frontiers in Forests and Global Change

TYPE Editorial
PUBLISHED 21 July 2026
DOI 10.3389/ffgc.2026.1924283

OPEN ACCESS

EDITED AND REVIEWED BY
Manfred J. Lexer,
University of Natural Resources and Life Sciences Vienna, Austria

*CORRESPONDENCE
Constança Camilo-Alves
✉ calves@uevora.pt

RECEIVED 30 June 2026
ACCEPTED 02 July 2026
PUBLISHED 21 July 2026

CITATION
Camilo-Alves C, Dey D and Owari T (2026) Editorial: Advances in oak ecology and silviculture: challenges and innovations.
Front. For. Glob. Change 9:1924283.
doi: 10.3389/ffgc.2026.1924283

Editorial: Advances in oak ecology and silviculture: challenges and innovations

Constança Camilo-Alves[1]*, Daniel Dey[2] and Toshiaki Owari[3]

[1]CREATE, Center for sci-tech Research in EArth sysTem and Energy, University of Evora, Evora, Portugal, [2]Northern Research Station, Forest Service (USDA), Madison, WI, United States, [3]Graduate School of Agricultural and Life Sciences, The University of Tokyo Hokkaido Forest, The University of Tokyo, Furano, Japan

KEYWORDS
ecology, oak, *Quercus*, silviculture, sustainable management

Editorial on the Research Topic
Advances in oak ecology and silviculture: challenges and innovations

Introduction

The oak genus (*Quercus*), originating approximately 56 million years ago in the temperate Americas, has diversified across the Northern Hemisphere. Oaks are integral components of various ecosystems, including temperate deciduous forests, temperate and subtropical evergreen forests, subtropical and tropical savannahs, oak-pine forests, oak-"piñon"-juniper woodlands, cloud forests, tropical premontane and montane forests, matorral (summer rain chaparral), and Mediterranean vegetation. While many species of *Quercus* are exceptionally large, dominant overstory trees, others exhibit a wide range of life forms, from small trees to stoloniferous shrubs, such as *Q. lusitanica*. Additionally, some oak species adopt a shrub-like growth form when subjected to adverse edaphoclimatic conditions. This ecological diversity allows oaks to serve as either climax or intermediate species, making their management highly variable and context dependent.

Oaks have been closely associated with human societies since ancient times. They have provided direct sustenance through acorns and supported hunting by sustaining game animals. Oak wood has historically been indispensable, serving as fuel for heating and cooking and as a critical resource for furniture, shipbuilding, wine barrel production, and railway construction. Today, oak wood, its derived products, and the environmental services provided by oak ecosystems continue to hold significant economic and ecological value. Oak species face challenges from climate change, altered disturbance regimes, and the phenomenon of oak decline, necessitating focused ecological and silvicultural investigations to bridge existing knowledge gaps and address the pressures undermining their health and sustainability.

This Research Topic of Frontiers in Forests and Global Change was inspired by the 2024 International Oak Symposium and organized by the deputies from the IUFRO Working Party 1.01.06 Ecology and silviculture of oak. The issue contains nine papers on important topics that inform oak ecology and silviculture.

This Research Topic aims to consolidate the latest research and insights into the sustainable management and conservation of oak species. By focusing on the adaptive strategies that bolster oak resilience, the goal is to foster an understanding of the integral roles oaks play within ecosystems and how they can be effectively managed in the face of changing environmental conditions and emerging threats.

Overview of the studies

Understanding the dynamics of species distribution allows us to project future trends, which can inform conservation measures. By examining past climate conditions and historical distribution patterns (Subedi, Adhikari et al.), or by identifying the most relevant climatic drivers (Camarero et al.; Subedi, Bhandari et al.), we can better forecast future potential oak species distributions, as well as diversity hotspots and areas suitable for endangered species recovery and conservation. However, an important factor to incorporate is the effect of long-term silvicultural management strategies, which reshape and realize the distribution range of oak species. In the United States, for instance, human choices have favored fire-intolerant species at the expense of *Quercus*, significantly influencing their distribution and abundance (Hanberry).

Once distribution dynamics are understood, and particularly for species of economic value— whether for timber or other ecosystem services—it is essential to define optimal silvicultural management models. This is achieved through the diachronic monitoring of stand structure and growth (Win et al.), alongside the development of robust biometric models (Bhatt et al.), in order to favor the desired traits—such as biomass, stand density, or tree diameter— through silvicultural models grounded in structural and growth data.

Species regeneration, in turn, is a critical factor in the context of climate change, especially in the Mediterranean region, where droughts and elevated temperatures are increasingly prevalent. Sharing regeneration data (Fierravanti and Fonseca) is one way of contributing to broader studies on the optimization of restoration practices. Novel silvicultural methods were also tested as a strategy to address the challenges currently faced by *Quercus* species. Specifically, irrigation techniques were assessed for their potential to promote regeneration and accelerate tree growth—in this case, of cork oak (*Quercus suber*) (Camilo-Alves et al.)—while also evaluating the effect of water availability on the quality of its main economic product, cork (Poeiras et al.).

Final remarks

Taken together, the nine articles show that oak species face multiple challenges, including climate change and the shifting of suitable habitat ranges; fragmentation and the loss of climatic refugia, particularly for rare or endemic species; historical changes in fire regimes, which favor the replacement of oaks by less fire-tolerant species; and difficulties in natural regeneration. These studies invest in the development of robust models—both to predict future distributions and to estimate growth—as well as in novel establishment techniques aimed at mitigating water stress.

Author contributions

CC-A: Writing – original draft. DD: Writing – review & editing. TO: Writing – review & editing.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that Generative AI was not used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note