No role for xylem embolism or carbohydrate shortage in temperate trees during the severe 2015 drought

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 4525554
Author(s) Dietrich, Lars; Delzon, Sylvain; Hoch, Guenter; Kahmen, Ansgar
Author(s) at UniBasel Kahmen, Ansgar ; Hoch, Günter ; Dietrich, Lars ;
Year 2019
Title No role for xylem embolism or carbohydrate shortage in temperate trees during the severe 2015 drought
Journal JOURNAL OF ECOLOGY
Volume 107
Number 1
Pages / **Article-Number** 334-349
Keywords carbon starvation; drought; ecophysiology; heat; hydraulic safety; mature trees; water limitation
Mesh terms Science & TechnologyLife Sciences & BiomedicinePlant SciencesEcologyPlant SciencesEnvironmental Sciences & Ecology

1. Temperate forests are predicted to experience an increased frequency and intensity of climate change-induced summer droughts and heat waves in the near future. Yet, while previous studies clearly showed a high drought sensitivity of different temperate tree species, the vulnerability of the physiological integrity of these trees remains unclear.2. Here, we assessed the sensitivity of six temperate tree species to severe water limitation during three consecutive growing seasons, including the exceptional 2015 central European summer drought and heat wave. Specifically, we assessed stem increment growth, sap flow, water potentials, hydraulic vulnerability, and nonstructural carbohydrate contents in leaves and branches to determine how mature temperate trees responded to this exceptional weather event and how the observed responses relate to variation in xylem embolism and carbohydrate economy.3. We found that the trees' predawn water potentials reached their minimum values during the 2015 summer drought and most species reduced their sap flow by up to 80%. Also, increment growth was strongly impaired with the onset of the drought in all species. Despite the strong responses in the trees' growth and water relations, all species exhibited minimum midday shoot water potentials well away from values associated with severe embolism (P-50). In addition, we detected no distinct decrease in nonstructural carbohydrate contents in leaves, bark, and stems throughout the drought event.4. Synthesis. This study shows that mature individuals of six common central European forest tree species strongly reacted to a severe summer drought by reducing their water consumption and stopping growth. We found, however, no indications for xylem embolism or carbohydrate depletion in these trees. This suggests, that xylem embolism formation and carbohydrate reserve depletion are not routine in temperate trees during seasonal strong drought and reveals a low vulnerability of the physiological integrity of temperate trees during drought events as we describe here.

Publisher WILEY
ISSN/ISBN 0022-0477
edoc-URL https://edoc.unibas.ch/74346/
Full Text on edoc No;
Digital Object Identifier DOI 10.1111/1365-2745.13051
ISI-Number 000459070600028

Document type (ISI) Article