



# CLIMATE-ADAPTED FOREST RESTORATION IN NATURA 2000 AREAS

STAKEHOLDER PERCEPTIONS AND  
CONFLICTS IN NORTH RHINE-  
WESTPHALIA, GERMANY



**SUPERB**  
Upscaling Forest Restoration



This project has received  
funding from the European  
Union's Horizon 2020  
research and innovation  
programme under grant  
agreement No 101036849.

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## Recommended citations

Jordão, P. and O'Brien, L. 2025. Climate-adapted forest restoration in Natura 2000 areas – Stakeholder perceptions and conflicts in North Rhine-Westphalia, Germany. European Forest Institute, Bonn, Germany. Pp 24.

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# EXECUTIVE SUMMARY

Restoration has been heralded as a key instrument for solving critical sustainability challenges and is a cornerstone of EU policies such as the EU Biodiversity Strategy and the newly adopted EU Nature Restoration Regulation. Yet, its implementation can be hindered by conflicts. Climate change presents an additional challenge as it rapidly alters ecosystem dynamics and composition, including in protected areas, where high biodiversity values are at stake. Restoration provides an opportunity to adapt degraded ecosystems to climate change but raises the question of whether changes to protected areas and their management are desirable and socially acceptable. With a focus on forest ecosystems, this study investigates this question in the Natura 2000 network of protected areas in Germany's state of North Rhine-Westphalia, a region at the epicentre of climate-related disturbances. Using qualitative in-depth interviews, the study assesses how different groups of stakeholders understand climate-adapted forest restoration, what conflicts emerge from these perspectives, and possible conflict improvement strategies. The study finds that although different stakeholder groups agree that forest restoration is an opportunity to prevent further climate change-related disturbances, they clash in perspective over the adaptation potential of forests and the function of Natura 2000 areas. These clashing perspectives lead to three conflict themes that may hinder implementation of nature restoration legislation: tree species selection, sustainable forest management, and deployment of renewable energy infrastructure in disturbed forests. Several improvements to these conflicts were proposed by the interviewed stakeholders, such as increased interpersonal exchange and training, financial incentives, more flexible implementation of the EU's Habitats Directive and contract-based conservation instruments. Key takeaways include the need to consider diverging perspectives in future decision-making processes, focus on context-dependent, desirable and feasible improvements in conflict management, and the need to address climate change adaptation at higher governance levels.



# INTRODUCTION

## Forest restoration and protected areas

Forest restoration and the establishment of Protected Areas (PAs) have the potential to function as complementary conservation strategies for forest ecosystems (Aldrich et al., 2004). While PAs are designed to protect natural features, species and ecological communities of a forest (IUCN and WCPA, 2017), restoration can play a critical role by improving the ecological condition of degraded forests. Specifically, restoration can improve habitat quality, including for endangered species (Aldrich et al. 2004), increase forest connectivity, and reduce edge effects and human pressures in the areas surrounding PAs (Heller and Zavaleta, 2009). However, climate change presents challenges for the restoration of forests and other ecosystems by altering species distribution zones, population dynamics and vegetation phenology and abundance (IPBES, 2019). In Europe, key tree species such as Norway spruce (*Picea abies*), silver fir (*Abies alba*) and beech (*Fagus sylvatica*) are predicted to decline due to climate change (Chakraborty et al. 2021; Koch et al. 2022).

An ecosystem's natural capacity to withstand, recover from, or adapt to climate change can be fostered through measures such as managing for genetic diversity (e.g., maintaining diversity amongst tree populations), establishing PAs that can buffer against regional climate extremes and act as corridors for species migration, managing fires and other disturbances such as insect outbreaks, and improving connectivity (Gross et al. 2016; Heller and Zavaleta, 2009; Prober et al. 2017). However, a tree's capacity to adapt or migrate can be limited by the speed of climate change (Aitken et al. 2008; Dumroese et al. 2015).

While earlier management of PAs often assumed long-term environmental stability and relied on passive approaches, there has been a shift toward more active management focused on conserving biodiversity and maintaining ecosystem functions in response to increasingly drastic and long-term environmental changes (Keenleyside, 2012). This focus on more active management may be important given two challenges: (a) habitats and ecosystems within PAs may be radically altered, degraded, or completely disappear under climate change; and (b) novel species assemblages may become established in the area (IUCN and WCPA, 2017). However, some active management approaches for climate change adaptation in protected areas are controversial in the field of conservation (Gross et al., 2016). For example, assisted migration (Benito-Garzón and Fernández-Manjarrés, 2015; Dumroese et al. 2015; Ste-Marie et al. 2011) may help adapt forest composition to climate change but may also have unpredictable ecological outcomes, such as introducing invasive or maladapted genotypes (Mimura et al. 2017) and slowing the rates of adaptation of local species (Siepielski et al. 2013)

These debates are particularly relevant for the Natura 2000 network, which covers around one-third of the EU's forests (EEA, 2023). Climate change within Natura 2000 is a contested topic. One view suggests that the network's focus on fixed habitat types, as defined in the



Habitats Directive, may limit the capacity of forests to respond dynamically to climate change and promotes more active intervention (Boćkowski et al. 2022; de Koning et al. 2014). An opposing view cautions that such changes could weaken implementation of the Habitats Directive and instead calls for stricter enforcement of Natura 2000 related legislation (Boćkowski et al. 2022; de Koning et al. 2014). A third perspective stresses the need for further research before changing Natura 2000 policies (de Koning et al. 2014).

In line with these shifts, alternative definitions of restoration have evolved to account for climate change, moving away from aiming to recreate a specific historical condition toward restoring the historical trajectory of an ecosystem (SER, n.d.). A contemporary restoration strategy, called 'prestation', focuses on continued ecosystem service provisioning and functioning in the face of climate change by selecting and prioritising species likely to persist under climate change (Butterfield et al. 2017). This strategy posits that returning habitats to their historical state may no longer be feasible under climate change (Allison, 2012; Seastedt et al. 2008).

## Research questions

This study investigates conflicts and disputes around forest restoration and climate adaptation in Natura 2000 areas in the German state of North Rhine-Westphalia which has recently been at the epicentre of extreme weather events and climate-related forest disturbances (MULNV, 2020). Specifically, it aims to examine stakeholders' understanding of climate-adapted restoration, potential incompatibilities and disputes emerging from these views, and conflict management options. The following key questions orient this research:

- (1) What do different stakeholders perceive as appropriate approaches to climate-adapted forest restoration in Natura 2000 areas?
- (2) What conflicts emerge from these perspectives?
- (3) What do stakeholders perceive as possible solutions to climate-adapted forest restoration and existing conflicts?

# METHODS

## Case study

This study focuses on Natura 2000 sites of Germany's state of North Rhine-Westphalia (NRW). NRW is a heavily industrialised state in western Germany and the most populous state of the country (Federal and State Statistical Offices, 2024). An area of 153,100 ha (16.7%) is protected under the Natura 2000 Network (Fig. 1). Within these areas, 60,000 ha are covered by semi-natural forests corresponding to the habitat types protected in the Habitats Directive (Wald und Holz, 2024). Habitat areas mapped according to the Habitat Directive's habitat types are known in Germany as Fauna-Flora-Habitat (FFH) areas to

differentiate them from bird sanctuaries protected by the Birds Directive. Each FFH area in NRW has a corresponding management plan (Lanuv, 2024) aiming to maintain or improve the condition of habitat areas and their conservation status (Hetzl et al., 2022), as required by the Habitats Directive.



Figure 1 - FFH sites in NRW (in red) and SENTINEL2 forest cover (in green). The overlap between red and green areas shows forested FFH sites. Source: Adapted by the authors from waldinfo.nrw © Land NRW (2021), © BKG (2021).

Since 2018, a series of extreme events has dramatically impacted the state of NRW's forests. Hurricane Frederike and extreme summer droughts from 2018-2023 (MULNV, 2020) weakened beech and oak trees, with 39% showing significant amounts of crown defoliation (MLV, 2023b). Bark beetle outbreaks affected 142,500 ha of spruce stands (MLV, 2023b) leading to widespread clearcuts (BUND-Kreisgruppe Rhein-Sieg, 2019) (Fig. 2 and 3).

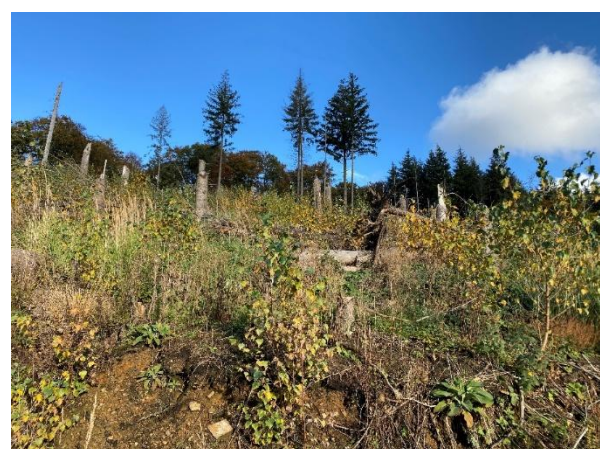


Figure 2 (left) - Spruce die-off area in NRW; Figure 3 (right) - Spruce clear-cut area in NRW. Credit: SUPERB project.

The deteriorating state of NRW's forests has made restoration and climate adaptation a policy priority in the state. In 2019, the state government introduced the Silviculture and Reforestation Concepts to guide and fund reforestation (State Government of NRW, 2019). The Reforestation Concept offers recommendations for the establishment of new forest stands after large-scale disturbances (MULNV, 2020), while the Silviculture Concept provides advice on developing site-appropriate and structured mixed stands, encompassing 72 "forest development types" with mixes of at least four climate resilient tree species (MULNV, 2021b). For FFH areas, the Silviculture Concept lists specific forest development types deemed compatible with the mapped habitat types and advises against the introduction of non-native species (MULNV, 2021b).

## Selection of interviewees, data collection, and analysis

We interviewed 14 stakeholders between January 2024 and March 2024. All interviews followed a structured interview guide. The aim of the interviews was to identify the relevance of climate change for forest restoration in NRW and Natura 2000 sites, stakeholder perceptions of climate-adapted forest restoration and the NRW Silvicultural Concept, conflicts and challenges related to climate-adapted forest restoration and conflict management strategies. Stakeholders were identified using a combination of desk-based online research, recommendations from stakeholders involved in the EU-funded forest restoration project SUPERB, and snowball sampling (i.e., asking the interviewees for recommendations of whom to interview). Interviewees were selected if they met at least one of the following criteria (1): representatives in senior positions on Natura 2000 governance or forest restoration in NRW; (2) high involvement in and/or geographical proximity to the SUPERB forest restoration demonstration area in NRW. Interviewees included authorities and organisations active at the state and regional administration levels, including nature conservation authorities (NCAs), environmental associations, the public forest administration, and private forest and forestry sector associations (Table 1). All interviews were conducted in German and lasted approximately one hour. All interviews were fully transcribed in German, translated in English, and subsequently coded in MAXQDA, a software for qualitative text analysis. Coding was done deductively and inductively. Conflicts related to climate-adapted forest restoration were analysed using discursive institutionalism as it combines different layers of conflict analysis and can be used to understand the dynamics of institutional change and allow for conflict management (Schmidt 2010, 2008).



Table 1: Overview of the interviewees

| Participant Type                                | Pseudonym                                                                       | Group Description                                                                                                                                  |
|-------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Nature Conservation Authorities (NCAs)          | NCA #1                                                                          | Higher and lower nature conservation officers. The pseudonyms do not distinguish between higher and lower NCAs to protect participants' identities |
|                                                 | NCA #2                                                                          |                                                                                                                                                    |
|                                                 | NCA #3                                                                          |                                                                                                                                                    |
|                                                 | NCA #4                                                                          |                                                                                                                                                    |
| Environmental Associations                      | Environmental Association Representative #1                                     | Representatives of non-governmental environmental organisations and associations at the state and regional levels                                  |
|                                                 | Environmental Association Representative #2                                     |                                                                                                                                                    |
|                                                 | Environmental Association Representative #3                                     |                                                                                                                                                    |
| Public forest administration                    | Scientific Expert of the State Forest Administration                            | Representatives of NRW's state forest administration, regional forestry offices, and municipal forest services                                     |
|                                                 | Forest Administration Advisor to Small Forest Owners                            |                                                                                                                                                    |
|                                                 | Municipal Forest Office Representative #1                                       |                                                                                                                                                    |
|                                                 | Municipal Forest Office Representative #2                                       |                                                                                                                                                    |
| Private forest and forestry sector associations | Private Forest Owner Association Representative                                 | Representatives of private forest owner, forestry and forest industry associations at the state and regional levels                                |
|                                                 | Private Forest Owner Association and Forest Business Association Representative |                                                                                                                                                    |
|                                                 | Representative of an Interest Association in the Field of Forestry              |                                                                                                                                                    |

# RESULTS

## Stakeholder perceptions of forest restoration in Natura 2000 areas

There was a consensus across stakeholder groups that climate-adapted forest restoration represents an opportunity to move away from spruce monocultures, which were considered by stakeholders as no longer feasible in NRW. However, stakeholders had distinctly different views on how this should be managed which reflected distinct preferences for restoration approaches (Table 2).

Table 2: Preferred climate-adapted forest restoration approaches for Natura 2000 areas

| Stakeholder group                               | Interview partner                                    | Preferred approach                                                                                                                                         |
|-------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NCAs                                            | NCA #1                                               | Assisted natural regeneration to maintain habitat type                                                                                                     |
|                                                 | NCA #2                                               | Assisted natural regeneration to maintain habitat type                                                                                                     |
|                                                 | NCA #3                                               | Ample space for natural regeneration, maintenance of habitat type, small-scale introductions of other native species                                       |
|                                                 | NCA #4                                               | Using habitat type as a basis in restoration but "open" to the topic in extreme locations                                                                  |
| Environmental Associations                      | Environmental Association Representative #1          | Assisted natural regeneration                                                                                                                              |
|                                                 | Environmental Association Representative #2          | Assisted natural regeneration                                                                                                                              |
|                                                 | Environmental Association Representative #3          | Natural regeneration combined with the promotion of mixed tree species, avoiding pure beech stands and using different provenances and native tree species |
| Public forest administration                    | Scientific Expert of the State Forest Administration | Combination of natural regeneration and prestoration using native tree species                                                                             |
|                                                 | Forest Administration Advisor to Small Forest Owners | Combination of natural regeneration and prestoration using native tree species                                                                             |
|                                                 | Municipal Forest Office Representative #1            | Combination of natural regeneration and prestoration using native tree species                                                                             |
|                                                 | Municipal Forest Office Representative #2            | Combination of natural regeneration and prestoration using native tree species                                                                             |
| Private forest and forestry sector associations | Private Forest Owner Association Representative      | Prestoration using most resilient species                                                                                                                  |
|                                                 | Private Forest Owner                                 | Prestoration using most resilient species                                                                                                                  |



|  |                                                                    |                                                                                |
|--|--------------------------------------------------------------------|--------------------------------------------------------------------------------|
|  | Association and Forest Business Association Representative         |                                                                                |
|  | Representative of an Interest Association in the Field of Forestry | Combination of natural regeneration and prestoration using native tree species |

## Forests as habitats and assisted natural regeneration

Most NCAs and environmental associations highlighted the importance of forests as habitat areas and the need to put biodiversity and ecosystem protection above timber production within Natura 2000 sites. NCAs considered the Habitat Directive habitat types as the most relevant criterion in restoration, stressing Germany's "great responsibility for beech forests in Europe..." (NCA #1). They emphasised the importance of complying with EU laws by maintaining the proportion of areas covered by habitat types to avoid the risk of EU infringement proceedings.

In terms of restoration approaches, NCAs and environmental associations preferred a focus on natural regeneration and dynamics: "We do not necessarily have to formulate what we want from the forest but should rather focus on what it 'offers' us" (NCA #3). They emphasised the possibility of natural adaptation of native seeds and seedlings, the success of natural regeneration compared to planting, and the uncertainty of introduced species. A guided approach to natural generation was also perceived as a suitable, especially when spruce is likely to reestablish naturally. In such a case, NCA stakeholders perceived that initial planting of deciduous native species and suppressing spruce growth can steer restoration in the "right" direction, after which nature processes can take over. In stands already dominated by beech, it was remarked that natural regeneration can work on its own if ungulate populations are controlled.

However, NCAs saw challenges in pursuing conservation goals in some locations, such as south facing areas with dry and nutrient poor soils and a thin humus layer, where "it could be that the beech tree no longer survives as a habitat type" (NCA #1). The topic was also problematised by environmental associations and it was questioned whether the current management approach in Natura 2000 areas will remain viable: "It is usually the case that the Natura 2000 areas have beech as the dominant tree species (...) But what is still endemic when you consider climate change? You need certain flexibility. At the EU level, there is a requirement for no deterioration. This is unlikely to be possible given the backdrop of climate change. I think massive legal problems will arise" (Environmental Association Representative #3).

## Multifunctional forest management combining natural regeneration and prestoration

All public forest administration representatives, one environmental association, and one forestry association representative emphasised the need to minimise disturbance risks, maintain forests' vitality and stability, and ensure economic, ecological and social functions through restoration. They perceived that adaptation to site drifts based on soil conditions and future climate scenarios should be used to guide restoration "because we are not creating the forests of today but the climate-resilient forests of the day after tomorrow" (Scientific Expert of the State Forest Administration). Climate change was seen as a challenge beyond Natura 2000 areas, requiring intervention rather than a passive approach, particularly in beech-dominated forests. To prevent forest die-offs, these stakeholders advocated for developing more mixed forest stands, using a combination of natural regeneration (if appropriate for the site conditions) and active management through plantings of different native species and provenances. In general, these stakeholders advocated for more flexibility in Natura 2000 regulations to allow for climate change adaptation, remarking that management plans might no longer accurately reflect site conditions.

## Forest productivity and prestoration using the most resilient species

Private forest owner representatives advocated for a prestoration based restoration approach, although they stated opinions among other forest owners may differ, depending on whether they are more biodiversity or economically focused. They perceived climate adaptation to be the selection of tree species that are both currently viable and are likely to be vital, vigorous and stable at the end of their rotation periods.

In addition, they argued that the increase in global average temperatures has already caused site shifts, warranting immediate changes in species compositions. As a result, they advocated for the freedom to plant any tree species (including non-native) inside or outside Natura 2000 sites, as they thought even drought-resistant native species like oak could also face challenges. Additional justifications of this approach included current state incentives and subsidies for wood production, intergenerational rights to forest resources, and the need for forest owners to generate income to keep their operations running.

## Climate-adapted forest restoration conflicts

Three conflict themes arose from stakeholders diverging perspectives on climate-adapted forest restoration in Natura 2000 areas. Conflicts related to tree species selection and sustainable forest management were the most frequently mentioned conflict themes by interviewed stakeholders, while issues surrounding renewable energy generation ranked third (Fig 4).



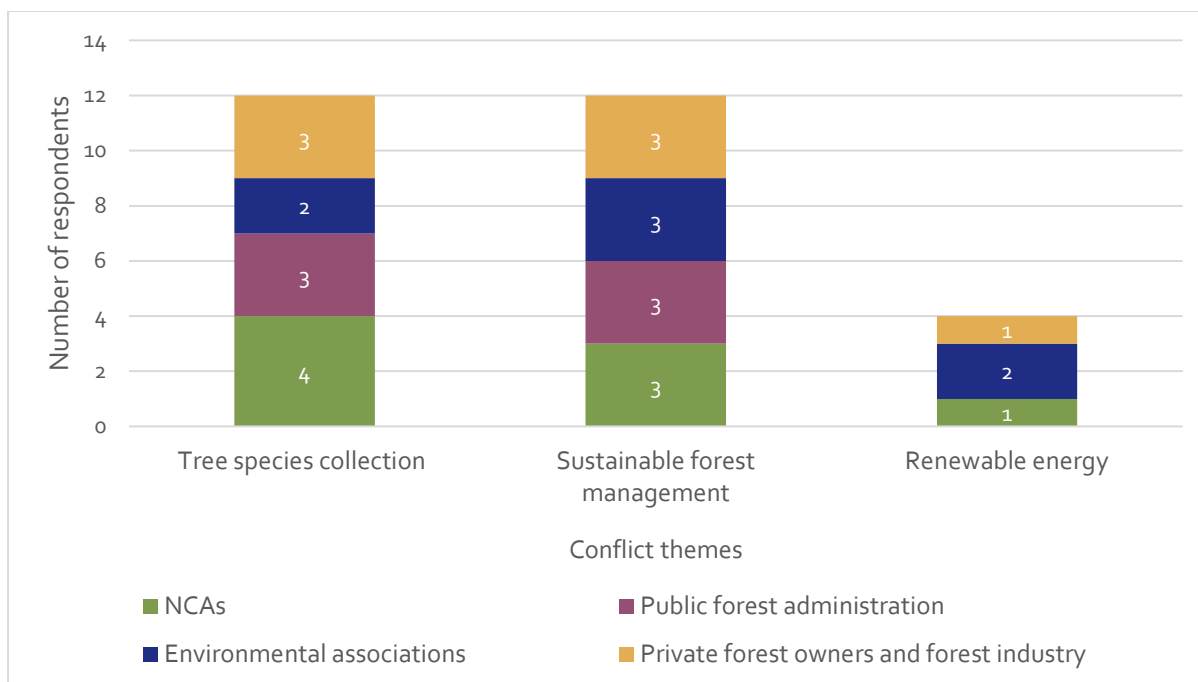


Figure 4: Identified conflict themes and numbers of actors who mentioned them, divided by stakeholder group

## Tree species selection

Conflicts around tree species selection are a point of contention in public forests between NCAs and the public forest administration and in private forests between NCAs, environmental associations, and private forest owners.

### Conflicts in public forests

In public forests, NCAs noted "hot discussions" around beech-dominated habitats and how other species such as oak should be planted in areas where beech struggles. Many NCAs recognised foresters' concerns about beech, acknowledging that they are shade-dependent, difficult to establish in bare areas, and may not survive on southern slopes, and therefore found it acceptable to mix some oak into beech stands. However, one NCA was convinced that the public forest administration wants to change a beech-dominant habitat type to a different species composition. NCAs and environmental associations also rejected comparisons between predictions of Germany's future climate and Mediterranean conditions which are often used to justify such approaches, due to different winter conditions.

A Scientific Expert of the State Forest Administration argued that beech forests need at least 30-40% oak to withstand climate change, suggesting that for habitat type 9110 (Luzulo Fagetum beech forests), a 30% composition is sufficient since beech and oak forests are equally valuable. On the other hand, an NCA warned that if only 30% of beech is planted, other species may surpass the proportion of beech in the long term, ultimately reducing the size of the habitat type or changing it into another. They also questioned the forest administration's preference for oak, suggesting economic motives and citing data on declining oak health.

In addition, stakeholders disagreed on how the terms native and habitat-typical trees should be interpreted. NCAs favoured strict local interpretations, giving preference to trees from the demarcated FFH site or region, while public forest administration representatives advocated for a broader approach, including species from other parts of the region or state. Members of the forest administration criticised NCA efforts to suppress naturally regenerated species that did not fit the local habitat type or restrict plantings of species that are native to NRW but not found in the specific FFH site.

Related to these disagreements, a conflict in the SUPERB forest restoration demonstration area in NRW between forest administrations and NCAs over reforesting a sun-exposed slope in a municipal forest after a bark beetle outbreak caused spruce dieback. The municipality proposed to reforest the area using a forest development type from the Silviculture Concept with a higher proportion of oak. However, the NCA rejected it, citing incompatibility with FFH habitat requirements. As a result, the restoration plan was abandoned by the municipality and forest administration and a new restoration area in a privately owned forest was selected.

### *Conflicts in private forests*

In private forests in Natura 2000 areas, disapproval arose from NCAs and environmental associations when spruce was planted before demarcation, exempting private forest owners from the non-deterioration clause of the Habitats Directive, which in some cases led to the replanting of spruce. Additionally, these two stakeholder groups were concerned that forest owners' attempts to create climate-stable forests using non-native species outside PAs could spread to Natura 2000 areas, risking invasiveness and causing conflicts between NCAs and the forest administration.

Private forest owners and forest industry association representatives highlighted uncertainty and confusion due to perceived overlaps between EU, national and state regulations, including FFH ordinances, forest and conservation policies, and certification standards. To navigate this uncertainty, some private forest chose not to take any action in FFH areas to prevent unintentional breaches of the legislation. Moreover, this stakeholder group criticised the condition that loans granted under the Silviculture Concept must be paid back if reforestation fails. Combined, these factors often made funding line conditions unacceptable to private owners: "The Silviculture Concept should theoretically play a big role in reforestation (...) But I'll say blasphemously (...) it's not being implemented anyway. My forecast is that in 80-90% of all private forest FFH areas nothing at all will happen. Maybe 10% of the areas will be reforested with funding. In secrecy, maybe the forest owner will stick a few Douglas firs in the ground where inspections don't come so often and hope they won't be noticed" (Private Forest Owner Association Representative).

### *Sustainable forest management in restoration*

Conflicts around sustainable forest management in connection with climate-adapted forest restoration were mostly related to clear-cutting, the use of larger harvesters, and incorrect implementation of the Silvicultural Concept in privately owned Natura 2000 forests. NCAs were concerned that these issues cannot be adequately monitored, and regulations are often

not enforced due to a lack of personnel. NCAs and environmental associations also perceived that economic aspects are more important to private forest owners in Natura 2000 areas, and environmental protection is not taken seriously. On the other hand, private forest owner associations accused environmental associations of wanting to leave forests untouched for natural development.

More than one representative of forest owners and industry said they mistrust the nature conservation sector after the Natura 2000 demarcation process that occurred 20 years earlier. They argued that it was not clearly communicated that some areas would be placed entirely under strict nature protection. Private forest owners expected to maintain certain forest communities with financial compensation but later faced additional requirements such as habitat improvements. Many claimed that they never received compensation, leading to disappointment and distrust in the state.

### Renewable energy generation

The installation of wind energy turbines or solar power plants in forests that were affected by natural disturbance was seen as a conflict particularly by environmental associations. They argued that forests should not be turned into commercial or industrial areas for power generation and argued that doing so may harm the forest. One NCA thought that the topic puts different societal goals against each other, such as climate mitigation and biodiversity conservation. However, NCAs did not entirely rule out wind energy facilities in PAs, since their installation is allowed as an “interim use” of the forest. However, they stressed the need to ensure that they do not interfere with nature conservation. Conversely, development of wind energy infrastructure in forests was described by a private owner association representative as both quick source of income after major financial losses from bark beetle outbreaks and a way to finance reforestation without needing to meet state funding requirement

### Improvements and solutions

Proposed improvements and solutions for climate-adapted restoration conflicts included an increase in the exchange of information and opportunities for interpersonal contact and training, financial solutions, changes to the Habitats Directive, FFH ordinances, or their implementation, changes to national legislation, and the adoption of contract-based nature conservation (Fig. 6).

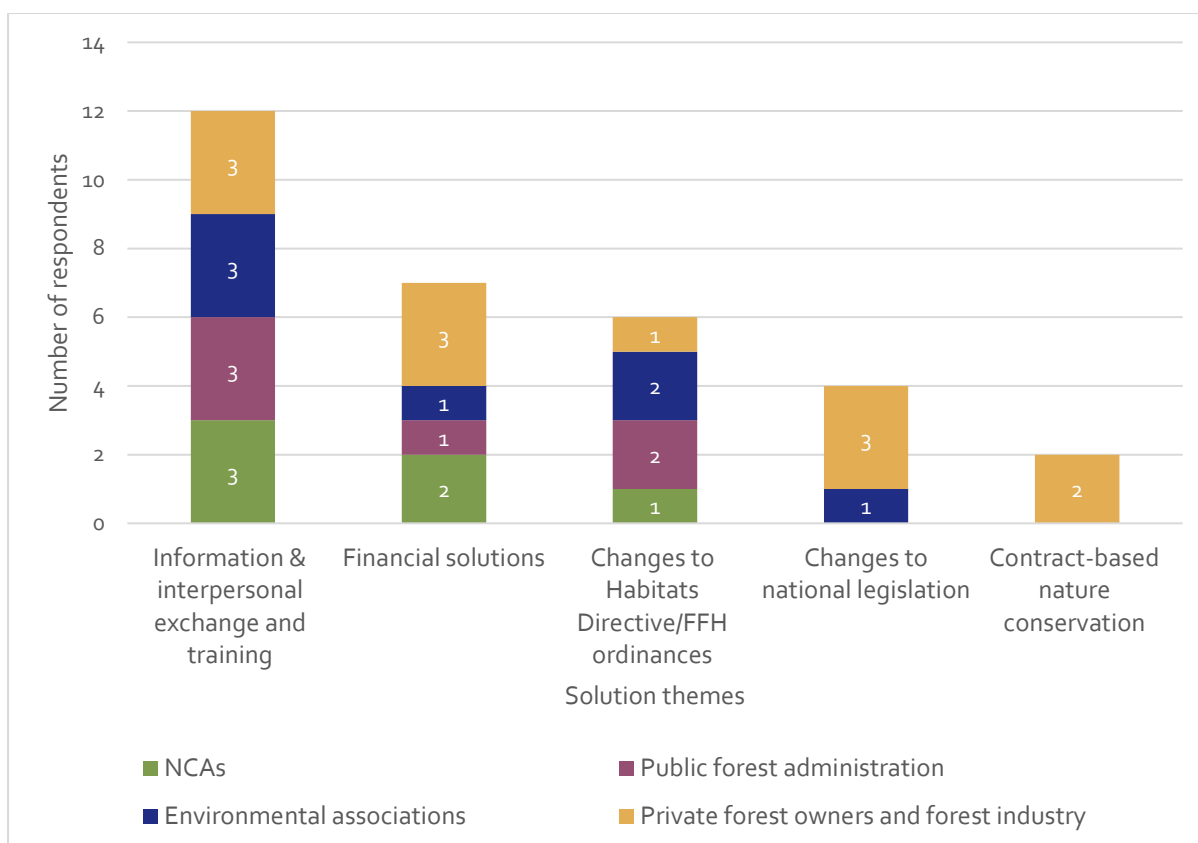


Figure 6: Proposed solution types and number of actors who mentioned them, divided by stakeholder group

## More information and interpersonal exchange and capacity-building

The need for more information exchange, opportunities for interpersonal contact and interdisciplinary training was the most mentioned improvement for conflicts related to tree species selection and sustainable forest management. It was highlighted that interpersonal exchange should take place before the restoration planning stage and should occur in informal contexts to create mutual understanding. Excursions to the forest were preferred over indoor settings because while stakeholders may have different perspectives, they "have the same image of the forest before their eyes" (Municipal Forest Office Representative #2). The effectiveness of workshops, lectures, and conferences was questioned as they were perceived to attract only a certain type of stakeholder. Instead, an environmental association suggested using roundtables with stakeholders and forest administration representatives called for more training and exchange of scientific information on climate change and forests.

## Financial incentives

All stakeholder groups highlighted financial incentives as a key means of encouraging private forest owners to undertake reforestation that aligns with Natura 2000 habitat type requirements. Three types of mechanisms were mentioned: (1) State-led adaption of funding lines; (2) Incentives to make wood from habitat trees more marketable; and (3) Market-based financial compensation for ecosystem services.

State-led adaptation of funding lines was mainly promoted by NCAs and environmental associations who suggested multiple options for implementation including (1) Larger grants to support private forest owners who reforest using species that align with the Natura 2000 habitat requirements; (2) Additional support for reforesting areas overgrown with pioneer vegetation such as bushes or blackberries; and (3) A shared risk model between the state and forest owners for failed plantings, as forest owners currently bear all of the risk.

Incentives to make wood from habitat trees more marketable were promoted by one environmental association and an NCA representative. Birch wood (*Betula pubescens*) was used as an example of a species that was once considered unprofitable but is now gaining interest due to the creation of new product lines and processing technologies. These stakeholders thought similar efforts could be made to promote beech wood, which could indirectly foster its use in restoration efforts.

Market-based financial compensation for ecosystem services were highlighted by all three private owner associations and the forestry sector representatives. They argued for additional economic incentives for private forest owners when reforestation follows FFH regulations, including financial rewards for CO<sub>2</sub> storage through certificate sales. A forest industry representative highlighted the advantage of issuing and purchasing CO<sub>2</sub> certificates in Germany, ensuring more effective monitoring and verification compared to more “questionable” foreign projects.

### Changes and/or flexible implementation of the Habitats Directive and FFH ordinances

Changes to the Habitats Directive, trickling down into local FFH ordinances or more flexible implementation were the third most mentioned solution to conflicts related to climate-adapted forest restoration.

Some representatives of the forest administration believed that the Natura 2000 process should be reassessed to better understand its impact on local bans and prohibitions. A Scientific Expert of the State Forest Administration highlighted that zoning ordinances, plans, and legislations from the 1980s and 1990s should be updated in response to climate change. However, as this was perceived to likely take years, he argued for the use of special solutions to address urgent regional issues. He also perceived that the federal states of Germany vary in their interpretation and implementation of the Habitats Directive. To reduce local discrepancies and legal uncertainty, he called for the EU and Germany to establish clearer regulations.

The need to consider climate change in FFH regulations was also cautiously echoed by three representatives of the nature conservation sector, however they advocated for more technical case-by-case solutions. Environmental Association #1 acknowledged that “moving away from static FFH guidelines” would at some point be unavoidable due to the habitat site drift, but experimenting with non-native species in PAs is currently problematic. An NCA also affirmed that FFH regulations must be strictly observed, but a certain degree of flexibility should be allowed including introducing climate change and in restoration of beech in small, sun-exposed areas.



## Changes in national legislation

To improve conflicts around sustainable forest management, an environmental association representative suggested a more precise definition of "proper timber management/economy" ("ordnungsgemäße Holzwirtschaft", in German) in the Federal Forest Act to prevent interpretation according to the personal interests of forest owners. However, this was opposed by the three private forest owner and forest industry association representatives who called for fewer regulations, bureaucracy and restrictions for forest owners.

## Contract-based nature conservation

Two forest owner association representatives criticised the excessive use of nature conservation laws, arguing that it could overwhelm private forest owners and lead to resistance. Instead, they suggested making contractual agreements for nature conservation in the Federal Forest Act, including setting management rules with financial compensation, leasing forest areas for nature conservation, and supporting forest owners with ecosystem service markets.

# KEY FINDINGS

## Clashing perceptions on forests and climate change exist among stakeholders

Stakeholders interviewed in this study had clashing perceptions of forests and the role of climate change in Natura 2000 area management. On the one hand, NCAs and environmental associations saw forests as adaptive ecosystems where major human interference is undesirable or not yet necessary on a significant scale. On the other hand, forest administration representatives viewed forests as threatened, multiple-use commons that balance multiple goals including wood production, recreation, and biodiversity and which require active management in the face of climate change. Private forest owners and the forestry sector viewed forests as climate change victims that require interventionist strategies including the use of climate-resilient species and long-distance migration.



## Conflicts are related to clashing value and interests of stakeholders

The different perspectives on forests and climate change identified in this study were related to different values and interests among stakeholders. In public forests, tree species selection conflicts are related to clashing value and interests which influence views on forest resilience, adaptive capacity, and preference of tree species. In private forests, value and interest-based conflicts also occur, mostly relating to the clash of economic and nature conservation goals. Additionally, conflicts related to trust, legitimacy, and historical events occur in the background. For example, private forest owners' perception of increasing state interference in their land due to more strict regulation of forest management and mistrust of NCAs and environmental associations that formed during the demarcation process of Natura 2000 areas in the past.



## Conflicts may hinder implementation of nature restoration legislation

If the conflicts related to climate-adapted forest restoration were to be left unresolved, some stakeholders predicted significant legal problems from violations of the Habitats Directive's non-deterioration clause (e.g., planting of unapproved species and the decay of habitat types due to climate change). Likewise, ongoing disputes could hinder implementation of the EU Nature Restoration Regulation, which prioritises Natura 2000 sites for restoration until 2030 (European Parliament, 2024). In addition, ongoing conflicts in NRW about nativeness and minimum criteria of Natura 2000 habitat types could complicate discussions on new nature restoration legislation and ultimately hinder implementation. In general, legal insecurity is considered a significant hindrance to restoration, with private owners often preferring not to reforest their land due to fears of potentially infringing the law.



# RECOMMENDATIONS

This study explored perceptions of climate-adapted forest restoration and related conflicts in NRW, a regional case study that is nevertheless representative of many other regions of the European continent, particularly those affected by bark beetle outbreaks in Central Europe.

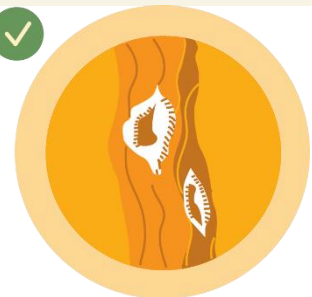
## Need to take diverging perspectives into account in future decision-making processes

This study found that there are different perspectives on climate-adapted forest restoration across different stakeholder groups that are ultimately shaped by different values and interests. These diverging perspectives and the values and interests that shape them should be openly discussed in decision-making and conflict management processes.



## Conflict management should focus on context-dependent, desirable, and feasible improvements

A wide array of strategies can contribute to improving conflicts related to climate-adapted forest restoration, including increased interpersonal exchange and peer-to-peer learning, financial incentives, legislative changes, and contract-based conservation agreements. Yet, it is important to highlight that improvements are context-dependent and must be both desirable and feasible to ensure their implementation does not trigger new disputes and contestation.



## Need to address climate change adaptation at higher levels

The results and implications of this study go beyond the study area in NRW, as the EU seeks to expand the number and extent of PAs through the EU Biodiversity Strategy for 2030. As ecosystem restoration is gaining political relevance with the EU Nature Restoration Regulation, this research highlights the importance of addressing climate adaptation in forest restoration policies and guidelines especially at the EU level as well as acknowledging contradictions in Natura 2000. If these factors are not addressed at higher governance levels, unresolved challenges may trickle down to lower levels where implementation takes place, ultimately hindering the fulfilment of restoration goals.



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