



# Mediterranean Network FORUM/22

**Barcelona**  
29 Nov. – 1 Dec.  
**2022**

# Theme 1: **Forest resilience in a context of global change related forest disturbances**

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29 November, Barcelona

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EXCELENCIA  
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*forests*



*Review*

# Global Change and Forest Disturbances in the Mediterranean Basin: Breakthroughs, Knowledge Gaps, and Recommendations

Josep Peñuelas <sup>1,2</sup>  and Jordi Sardans <sup>1,2,\*</sup> 



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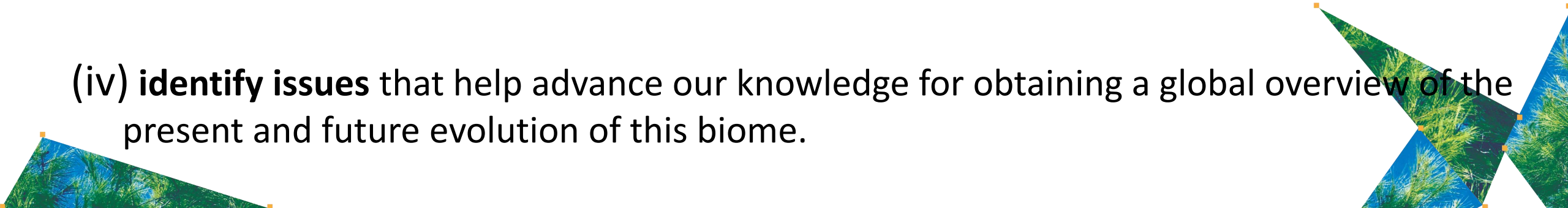
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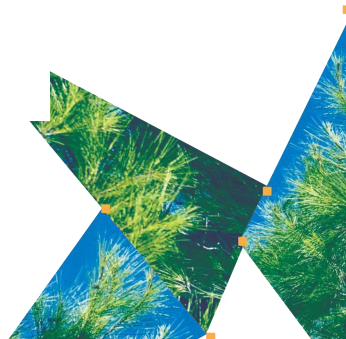
# Objectives

This study was aimed to

- (i) identify the current status** of the diverse human and natural disturbances in Mediterranean forests over recent decades
- (ii) identify the main causes** of the changes in these forested areas responsible for the current situation, which can provide clues for a future perspective for forested areas in the Mediterranean Basin
- (iii) propose actions** that could help improve the survival of the forest biome in the Mediterranean Basin
- (iv) identify issues** that help advance our knowledge for obtaining a global overview of the present and future evolution of this biome.



## Sites with observational/ experimental data used in this study



# Several Concurrent Risks

1- Present and Future Aridity: The Larger Threat

2. Species Invasion

3. Soil Fragility and Forest Maintenance and Regeneration

4. Depopulation and abandonment of rural areas





# 1- Present and Future Aridity: The Larger Threat

## Dieback, defoliation, and lower growth

- *Drought Is Currently Shaping the Structure of Mediterranean Forests*
  - The expansion of shrublands at the expense of forests is expected
- **Several Mediterranean forested areas are on steep slopes** and thus frequently have shallow soils, so they are more sensitive to drought as observed in climate models

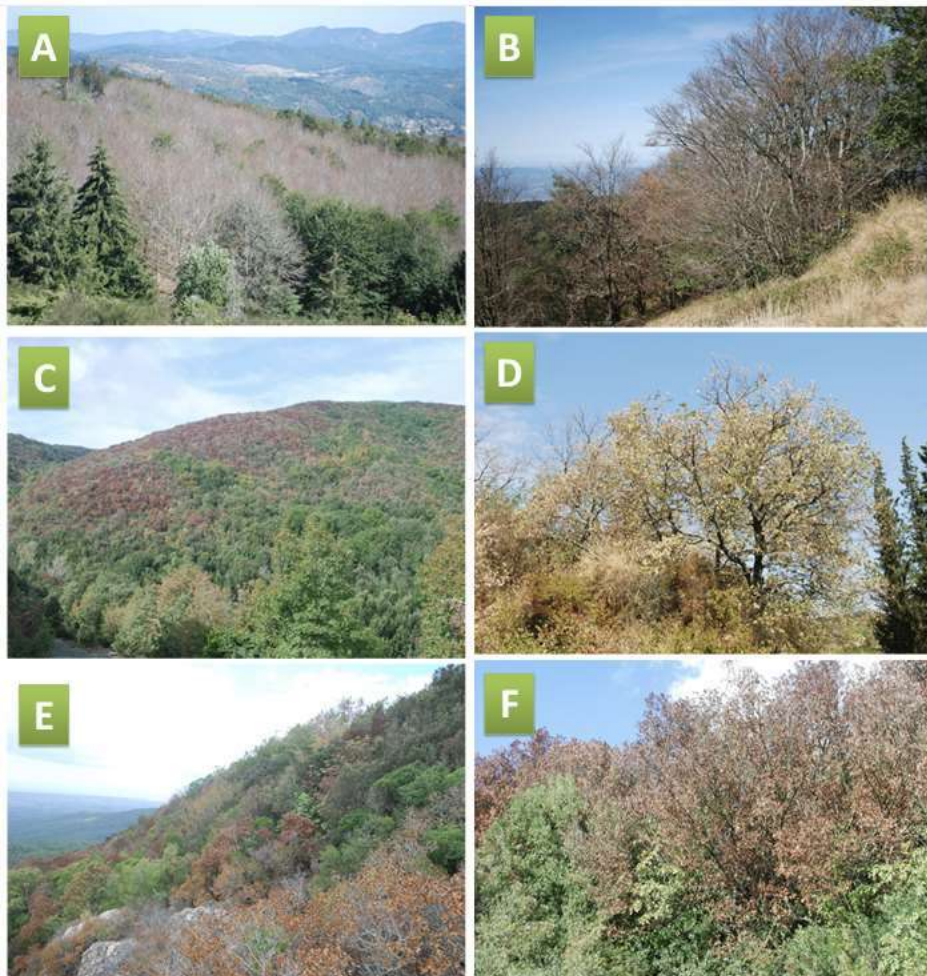


Fig. 1. Crown defoliation and desiccation induced by drought and heat waves observed in Tuscany during the summer 2017. A-B: beech forests; C-D: downy and Turkey oak mixed forest; E evergreen sclerophyllous forest; F holm oak.

*Pollastrini et al.,*





# 1- Present and Future Aridity (continuous)

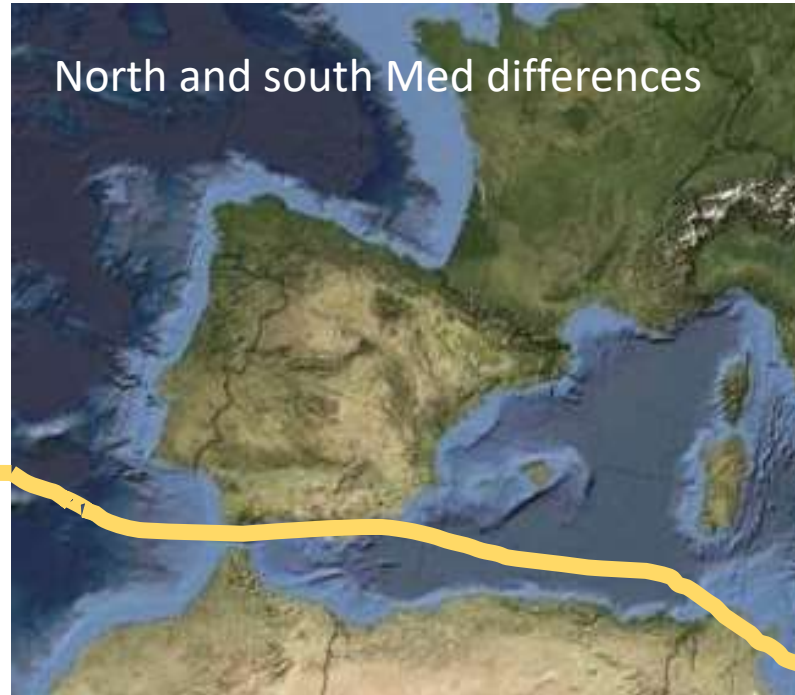
## Effect of grazing

### Lack of grazing



Biomass accumulation  
Closed forests / less diversity  
Forest fire risk

North and south Med differences



## Excessive livestock pressure



Soil degradation  
Forest degradation  
Slow regeneration.





# 1- Present and Future Aridity (continuous)

## Aridity and Warming: An Open Door for Pests

Increases in heatwaves, warming, and droughts have been associated with pathogens



**Decline in  
tree  
population**



**Affect tree  
resistance to  
drought**



## 2- Invasion

Forests are generally **the least invaded habitats particularly in Europe and the Mediterranean Basin**

**Peri-urban forests, however, are the most vulnerable to invasion due to the presence and activity of humans**

- **Apply pressure for dispersing invasive species**
- **Promote open ecological spaces that allow new species to invade while maintaining high resource availability**

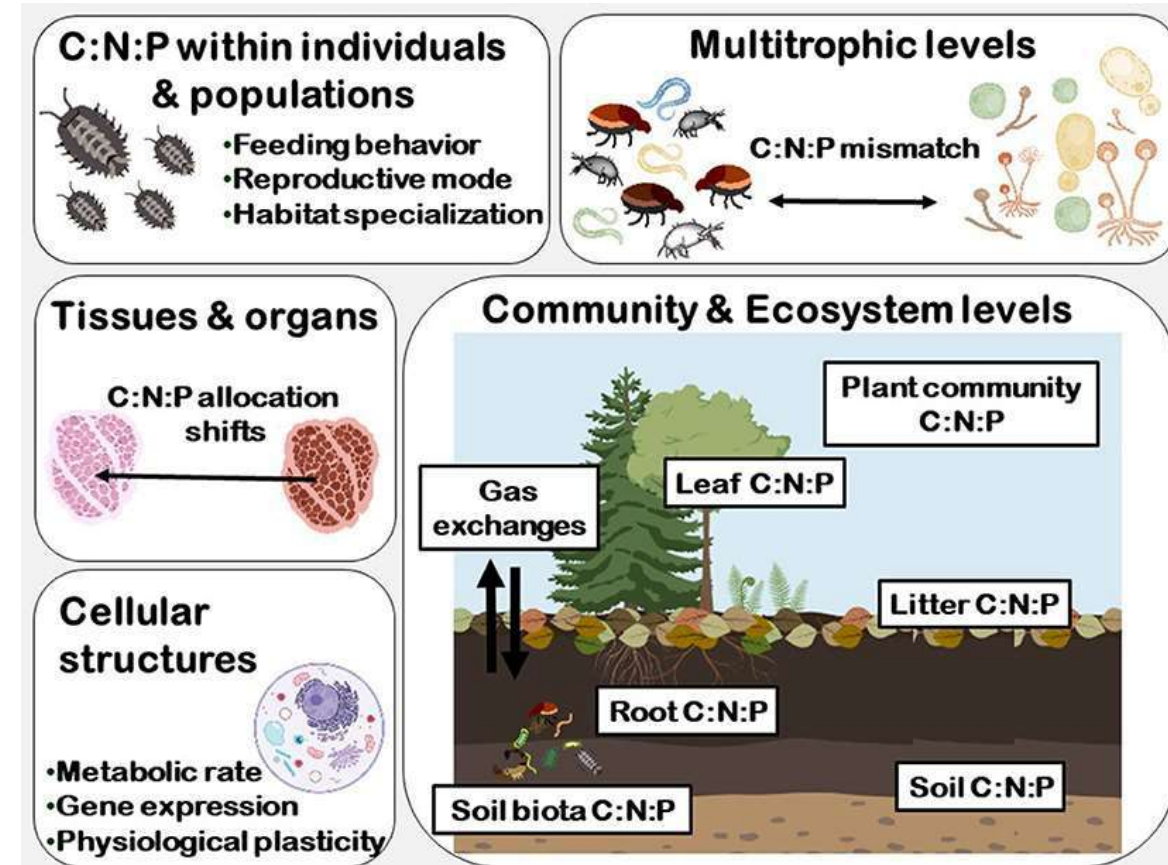
**Many species have been intentionally introduced for afforestation and silvicultural management (e.g. *Acacia*, *Eucalyptus*, *Robinia*, *Ailanthus*)**





# 3- Soil Fragility and Forest Maintenance and Regeneration

- Low and irregular precipitation is the main factor limiting tree establishment and growth
- Unstable balance between the trees and soil water content
- The quality of soil is key ensuring the health and regenerative capacity of Mediterranean forests.
- Forests are the best types land cover for maintaining soil **quality** and avoiding its degradation in Mediterranean climates



# 4. Depopulation and abandonment of rural areas

## Land abandonment / overexploitation

### Land abandonment



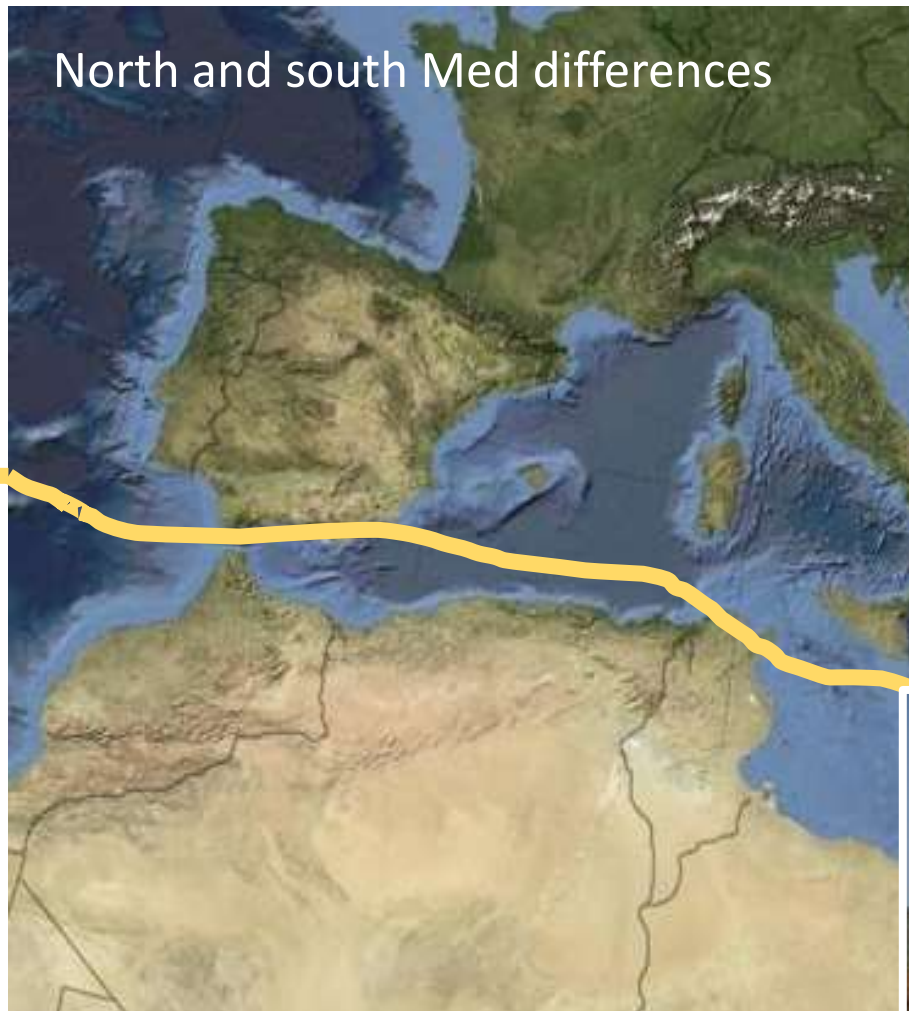
Biomass accumulation  
Closed forests / less diversity  
Forest fire risk

### Expansion of cropland in rural areas



Ploughing of slopes for livestock  
Soil degradation  
Forest degradation  
Slow regeneration.

### North and south Med differences







Diverse landscape with forest patches of different sizes



Mediterranean forest re-establishment and conversion

Move to northern latitudes and higher altitudes

Mediterranean forest



Shrubland & savannoid landscapes



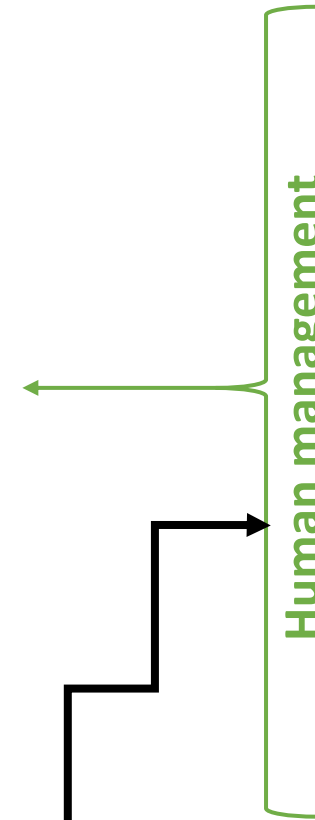
Low-tall shrubland



Semi-arid steppe



REPETITIVE FIRE



Adequate livestock management



Sustainable development in rural areas



Reforestation / afforestation

# Conclusion

Aridity is the main climatic constraint for Mediterranean forests

Need to know more about properly managing forests to increase their resistance to drought and the interacting disturbances.

A strong alliance is needed to avoid excessive depopulation of rural forested areas and unmanaged secondary forest expansion in Mediterranean Europe, and on the other extreme, to control population expansion and forest over-exploitation and loss in North Africa.

All the data strongly suggest that maintaining biodiversity, as well as a variety of goods and services from cropland and forested areas will be necessary to reach these objectives.

The management of forested areas should incorporate a hierarchical landscape planning at different scales.





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## RESULTS

# Mediterranean Forest Research Agenda **2030**



WEBINAR #2

Forest resilience in a context of  
global change-related forest  
disturbances

*Joan Pino,*  
**CREAF**

Centre for Research on Ecology and  
Forestry Applications

10 Nov. **2022**



## Key research questions identified:

1

How is climate change transforming forest structures, especially regarding changes in precipitation and increases in temperature and aridity?

2

What are the key elements of plant-soil interactions in relation to nutrient and carbon cycling under increasing aridity and leaching of nutrients?

3

How have tree morphology, physiology, growth, reproduction, and mortality responded to, or been influenced by climate-change impacts?

4

What is the role of Mediterranean forests in the creation of rainfall?

5

What integrated approaches to conservation and management can improve the resilience of forests including those involving microbes, fungi, lichens, and animals that are sensitive to the impacts of drought, fire, and other disturbances?

6

How do disturbances create or accelerate changes in forest ecosystems? What are the consequent effects on the economic and social functions of such shifts on species? How to build back better adapted ecosystems?

7

What management approaches help develop forest resilience without compromising their economic, social and biodiversity-related ecosystem services (e.g., approaches such as reforestation, afforestation, and livestock management)?

8

How might comprehensive land abandonment impact and promote key future changes for both ecosystems and local communities?

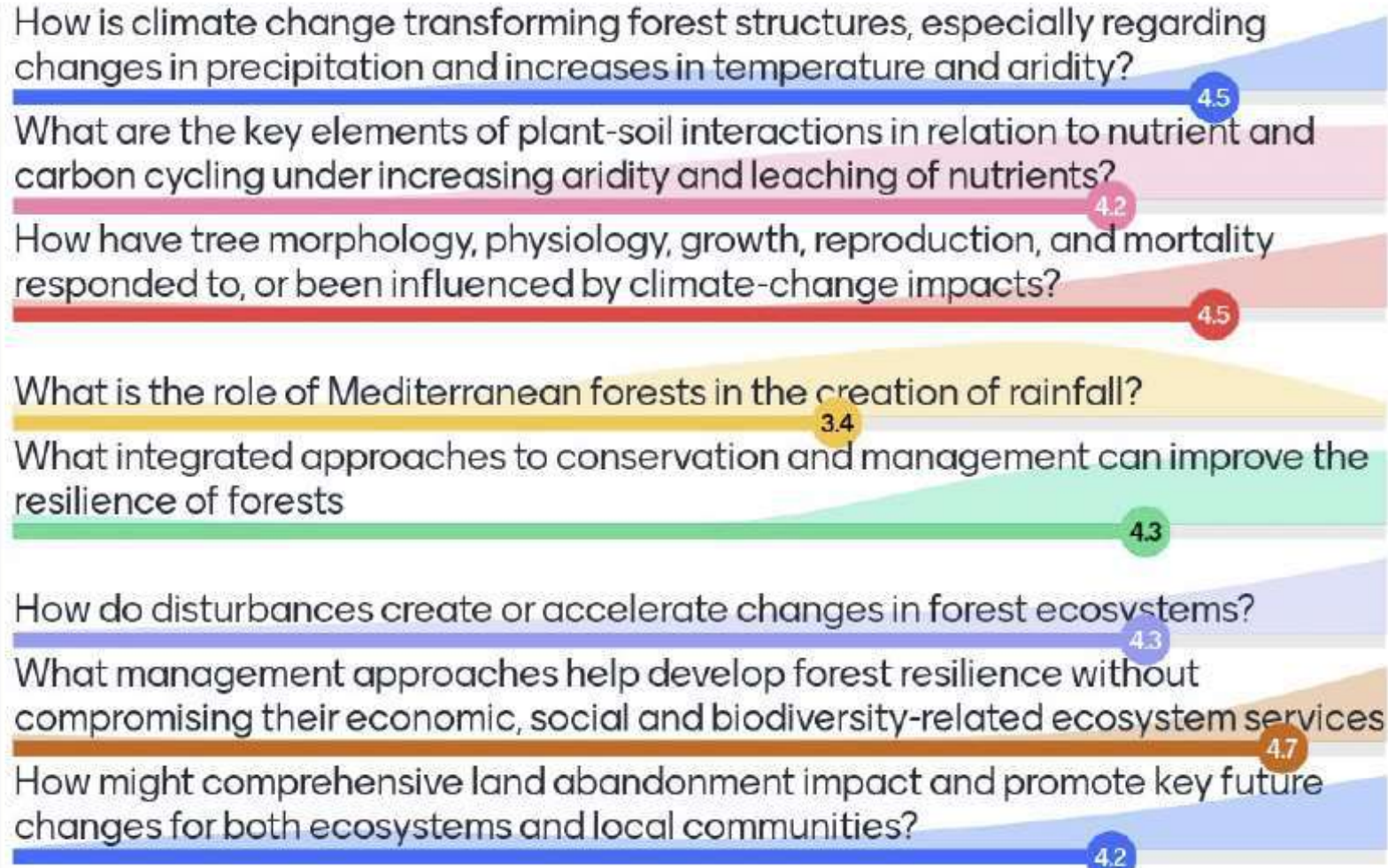




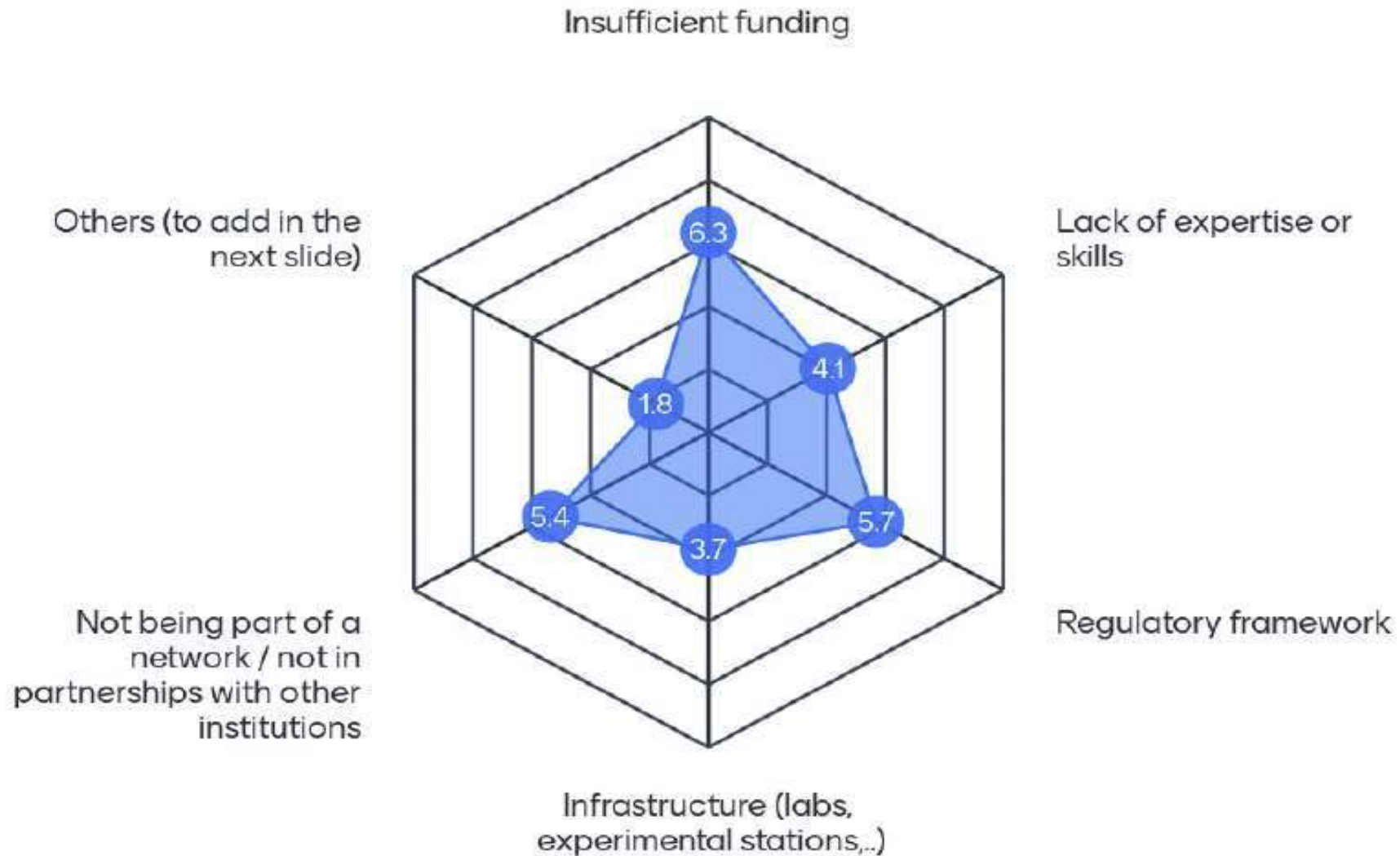
# Please rate how relevant are those questions for your country

Irrelevant

Very relevant



# The main challenges to implement the research proposed are :





# What are the additional challenges to implement this work ?

Lack of working  
Force

Lack of cooperation between  
different institutions

Forest responsibilities dispersed among  
different institutions





## Opportunities

- The fossil energy crisis encourages the use of alternative energy sources, such as thinning residues, contributing at the same time to reducing wildfire risks.
- Managing Mediterranean forests for increased carbon sequestration and greenhouse gas emissions offsetting is increasingly needed.



## Challenges

- Developing management strategies that avoid landscape homogenisation and excessive biomass / fuel accumulation.
- Slow evolution and update of the regulatory framework in different countries to be able to manage private and public forests following new recommendations.



## Recommendations

- Feature controlled livestock management as a tool for maintaining biodiversity and mitigating wildfire risks.
- Implement hierarchical landscape planning at multiple scales by assessing the larger-scale drivers and effects of various disturbances and ecosystem services, while planning for minor-scale action such as improved stakeholder education and land management.
- Find synergies with biodiversity conservation and new circular bioeconomy activities when developing management strategies.







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# Thanks!!

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