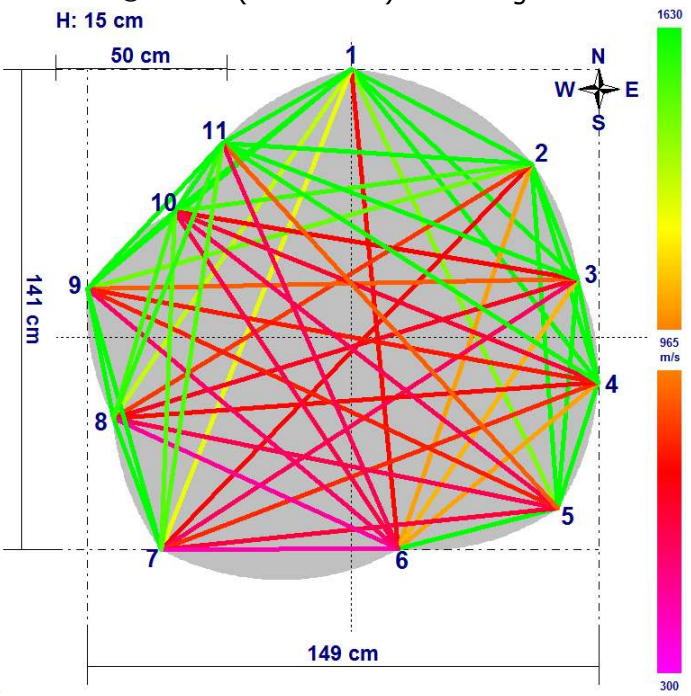
# Technical tree inspection case study from Hazard Tree Conference, Sedona 2013: stem base, sonic tomogram and resistance drilling profiles

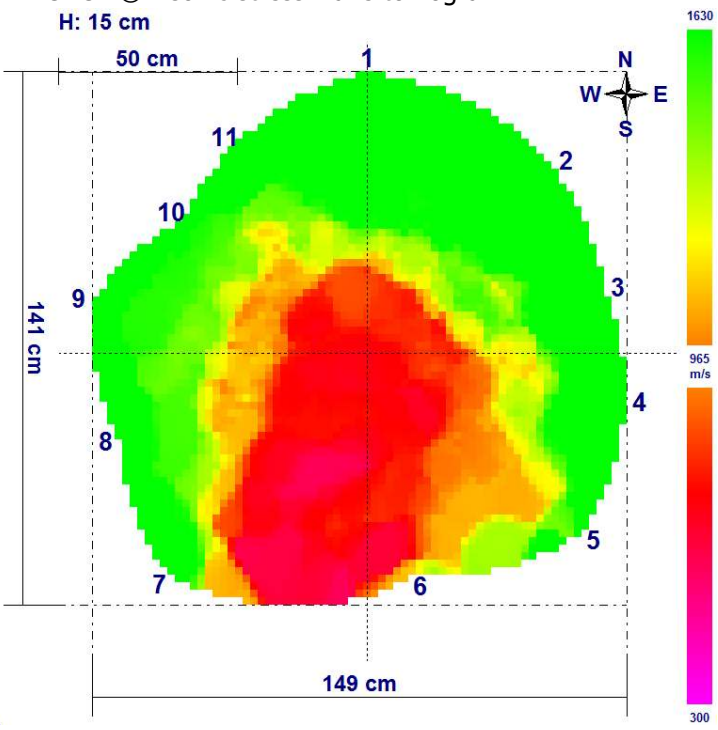
ARBOTOM® - sonic (stress wave) line tomogram:



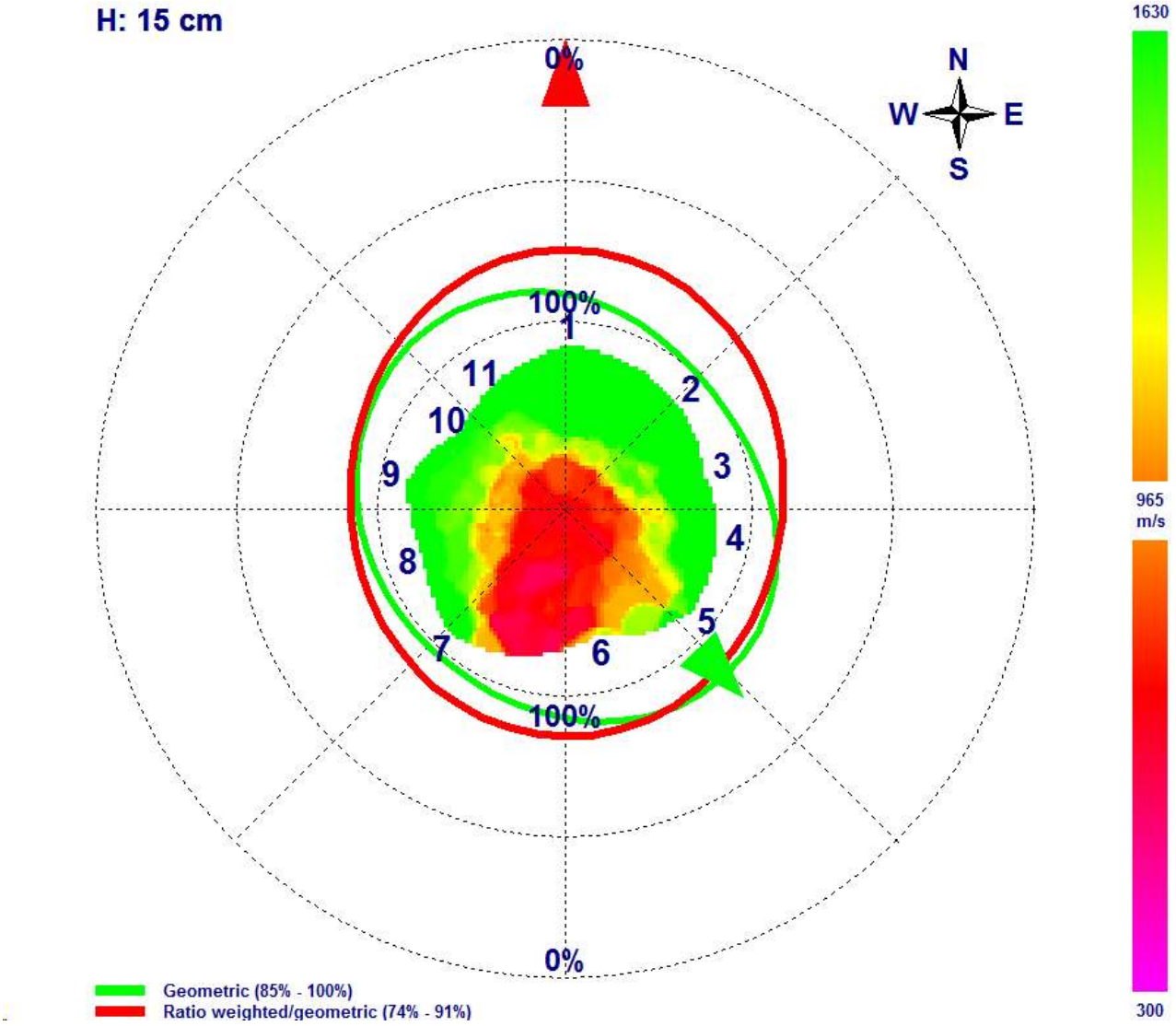

The line graph just reveals the 'apparent speed': one sensor is tapped and then all other sensors measure the time of flight of the first arriving (=fastest) stress wave. When damages are present in the cross section, the fastest wave most likely made a dertour around the damaged area. Thus especially the red and purple lines commonly do not represent the travel path of the measured stress wave.

Based on this line graph, the measured values, and the typical mechanical properties of the wood species, the computer program calculates the most probable distribution of intact wood in the cross section (green) and creates the 'tomogram'. But there is no information about what is going on in the red and/or purple area because there are no values coming from such areas, thus no spatial resolution can be defined! The red/purple parts just do not contribute to the load carrying capacity of the cross section, what is usually more important than wood condition in terms of safety evaluation.

ARBOTOM® - sonic stress wave tomogram:

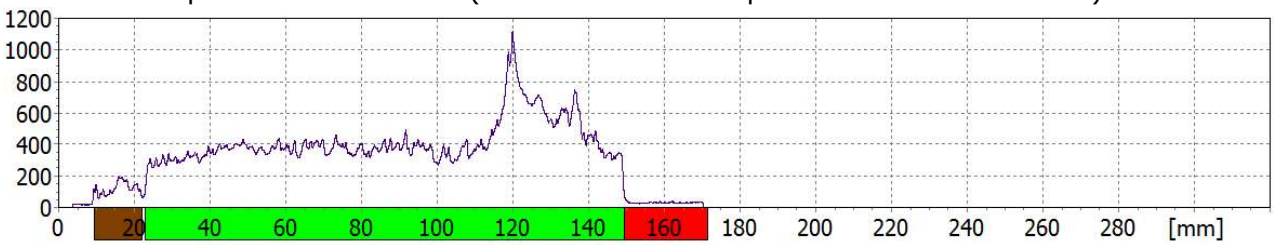


Although a significant part of the cross section is damaged (decay and/or void), the load carrying capacity ('stability') of this cross section (as described and represented by the section modulus) is reduced by only about 25% - compared to the fully intact cross section. Such a reduction is similar to the situation of a circular trunk cross section with a hollowness of approximately 70%. That means, in terms of stability, the reduction found here is similar to a tree with t/R~1/3. But, the tree inspected here, has already reached it's maximum height years ago and consequently the basic safety factor is much higher due to the continuous growth in girth. Because the load carrying capacity depends on the diameter to the power of three, even slight radial increments have a much bigger impact on stability. Consequently, the cross section shown here is correspondingly 'safer' than a circular stem being centrally deteriorated by about 70% and having t/R~1/3. Thus, there is currently no need to prune or take down the tree because of this damage. But, the future situation can not be estimated based on the tomogram. Resistance drilling profiles help making better estimates for future developments because they indicate deterioration propagation trends:

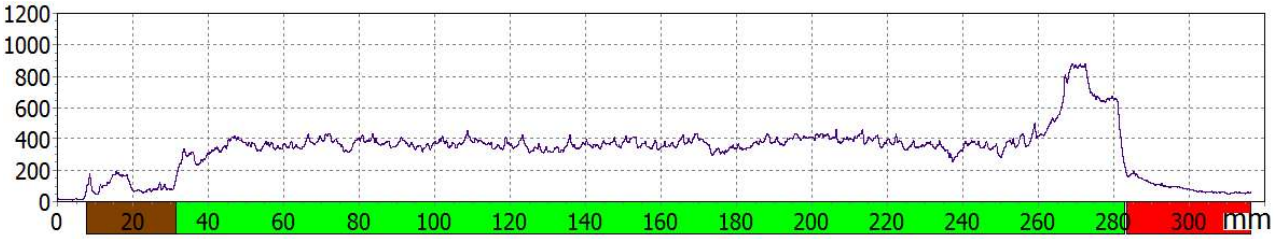



Pictures: Julian Dunster and David Braun. Data measured with sonic tomograph of Joe McNeil. Thank you!

RESISTOGRAPH® - profile approx. 1m (~3ft) above sensor 8 (300mm ~ 1ft). A steep drop of the profile from intact to decay indicates that deterioation stopped propagating in this area. A peak mostly comes from a densified compartimentalization zone (additional subberines+phenols+ ... in the cell lumen):

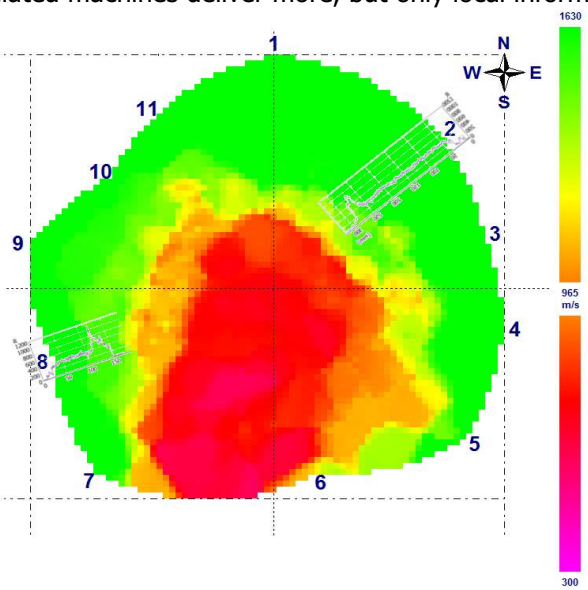



RESISTOGRAPH® - profile approx. at sensor 2: (brown=bark, green=intact, red=decay/void)




The drilling above sensor 8 was too high to be directly compared with the tomogram:

The superposition at sensor 2 shows that, in this case, the tomogram over-estimates the shell wall thickness: the inner side of the remaining intact wood was dry, leading to a unusual higher sonic speed (suggesting more sound wood than real). Resistance drilling profiles from calibrateable, electronically regulated machines deliver more, but only local information:




Based on these results I do not see any need for any urgent action. However, the assessment should be extended to other parts of the trunk and the roots before drawing final conclusions and giving recommendations. Visual inspection has to take special care about this tree in the future and determine when/if technical re-inspection is required.