



Monitoring water stress in temperate forests using accelerometers

Steven P. Loheide II and Dom Ciruzzi

University of Wisconsin - Madison, United States (loheide@wisc.edu)

Temperate forests are infrequently expected to experience water stress. Yet, where sandy soils exist, soil drought may be more frequent than assumed and may be more common under future climatic regimes. Environmental conditions, particularly shallow groundwater, may serve to buffer trees against the adverse effects of water limitation in portions of the landscape where the water table is near the land surface. Understanding the relationship between water stress in temperate forests along depth to groundwater gradients requires better instrumentation for monitoring water stress continuously at a high number of sites. In this study, we investigate the potential of accelerometers for detecting water stress in trees. Wind gusts excite tree motion, which then sway with a natural frequency that is dependent upon their dimensions, mass, and the elasticity of the trunk. When trees become water stressed, the mass of water stored in the tree decreases as does the trunk elasticity. These changes have opposing effects on sway frequency. However, the magnitude of the elasticity effect appears larger than that of the mass indicating that diurnal variability in sway frequency could be used as an indicator of water stress in trees.