

Publication

TreeNet-The Biological Drought and Growth Indicator Network

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Author(s) Zweifel, Roman; Etzold, Sophia; Basler, David; Bischoff, Reinhard; Braun, Sabine; Buchmann, Nina; Conedera, Marco; Fonti, Patrick; Gessler, Arthur; Haeni, Matthias; Hoch, Günter; Kahmen, Ansgar; Köchli, Roger; Maeder, Marcus; Nievergelt, Daniel; Peter, Martina; Peters, Richard L.; Schaub, Marcus; Trotsiuk, Volodymyr; Walthert, Lorenz; Wilhelm, Micah; Eugster, Werner

Author(s) at UniBasel [Kahmen, Ansgar](#) ; [Basler, David](#) ; [Hoch, Günter](#) ; [Peters, Richard](#) ;

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The TreeNet research and monitoring network has been continuously collecting data from point dendrometers and air and soil microclimate using an automated system since 2011. The goal of TreeNet is to generate high temporal resolution datasets of tree growth and tree water dynamics for research and to provide near real-time indicators of forest growth performance and drought stress to a wide audience. This paper explains the key working steps from the installation of sensors in the field to data acquisition, data transmission, data processing, and online visualization. Moreover, we discuss the underlying premises to convert dynamic stem size changes into relevant biological information. Every 10 min, the stem radii of about 420 trees from 13 species at 61 sites in Switzerland are measured electronically with micrometer precision, in parallel with the environmental conditions above and below ground. The data are automatically transmitted, processed and stored on a central server. Automated data processing (Rbased functions) includes screening of outliers, interpolation of data gaps, and extraction of radial stem growth and water deficit for each tree. These long-term data are used for scientific investigations as well as to calculate and display daily indicators of growth trends and drought levels in Switzerland based on historical and current data. The current collection of over 100 million data points forms the basis for identifying dynamics of tree-, site- and species-specific processes along environmental gradients. TreeNet is one of the few forest networks capable of tracking the diurnal and seasonal cycles of tree physiology in near real-time, covering a wide range of temperate forest species and their respective environmental conditions.

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