informa SCIENCE-BASED INTEGRATED FOREST MANAGEMENT FOR CLIMATE MITIGATION

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Faced with the Climate Crisis, How Will Forest Owners and Managers Adapt?

Forest management can help forest and local communities to mitigate climate change and adapt to its effects. However, forest management decisions on climate change adaptation involve differences in values, beliefs, knowledge, risk perceptions, desired objectives, issues of trust and prior experiences among forest managers. Therefore, it is important to understand forest owners and managers' perceptions of abiotic and biotic climate-change related threats to forests.

Voicing forest managers and owners' perceptions, needs and expectations on forest-based mitigation and adaptation measures

A survey was conducted as part of the INFORMA project to learn about forest managers' opinions on climate change impacts on forest ecosystem services and their perceptions on adaptation options. A total of 237 responses were compiled from eight countries (Romania, Spain, France, Germany, Belgium, Netherlands, Finland and the Republic of Moldova). Forest managers are highly aware of climate change effects on the forest they manage, and two thirds of them think forests will be significantly affected.

Temperature vs. rainfall. Forest managers agree that the main climate change effects are changes in temperatures and precipitation regimes. Most of them (97%) expect higher temperatures and lower precipitation, yet the fluctuation in rainfall regimes may lead to an increased impact of flooding, as expected by one third of the respondents.

How will climate change affect ecosystem services provisioning? The vulnerabilities perceived as being certain (certainly yes and probably yes) by at least two thirds of respondents are:

1. **Incidence of forest fires**: 75% of the forest managers identified forest fires as a major vulnerability in the future;
2. **Forest decline/dying stands**: 81% of the forest managers expect forest decline to occur in the future;
3. **Replacement and complementation of forest species and provenances**: 79% of forest managers think we will need to promote changes in forests' species composition;
4. **Forest diseases and pests**: 89% of forest managers fear forests will be affected by diseases and pests;
5. **Incidence of windfall**: 69% of forest managers think we will be confronted with a higher incidence of windfall;
6. **Difficulties with natural regeneration**: 72% of the forest managers perceive a higher difficulty to naturally regenerate forest stands;
7. **Decline in forest productivity**: 73% of forest managers think forest productivity will be lower in the future.

Bioregion	Responses	Countries
Alpine	20	France, Romania
Atlantic	28	France, Netherlands
Boreal	11	Finland, France
Continental	46	France, Romania
Mediterranean	49	Spain, France
Silvosteppe	71	Romania, Moldova
Panonic	1	Romania
Not sure/none of the above	10	France

The impact of direct biotic and abiotic factors on forests raises the biggest concern, but a high share of the respondents (69%) worry about the negative public perception of forest management.

While forest managers agree that we will witness a decline in forest productivity, they show less concern about timber production than about biodiversity decline: 57% expressed concern due to lower timber production, but 70% said they worry about biodiversity loss due to climate change.

Main factors hindering the implementation of carbon storage strategies in long-term projects

While there are technical methods to boost forest-based climate change mitigation, various barriers may hinder the implementation of carbon storage strategies in the long-term. Our literature review identified gaps in project implementation, the social acceptability of mitigation measures and preferences, conflicts in forest use and land-use and associated trade-offs, financing issues and issues involving uncertainty and information gaps. These main barriers to feasible mitigation and adaptation strategies were present also in answers of the INFORMA survey. Respondents from different countries mentioned several obstacles they perceive in adapting forest management, such as:

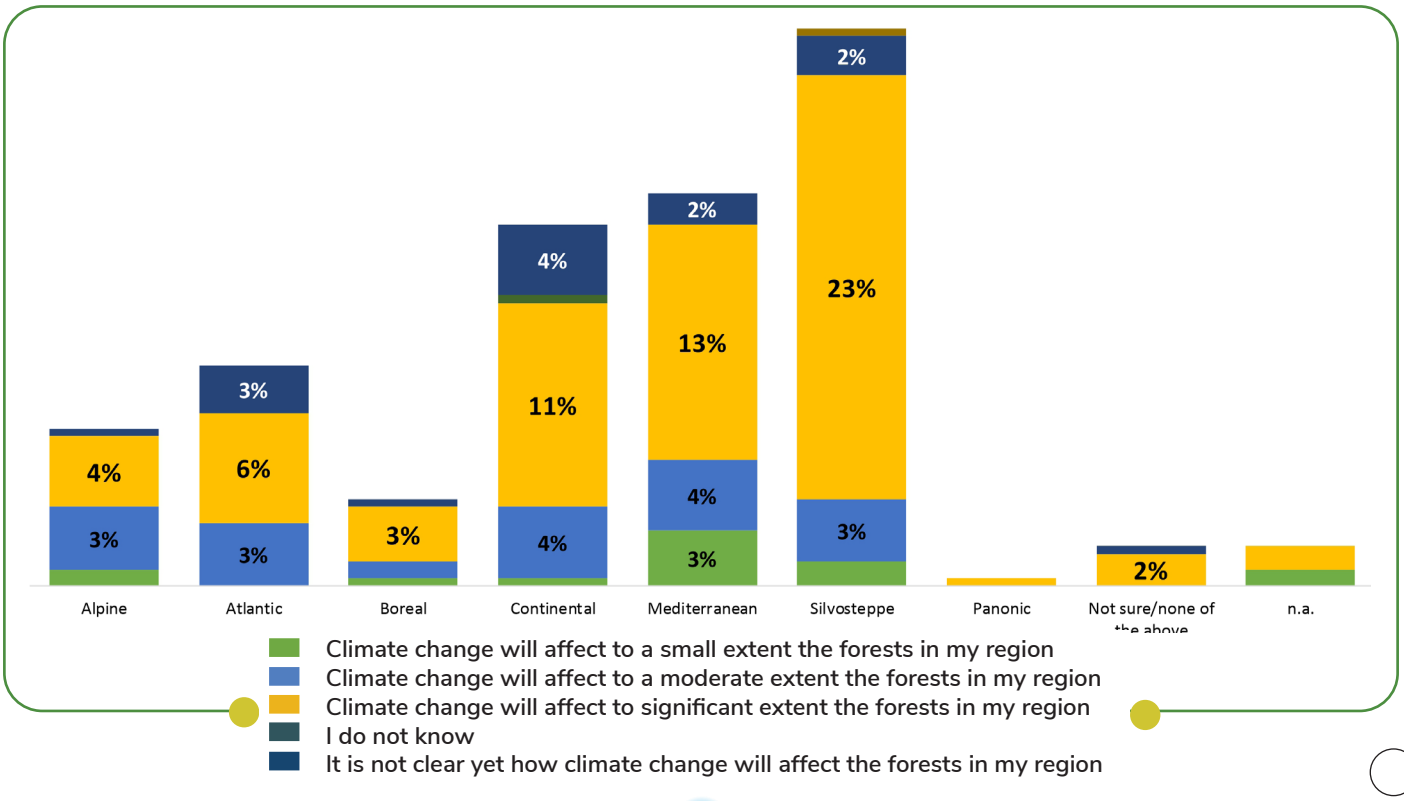
- **High bureaucracy** (Romania, Spain) or excessively **restrictive legislation** (Romania, Netherlands, Spain);
- **Traditional or conservative mindset** that works against changes in harvesting methods (Romania, Netherlands, Finland, France, Spain), or against maximizing productivity by using monocultures (France);
- **Workforce shortage** and **training needs** (Romania, Republic of Moldova, France);
- **Biodiversity obstacles**: game damage hampers the effort to foster natural regeneration (France, Finland, Republic of Moldova);
- **Economic or administration obstacles** such as: poor work remuneration (Republic of Moldova), difficulty of the timber industry to adapt (Spain, France), lack of appropriate genetic material (Spain), lack of subsidies (France, Romania), lack of profitability and the risk that the development of mitigation-based forest management strategies is too dependent on market pricing (Spain);
- **Public perceptions** about decisions taken to implement climate change adaptation and mitigation strategies (France, Spain).

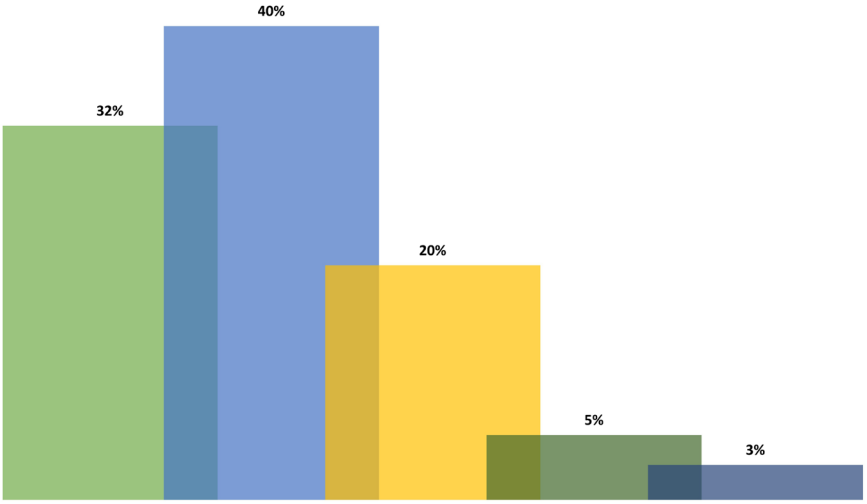
Forest managers from different European bioregions have different perceptions on climate change impacts and their manifestation

As shown by the perceptions of the severity of climate change impacts, respondents from Alpine, Atlantic and Boreal regions are less convinced that climate change will affect to a significant extent the forests in their region, as compared with forest managers from the Continental, Mediterranean and Silvosteppe bioregions.

In these regions, forest managers expect temperatures to be higher than normal and the precipitation volume to be lower and unequally distributed, with a potential increased impact from floods and drought. Large changes expected in forest soil moisture are likely to hamper natural regeneration of the stands in the future.

In light of these challenges, the most popular options for adaptive forest management are to work with species composition in promoting mixed forests (65% of the expressed options), and to favor species less vulnerable to windfall or drought in forest regeneration (62%). Other options preferred by forest managers from these regions were to implement selection cuttings with longer regeneration periods (51%) or switch to natural regeneration instead of planting (29%). In general, forest managers avoided opting for a change in the intensity or frequency of interventions for thinning regeneration or for the use of additional resources (irrigation, fertilizers, weed controls) to secure plant development. Overall, 55% of the forest managers stated that improving forest infrastructure for rapid reaction in case of climate-change related disturbances will have a strong mitigating impact.



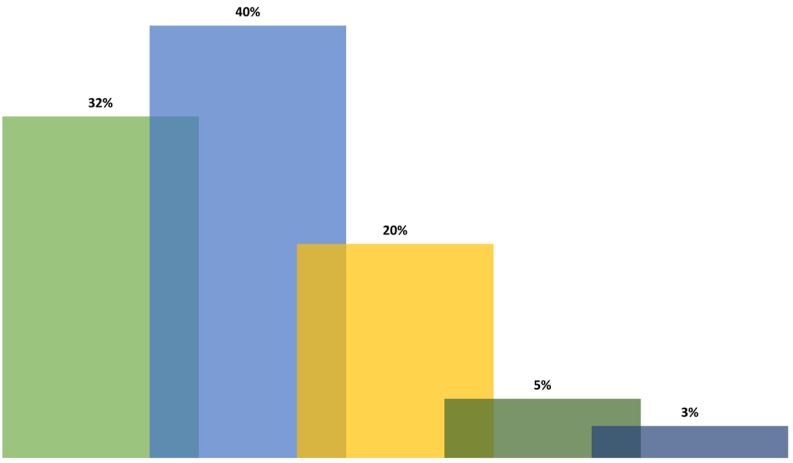


Which of the following measures can have a potential positive impact in mitigating climate change?

"Improve the forest infrastructure for rapid reaction in case of severe disturbances"

- Very strong impact
- Strong impact
- Middle impact
- Weak impact
- No impact

Climate change is challenging forest regeneration practices



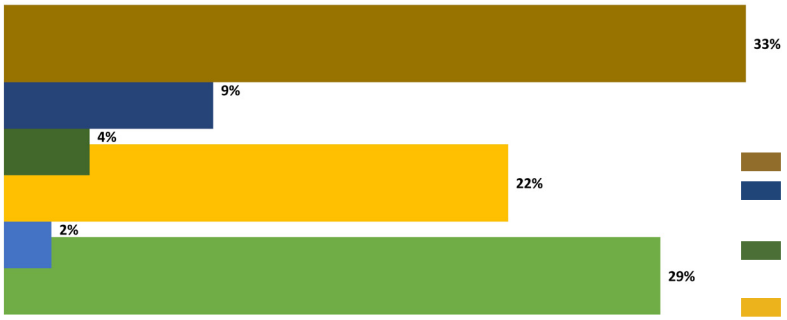
Which of the following vulnerabilities and risks are likely to affect the forests from your region in the next decades?

"Difficulties to achieve natural regeneration of stands"

- Certainly yes
- Probably yes
- Probably not
- Certainly not
- Don't know/ can't say

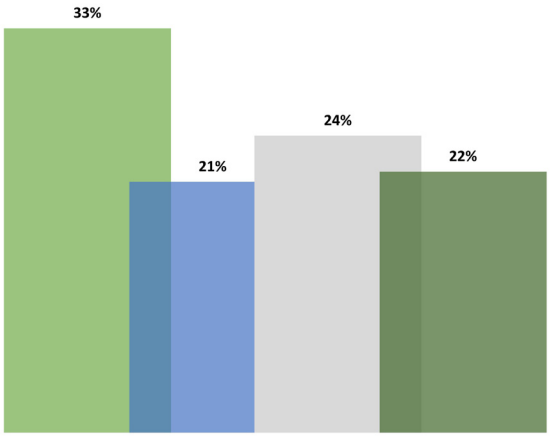
Most forest managers (72%) are convinced that difficulties to achieve natural regeneration of the stands will affect forests in their region in the next decade. However, 29% of forest managers said they have changed species selection criteria to anticipate climate-change related impacts, while more than half did not change the way they select the species for planting.

On the other hand, one third of the respondents said they have increased the share of the natural regeneration, while some others said they increased the share of planting as main regeneration measure or as a complement to existing natural regeneration. Overall, the answers suggest an increased effort to achieve forest regeneration.



Have you changed your tree species selection criteria in the last decade?

- I have not changed anything
- I have chosen my seedlings to introduce local species coming from other populations
- I have chosen my seedings to address selection criteria for EU/country-level existing incentives
- I have chosen my seedlings based on wood productivity
- I have chosen my seedlings based on non-woody products productivity
- I have chosen my seedlings as to anticipate climate-change related effects



How has the regeneration of your forest changed in the last decade?

- I increased the share of natural regeneration
- I increased the share of planting
- I have not changed anything
- I tried to increase the share of natural regeneration, but I needed to complement it with planting

Conclusion

To successfully overcome barriers in implementing mitigation and adaptation strategies, any climate change adaptation and mitigation measure should consider existing forest legacies and the diversity of potential climate change manifestations in different European biogeographical regions. Secondly, the forest sector is confronted with uncertainty and needs to learn how to communicate about such uncertainty and risks in forest management. Finally, considering the local expertise and the perceptions (from the general public, but also from forest owners and managers) may help society to better deal with trade-offs and controversies.

Results from the INFORMA survey suggest that respondents' actions have not been driven by market forces or economic concerns, but rather by conservative and reactive attitudes, and that forest management planning, expert advice and extension services continue to play a significant role in decisions about mitigation and adaptation measures.

Project partner

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