A New Label for our Samples

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The purpose of this writing is to induce people to record additional information along with their wood specimens. Such additional information accounts for the variability in wood structure within the stem, so that wood samples can be reference material for identification of wood specimens of the same species that may not have been collected from the stem, and therefore hard to identify based on anatomy (Schweingruber, 1990).

Trees are fascinating living organisms. They provide oxygen, store carbon dioxide, cool the air, and protect from wind. By displaying foliage and flowers to resources like light and pollinators, trees make our landscape beautiful and colorful all year around. Trees provide us food, gums, medicines, extractives, odors, and dyes (Thomas, 2014). Trees do all these, and much more, thanks to their structure.

The structure of a tree is well known, but still not fully understood. Trees are basically structured in roots, stem(s), and branches (carrying leaves). All these tree organs are in different amounts, made out of xylem, to which we refer as wood as soon as they grow to a sufficient diameter. The wood samples we collect most frequently come from a stem. We are not so familiar with the wood from the roots and we usually discard the wood from the branches. Wood is making a tree possible. Wood moves water, providing mechanical strength, storing reserves, defending from infections and taking care of many more things in a living tree. But what do we know about wood? Or, what don't we know about it? I will just give an example.

We know, since the beginning of plant anatomy in the XVII century, that the size of the sap-conducting cells in the wood changes according to the position along the stem (Grew 1682) and the radius (Malpighi 1675). Basipetal and radial increases in conduit diameters are collectively known as Sanio's Laws (Sanio 1872).

Conduit cells (including axial tracheids in conifers and vessels in hardwood species) widen along the way down towards the roots. So, if we sample a tree along its stem and measure the size of the conduits on the same ring, we will end up seeing much narrower conduits at the top of the tree and wider conduits toward the stem base[1]. We now know why this happens (West et al. 1999; Savage et al. 2010). The reason why cells widen is now presented as a universal rule within plants (Olson et al. 2014): changing the size of the conduits moving the water all the way up from the roots to the leaves makes the hydraulic system of a tree more efficient and independent from the length of the conduits (West et al. 1999; Rosell et al. 2017). In other words, the tree grows taller and taller without having to face increasing resistance in moving the sap up along stem and branches. Cell widening just happens to be the best way to couple with a water conducting system that is changing over time, as the tree grows taller and taller (Anfodillo et al. 2013). Next time you collect a sample for your collection, keep in mind that it was part of a water transport system connecting the roots buried in the soil with the leaves displayed in the air.

Actually, the same turns out to be true also for wood mechanical properties. Wood is less stiff and less strong towards the treetop, as it is towards the pith. This makes sense if you think about a tree in the strong wind: the twigs bend more than the branches that bend more than the stem. So, next time you collect a sample for your collection, also keep in mind that it was part of an organism mechanically designed to cope with different dynamic (e.g., wind) and static (e.g. snow load) situations.

But why, instead of keeping in mind these two thoughts, don't we just write them down? I don't know how you collect your samples and how you collect information on your samples, but I would like to share how I do it for my samples. I prefer to collect samples from living trees or from recently dead trees. This is because I want to see the treetop and the part of stem from where I am going to collect my samples. Furthermore, I want to see them still connected. I actually need that because I want to record for every sample I collect its position along the stem. To achieve this aim, I measure the distance from the treetop to the point where I cut the stem, and I note it down. Next, some boards will be cut from the stem and eventually I will process the boards to get the samples for my collection. At the end of the process, having the distance from the top of the tree of the uppermost end of every single board I got, I am able to get the distance from the top of the tree of every single sample I cut from the board. I follow this procedure for all the samples with bark.

My samples record not only the wood features typical for that species, but also the information of the conductive

[1] E.g. conduits size varies from 14 µm (0.014 mm) at the top to 43 µm at the base of a 4.5 meters (~15 feet) tall *Picea abies*, and from 43 to 104 µm at the top and the base of earlywood vessels in *Fraxinus excelsior* (data from Anfodillo et al. 2006).

and the mechanical systems involved in making that tree capable to survive for many years in its environment. By recording the distance of the sample from the top of the tree, I keep much more information on it than just adding a family name and a collection site beside the scientific name.

You, too, can do it! Whenever possible compile a label like the following (Tab. 1).

While databases and reference books do not yet incorporate data on treetop, branch, and root wood, that little number will make your sample much more valuable for wood identification and the generations to come.

Family	Check family names and scientific names in www.theplantlist.org, they are changing over time!	Lythraceae
Scientific name		*Punica granatum* L.
Site of collection	Provide nearby city or geographic coordinates.	Deftera, CY
Elevation	above sea level	300 m
Date of collection		August 9th, 2009
Collector		Alan Crivellaro
Distance of the sample from the treetop		230 cm
Total plant height		305 cm
Part of plant	Root/stem/branch	Stem

Tab. 1. Information to be described in a wood sample label, or in a notebook connected to the wood collection.

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