

A COMPREHENSIVE REVIEW OF OAK DECLINE DRIVERS IN THE MEDITERRANEAN REGIONS OF THE NORTHERN HEMISPHERE

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PURPOSE AND SCOPE

Forest ecosystems of the *Quercus* genus, which is one of the most widespread genera in the Mediterranean-type climate (MTC) regions of the Northern Hemisphere, have been affected by a worrying decline. However, a systematic review synthesizing the causal factors of this phenomenon in these regions, contributing to a better understanding of the problem, has not been conducted. The aims of this study were to: (1) map peer-reviewed research on oak decline in MTC regions; (2) systematize factors identified as responsible for oak decline across these regions and analyze their distribution; (3) identify interactions between different causal factors; and (4) identify knowledge gaps and future research needs.

METHODS AND APPROACH

Oak decline was defined as a broad concept encompassing decline, mortality, dieback, degradation, and deforestation. Following this definition, we conducted a review, using systematic search guidelines in environmental management (CEE 2022), through peer-reviewed literature related to oak decline in MTC regions. Searches performed in Web of Science and Scopus yielded a total of 3,923 articles, from which 241 articles were selected for their relevance after screening.

FINDINGS AND IMPLICATIONS

Research on the causal factors of oak decline began in the 1980s. Within the two MTC regions, the Mediterranean Basin has seen the most research activity. In California, research is concentrated in the coastal areas, particularly near San Francisco County.

The research predominantly focuses on evergreen oak species and follows the distribution areas of species with significant economic and ecological importance.

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Pathogens and climatic agents were identified as the two key factors of oak decline in both regions. Human activities, especially in agroforestry systems, also play a significant role as a decline factor, though pests are important and closely related to pathogens. Regional differences in the distribution of pathogens and pests were observed, highlighting the need to consider biotic factors that can invade other regions with potentially unforeseen consequences. Moreover, results show that factors interact in multiple combinations potentially exacerbating oak decline. Climate factors emerge as the most interactive with all other factors, underscoring their significance in the context of climate change.

Three knowledge gaps were identified: (1) research is disproportionately focused on a few *Quercus* species; (2) there is asymmetric research between the north and southern/east Mediterranean Basin; and (3) studies tend to concentrate on individual decline causal factors, often neglecting the exploration of interactions between different factors.

LITERATURE CITED

Collaboration for Environmental Evidence [CEE]. 2022. Guidelines and Standards for Evidence synthesis in Environmental Management. Version 5.1. Pullin, A.; Frampton, G.; Livoreil, B.; Petrokofsky, G., eds. <https://environmentalevidence.org/wp-content/uploads/2022/10/CEE-Guidelines-Version-5.0-051022.pdf>. [Date accessed: 17 July 2024].