Elucidation of the mechanisms involved in long-distance water transport in trees requires knowledge of the water distribution within the sapwood and heartwood of the stem as well as of the earlywood and latewood of an annual ring. X-ray computed tomography is a powerful tool for measuring density distributions and water contents in the xylem with high spatial resolution. Ten- to 20-year-old spruce (Picea abies L. KARST.) and oak (Quercus robur) trees grown in the field were used throughout the experiments. Stem and branch discs were collected from different tree heights, immediately deep frozen, and used for the tomographic determinations of spatial water distributions. Results are presented for single-tree individuals, demonstrating heartwood and sapwood distribution throughout their entire length as well as the water relations in single annual rings of both types of wood. Tree rings of the sapwood show steep water gradients from latewood to earlywood, whereas those of the heartwood reflect water deficiency in both species. Although only the latest two annual rings of the ringporous species are generally assumed to transport water, we found similar amounts of water and no tyloses in all rings of the oak sapwood, which indicates that at least water storage is important in the whole sapwood.