departamento de Engenharia Florestal, 80210-170, Curitiba/PR; ³Embrapa Pantanal, Rua 21 de setembro, 1880, caixa postal 109, 79320-900, Corumbá/MS, Brazil - Dendroecology potential of *Tabebuia heptaphylla* (Vell.) Tol. (Poster)

Information on the influence of environmental factors upon growth rate of trees is crucial for the development of forest management programs. The use of growth ring information is nowadays increasing and might be of great importance for tropical natural forests. In these areas there is usually a great demand for wood, but no available data to carry out a management program. The Pantanal of Nhecolândia, sub-region of Pantanal Mato-grossense may be viewed as one of those regions, as its climate and soil induce annual growth ring development. This

study aims at determining the correlation of growth increments by growth ring analysis of *Tabebuia heptaphylla*, a deciduous tree that occurs naturally in that region. Ten disk samples of a tree with good canopy development were collected at soil level and at every one meter height. The tree was 12 metres high with a 20 centimeter trunk diameter at breast height. The growth rings were counted and measured on eight radii of each disk. Permanent slides were prepared for anatomical descriptions. Pearson coefficient was used to show the correlation between growth rings and precipitation rates. Growth rings were distinct through tangential lines due to thickening and radial flattening of the fibre walls and were also distinct by the coalescent paratracheal parenchyma which formed interrupted lines suggesting marginal parenchyma. The age of the tree was estimated as 16 years old, by counting the growth rings of the basal disk. The correlation of radial increment and precipitation was significant at the level of 5% on disks 1 to 5 metres. Above 6 metres the results were not significant, probably due to the small number of compared pairs. Some differences might be explained by some procedure steps on the growth rings identification and measurement process or other more relevant growth stress cause than water limitation during the growing season. These results showed the great potential of *Tabebuia heptaphylla* of being used in dendroecology studies, in addition to the opportunity of enhancing further studies on growing dynamics of the species.

DE MICCO V.¹, TORALDO G.², ARONNE G.¹: ¹Laboratory of Botany and Reproductive Ecology, Department of Fruitculture, Botany and Plant Pathology, University of Naples "Federico II", Faculty of Agriculture, Via Università' 100, I-80055 Portici, Napoli, Italy; ²Department of Agricultural Engineering and Agronomy, University of Naples "Federico II", Faculty of Agriculture, Via Università' 100, I-80055 Portici, Napoli, Italy - A new method to classify and measure different types of xylem elements on cross sections (Poster)

In recent decades, several attempts have been made to quantify xylem anatomy and to model conduit parameters based on graphical and algebraic methods. Recently, computerised image analysis has renewed interest in automatic systems to measure anatomical parameters of various structures. At present no systems are designed to distinguish between various types of xylem cells and automatically measure them. The classification of xylem elements requires the observation of longitudinal sections or expert application of histochemical and fluorescence techniques on cross sections. Longitudinal sectioning is difficult and time-consuming, so the possibility of classifying xylem elements on cross sections would be ideal, especially if classification is accompanied by automatic measurement of parameters such as lumen area and shape. In this study, a new methodology, based on the application of digital image analysis combined with mathematical and statistical methods, is proposed in order to classify and measure lumina of different xylem elements of one-year-old shoots through the analysis of single cross sections. The method was tested on several woody species, both trees and shrubs, occurring in a natural ecosystem of Southern Italy. The development of the method was based on the comparison between data collected according to four procedures: a) manual identification and measurement of conduit lumen diameter on longitudinal sections; b) manual identification and measurement of conduit lumen diameter on cross sections; c) manual identification and measurement of conduit lumen area on cross sections; d) automatic measurement of conduit lumen area on cross sections. The influence of image resolution and of the position of selected area was verified. The proposed method was specific for woody structures and allowed the construction of a model-graph for each species.

DE MICCO V., ARONNE G.: Laboratory of Botany and Reproductive Ecology, Department of Fruitculture, Botany and Plant Pathology, University of Naples "Federico II", Faculty of Agriculture, Via Università' 100, I-80055 Portici, Napoli, Italy - Xylem anatomy and lignin composition of cell walls in shoots of *Rhamnus californica* L. (Poster)

Many studies have emphasised the importance of phenology, habit and tissue alteration in order to survive during arid periods in Mediterranean-type climates. Indeed, wood anatomy plays an important role in plant survival during the dry season. Apart from anatomical features, chemical composition of cell walls, especially lignin content and composition, is of interest. Lignification is related to several factors such as latitude, temperature, mechanical stress, water and nutrient availability. Moreover, the type of structural units in lignin of angiosperm xylem can be related to cell function. This study reports on anatomical and chemical features of one-year-old shoots of *Rhamnus californica* L. in order to highlight the traits that suggest adaptation to Mediterranean-type ecosystems. Shoots represent the last connection between the leaves, which are the terminal components of the transpiration stream, and the vascular system of the main branches. As a consequence, their attributes can severely affect and constrain the whole-plant hydraulic conductance. Branches were collected from plants growing in greenhouses at Washington State University (Pullman, WA, USA). Samples were processed for both microscopy and chemical analyses. After fixation, samples were embedded in resin, sectioned with an ultramicrotome and prepared for light, epifluorescence and confocal microscopy. Digital image analysis allowed quantification of anatomical features. Chemical analyses were aimed to determine lignin content and