

# Spanish forest ecosystems' carbon emission will be higher than sequestration

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In a report, authors highlight that management strategies adapted to environmental changes are crucial to the conservation of Iberian forests. Credit: Carles Gracia

Spanish forest ecosystems will quite probably emit high quantities of carbon dioxide in the second half of the 21st century. This is the conclusion of a report that reviews the results obtained from the implementation of the forest simulation model GOTILWA+, a tool to

simulate forest growth processes under several environmental conditions and to optimize Mediterranean forests management strategies in the context of climate change.

The report was published on the latest issue of the ecology and environment journal *Ecosistemas*, edited by the Spanish Association of Terrestrial Ecology. Peer review was led by professors Santiago Sabaté and Carlos Gracia, of the Department of Ecology at the University of Barcelona (UB) and the Centre for Ecological Research and Forestry Applications (CREAF), and the expert Daniel Nadal, of UB's former Department.

The study analyses data obtained from the simulation forest growth model GOTILWA+ (Growth Of Trees Is Limited by WAter), based on ecophysiological processes. The model enables to explore the effects of [climate change](#) on forestry ecosystems under changed [environmental conditions](#) and to simulate different management scenarios and compare them.

## **Future perspectives for Spanish forests**

In [climate change scenarios](#) simulated by the model GOTILWA+, within the Consolider-Ingenio project Montes and the research project Med-Forestream, net primary productivity of Spanish forests (how much carbon dioxide plants take in during photosynthesis minus how much carbon dioxide they release during respiration) will decrease from the second half of this century. Consequently, woodlands that now drain carbon will become carbon producers because plant respiration (a process in which oxygen is taken in and [carbon dioxide](#) is given out) and the decomposition of death organic matter will exceed photosynthesis processes (carbon sequestration and oxygen release).

GOTILWA+ also explores the responses of different forest types to

water availability. Climate change involves an increase of aridity and evaporative rates. In this context, simulations show that an increase of evapotranspiration will occur in Spanish forests; it will have a negative impact on other ecosystems, for example, on rivers.

## **The most sensitive areas**

The most sensitive areas to climate change effects are Mediterranean forests of evergreen oak, Aleppo pine and Scots pine, located in the south-west of the Iberian Peninsula. Forest located in the north-west will be also affected, as simulations show a severe precipitation decrease in this area. Moreover, simulations show an increase of these forests' sensitivity to aridity. For instance, beech forests are particularly sensitive to a slight increase in average temperature as well as those forests located at low height, so altitudinal migrations will probably occur.

## **Forest management: key to mitigate climate change impact**

In the report, Gracia, Sabaté and Nadal highlight that management strategies adapted to environmental changes are crucial to the conservation of Iberian forests and the resources they provide to society. Particularly, it is essential to consider that Mediterranean [forest](#) ecosystems' growth is already limited by water availability. Furthermore, authors point out that in order to solve the limitations of GOTILWA+, the model is under a process of revision and innovation. "A satisfactory implementation of the model should be based on extensive knowledge on territory: weather conditions and edaphological characteristics, plant physiology, and main features concerning structure and population", conclude researchers.

**More information:** Nadal-Sala, D., Sabaté, S., Gracia, C. 2013.

"GOTILWA+: un modelo de procesos que evalúa efectos del cambio climático en los bosques y explora alternativas de gestión para su mitigación." *Ecosistemas* 22(3):29-36. Doi.:  
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