

Common challenges in implementing forest restoration

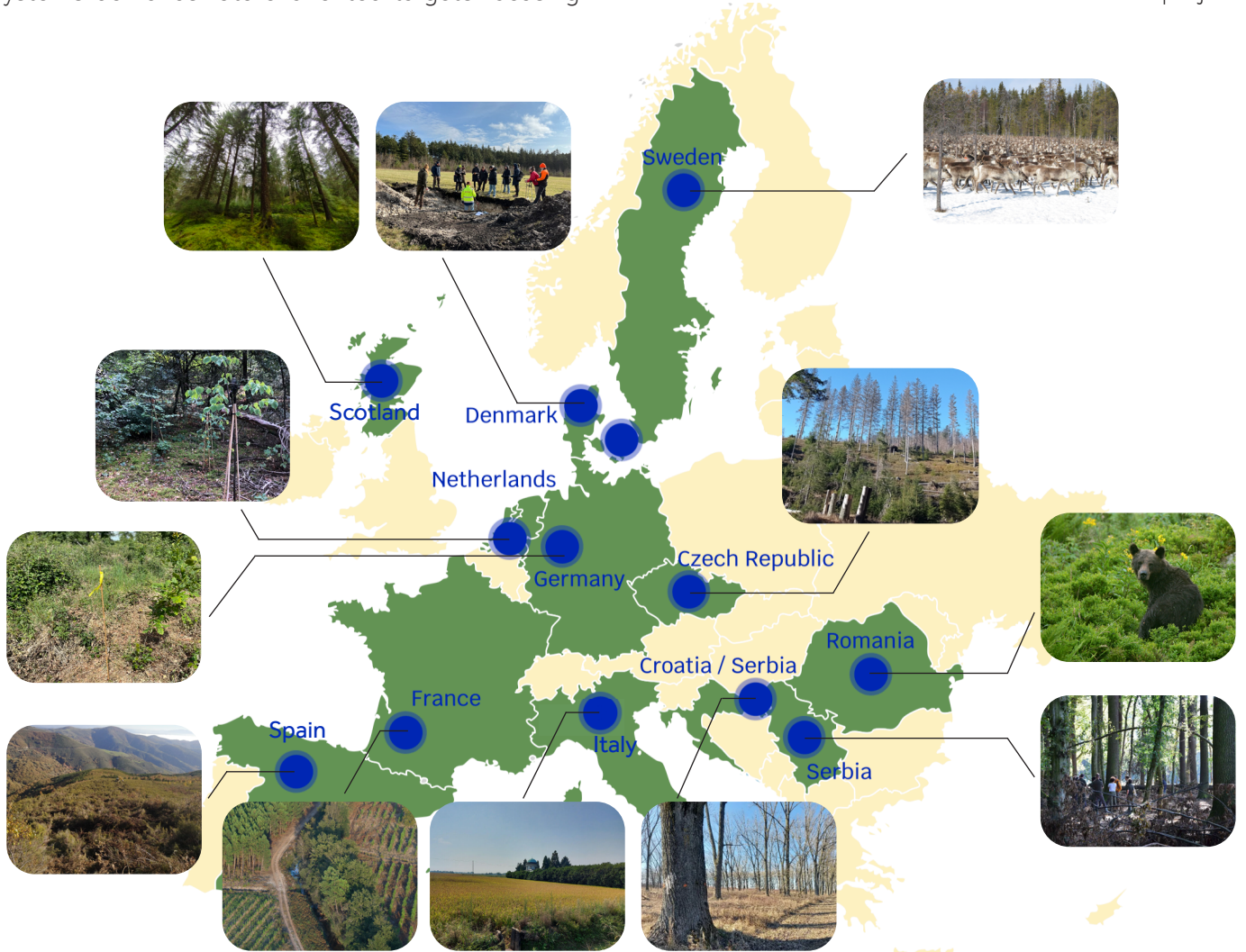
Experiences from 12 large-scale demonstration areas across Europe

Forest restoration – a cornerstone of European and global strategies to address biodiversity loss and climate change effects – requires a clear, well-informed strategy grounded in multidisciplinary scientific knowledge and practical experience. Restoration typically involves five phases: (i) assessing initial conditions and degradation drivers, (ii) planning and setting goals, (iii) implementation, (iv) maintenance and ongoing management, and (v) monitoring and evaluation. Multi-objective and transformative restoration depends on multi-stakeholder engagement, information sharing, and adaptive, flexible approaches throughout the process. Facing the challenges of climate change, natural disturbances and shifting socio-economic constraints and demands, restoring resilient social-ecological systems demands future-oriented targets focusing

on (a) desired ecosystem services, (b) the ecological processes that sustain them, and (c) the biodiversity that drives those processes.

Forest restoration is a long-term effort, and its effectiveness often becomes clear only after decades. This makes sustained funding for monitoring and adaptive management essential.

Objectives and methods vary across Europe due to differences in forest structure, management history, policies, ownership, and traditions. Measures can range from subtle interventions (e.g., conserving deadwood) to major actions (e.g., full replanting with new species). Despite this diversity, common implementation challenges emerged across the 12 large-scale forest restoration demonstration areas in the SUPERB project.






Four common but often neglected challenges in early restoration phases and recommendations how to tackle them

1. Conflicting regulations and their interpretation

Not all restoration measures are generally accepted across countries or are included in Member State forest laws. Challenges may arise in implementation of restoration within Natura 2000 areas and other nature conservation areas where the potential natural vegetation is a guiding principle and climate change impacts are not considered; or when the particular implementation practice like adapted species mixtures is not accepted, while the outcomes would be in line with the conservation goals.

Also, leaving deadwood in the forest after natural disturbances sometimes is restricted, while the sanitary problem no longer persists (e.g., when the new bark beetle generation has already left the trunk). In other cases, restoration of forests after disturbances is required within a period of a few years. Such strict time limits cause multiple issues such as unavailability of the preferred planting, limitations to the inclusion of natural regeneration, lack of labour capacity and delay in regular management operations.

Recommendations:



-  Consider climate change projections in nature conservation planning including Natura 2000 management plans and Nature Restoration Plans.
-  Contingency planning based on restoration goals for natural disturbance events.
-  Flexibility in the chosen restoration measures, timeframes and setting of multiple objectives.





2. Limited availability of planting material and other on-the-ground challenges

Forest Reproductive Materials legislations still largely favour local provenances and are restrictive on foreign provenances or non-native species. However, increased frequency and severity of natural disturbances cause large pulses in demand for climate change adapted seedlings to implement large scale restoration. It also results in a shortage of available seed material as extreme weather conditions have negative effects on seed production and cause more irregular masting seasons for some species, exacerbated by pests

and pathogens affecting the seeds. Furthermore, the production of planting material takes time and requires a significant upfront investment. Therefore, it is challenging for tree nurseries to anticipate the irregular demand for a wide range of different species and provenances. In addition, prolonged warm periods in autumn hamper hardening of the planting material, which in turn postpones its availability. In shorter planting seasons, the shortage of labour capacity will be an additional constraint.

Recommendations:

-  Adapt planting guidelines with reduced planting density.
-  Combine natural regeneration of suitable species with planting of complementary species adapted to future climate conditions.





-  Use pioneer and early-successional species with delayed underplanting of shade-tolerant, late successional or climate-adapted species when necessary.
-  Adapt Forest Reproductive Materials legislations to include climate adapted non-native species and provenances to enable assisted migration.
-  Establish more seed stands and seedling production especially from rare and drought tolerant species to ensure their long-term availability.
-  Long-term planning of restoration effort to anticipate seedling production and funding, and to provide increased security for nurseries.

3. Browsing

High numbers of ungulates often exceeding the ecosystem's carrying capacity are a major impediment to restoration, causing damage to forest ecosystems through browsing of young trees, with broadleaves more affected than conifers, shifting species composition and structure of tree regeneration in an often-unfavourable way.

Ungulate herbivory may even double the implementation costs of restoration as a significant amount of money is spent on protective and maintenance measures, e.g. fences, tree tubes, repellents.

Recommendations:





-  Adapt hunting legislation to ensure the establishment of resilient mixed forests where it matters which tree species survive.
-  Since much browsing damage is not even visible and many young seedlings never become established, stronger monitoring of browsing is essential e.g., by directly monitoring ungulate density or monitoring successful natural regeneration of target species.
-  Fencing and other protective measures are not cost-effective; permanent solutions to resolve large-scale overpopulation of ungulates are needed.
-  Dialogue processes involving forest managers, hunters, and other stakeholders – along with the broader public – are crucial for developing solutions suited to the regional context, including on contentious topics such as carnivore management.

4. Failure to engage private forest owners and communities

Private forest owners hold 60% of the European forests but involvement of especially small-scale owners takes time and requires well planned engagement. It can be difficult to motivate them to act and invest in restoration measures when they have just lost their capital after disturbances, or

when they do not live close to their forest. Further, local communities in and around the forest areas may be affected in multiple ways by the restoration (changed appearance of the forest, flooding, jobs, recreational opportunities etc.) and thus need to be involved from the beginning.

Recommendations:

-  Support of forest cooperations to implement forest restoration in landscapes with fragmented forest holdings.
-  Recognise role and needs of local communities.
-  Foster economic subsidiary and promotion of multiple income streams to stimulate interest of private owners and avoid land abandonment.
-  Promoting cost-efficient restoration measures, such as natural regeneration with pioneer species for quick returns, and the conservation of deadwood or habitat trees.



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