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Drought stress, growth, and nonstructural carbohydrate dynamics of pine trees in a semi-arid forest

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• In trees under prolonged drought, both carbon uptake (C source) and growth (C sink) typically decrease. This correlation raises two important questions: (1) to what degree is tree growth limited by C availability; and (2) Is growth limited by concurrent C storage (e.g. as nonstructural carbohydrates, NSC).
• To test the relationships between drought, growth, and C reserves, we monitored the changes in NSC levels and constructed stem growth chronologies of Pinus halepensis trees of three drought stress levels growing in Yatir forest, Israel, at the dry limit of forest existence.
• Moderately stressed and stressed trees showed 37% and 21% of the stem growth of healthy trees in 2012; 71% and 31% of the sap flux density; and 79% and 66% of the final needle length. In spite of these large reductions, both starch and soluble sugars concentrations in branches of these trees were similar in all trees throughout the dry season (2-4% dry mass). At the same time the root starch concentrations of moderately stressed and stressed trees were 47% and 58% of that of healthy trees, but never below 2% d.m.
• Our results suggest that the drought-induced growth reduction is associated with a general C shortage, rather than competition with concurrent C storage. The relatively small effect of drought stress level on NSC dynamics, the maintenance of a 2% d.m. starch, and the continued sap flow indicate that a whole-tree C starvation is not likely to occur in these trees growing at the edge of the desert.

Special request: If the abstract is not accepted for presentation in this session, please consider for presentation in session BG2.11 Plant traits and biogeochemical cycles. Thank you.