LAND-USE CHANGE IN HORST AAN DE MAAS, THE NETHERLANDS

CHALLENGES AND OPPORTUNITIES FOR FOREST RESTORATION

SUPERB
Upscaling Forest Restoration

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EXECUTIVE SUMMARY

This study investigates how changing land-use in the Kronenbergse forests located in Horst aan de Maas, the Netherlands, may create challenges or opportunities for forest restoration. Drawing on 18 stakeholder interviews, the study found that stakeholders mainly perceive recreational developments as the largest land-use change that has influenced the forests. Four narratives emerged on the implications of these developments for forest restoration: (1) Destruction without dialogue; (2) Managing trade-offs; (3) Restoration by recreation; and (4) Farmers bear the burden. Stakeholders held different views on how land-use changes, especially recreational developments, have impacted the Kronenbergse forests. Some groups see the forest as destroyed while others see recreational developments as an opportunity for forest restoration. Perceptions of decision-making power also varied, with some groups feeling excluded and others perceiving these "excluded" groups as influential. Past governance of land-use changes shaped stakeholder interest in restoration, with negative experiences creating distrust and lack of interest. Most stakeholders called for more communication and engagement, though their goals differed based on their specific concerns. These findings highlight the need for creating a shared understanding of land-use impacts and decision-making power, recognition of past grievances related to land-use governance, and developing tailored communication strategies to support future forest restoration.

INTRODUCTION

The Netherlands is one of the most densely populated countries in Europe with high agricultural land-use (Eurostat, 2023). In 2015, 67% of the land was agriculture, 15% buildings and infrastructure, 14% forest and other natural areas, 3% recreational areas, and 0.4% other (Brink, 2015). Historical agricultural land-use has led to high nutrient input in aquatic ecosystems, low groundwater, high use of pesticides, and habitat fragmentation with negative effects for biodiversity (Buiteveld, 2012; Brink, 2015). Forests in the Netherlands are crucially important for nature conservation and recreation as well as other ecosystem services but have legacies of human impact. The Netherlands has one of the lowest percentages of forest cover in Europe (around 11%) compared to other European countries and the remaining forests are highly fragmented and often composed of non-native species (Buiteveld, 2012). In addition, forests in the country are under high recreational pressure, which can lead to conflicts with nature conservation and other forest management objectives (Bell et al. 2007; van Sprundel, 2021). Forests are also under pressure from other land use-types, including agriculture, urban expansion, road construction, and clay and sand mining (Buiteveld, 2012). This has led to conflict in some Dutch forests. For example, there have been various protests over decades in the country over the construction and expansion of highway A27 through a forest (NOS, 2020).

Efforts to combat biodiversity decline in Dutch forests and other ecosystems include establishment the National Nature Network (NNN) and implementing the Integrated Approach to Nitrogen (PAS) to reduce biodiversity loss caused by nitrogen deposition. National policies like the Flora and Fauna Act and the Nature Conservation Act also aim to protect and restore nature (Brink, 2015). The 2020 National Forest Strategy sets targets for 2030, including expanding forest cover by 10% and improving the quality of existing forests by reducing nitrogen deposition, preventing desiccation, and restoring forests to make them more biodiverse and resilient to climate change (Ministerie van Landbouw, Natuur en Voedselkwaliteit and Interprovinciaal Overleg, 2020). Small decreases in agricultural land-use in the last decades may provide an opportunity to develop new forests and nature areas (Brink, 2015)

Given high land-use pressure in the Netherlands and the growing political motivation for forest restoration, this in-depth case study explores how land-use change in the Kronenbergse forests in Horst aan de Maas – a forest used intensively for recreation – may create challenges and/or opportunities for forest restoration and how potential challenges can be managed.

Our research questions are:

1. Do stakeholders perceive land-use changes in the Kronenbergse forests in the last decade and if so, how does this create challenges and/or opportunities for forest restoration?
2. If challenges exist, what are potential solutions?
3. How does the power of stakeholders influence land-use decision-making in the Kronenbergse forests?

METHODS

Case study

This study was conducted in the SUPERB project's 320 ha forest restoration demonstration area in the municipality of Horst aan de Maas in the province of Limburg, the Netherlands (Figure 1). The demonstration area is mostly owned by the municipality, but other owners include nature conservation organisations, the State Forest Agency (Staatsbosbeheer) and private forest owners. The area is fragmented and primarily made up of forests, farmland, and small villages. It experiences high recreational pressure from both tourists and the local community, driven by nearby attractions such as equestrian centres, an amusement park, holiday cottage parks, and golf clubs (Figure 2). The research in this study specifically focuses on the Kronenbergse forests (Figure 1). The forests, primarily made up of non-native Scots pine planted around 1900 for timber production, are small, fragmented, and surrounded by intensive agriculture. The combination of surrounding intensive agriculture, the conversion of old native forests into young pine monocultures, and acid rain has disrupted hydrological cycles, increased nitrogen deposition, caused biodiversity loss, soil degradation and acidification, resulting in less resilient forests.

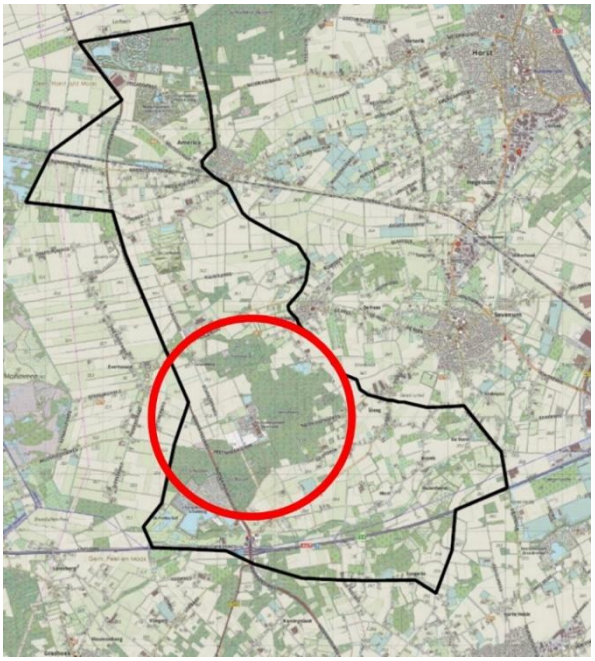


Figure 1: Map of the SUPERB forest restoration demonstration area in Horst aan de Maas, the Netherlands. The black lines indicate the borders of the demonstration area while the Kronenbergse forests are marked within in the red circle.

The main goal of forest restoration in the demonstration area is to restore between 40 and 100 ha of fragmented old Scots pine plantations to more biodiverse forests, while considering current needs for other ecosystem services, including CO_2-sequestration, wood production, forest biodiversity, water retention, ameliorated ground water quality, and recreational use. Specifically, the restoration plans include both revitalisation of the current forest and planting of new forests on former agricultural lands. Restoration approaches include diversifying tree species, stimulating natural regeneration, revitalising soils and restoring hydrological systems.

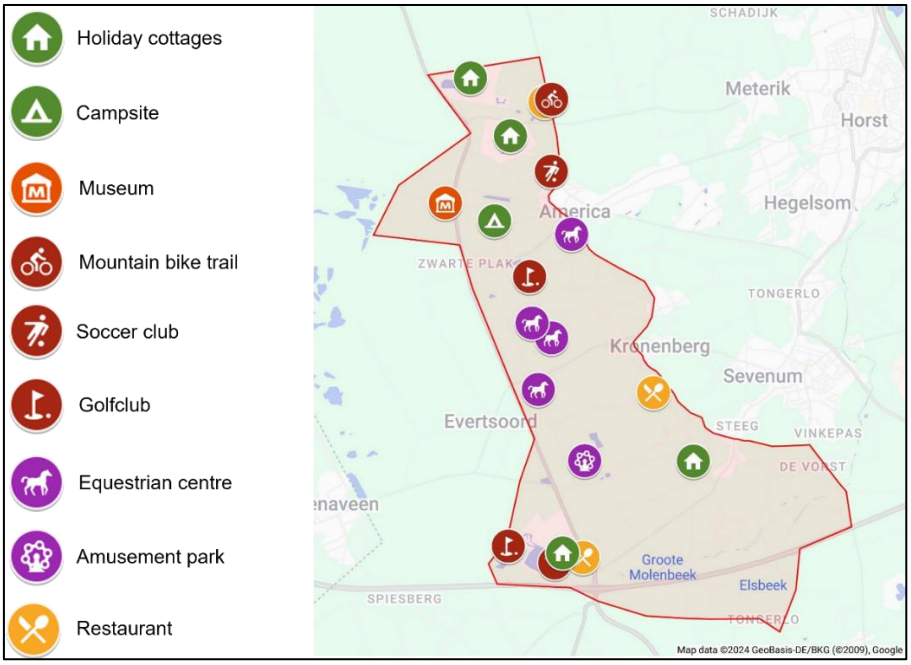


Figure 2: Map of the SUPERB demonstration area, showing different recreational facilities.

Selection of interviewees, data collection, and analysis

We conducted 16 interviews with 18 individuals engaged in or affected by land management and land-use in the area (on two occasions two stakeholders from the same organisation were interviewed together) between August and December 2024 (Table 1). Stakeholders were identified through recommendation by the lead of SUPERB's Dutch demonstration area and snowball sampling (i.e., asking the interviewees for recommendations of whom to interview). All interviews were conducted online in Dutch, with one exception which was conducted in English. The interviews lasted between 1 and 1.5 hours. All interviews were fully transcribed in Dutch, translated in English, and subsequently coded in MAXQDA, a software for qualitative text analysis. Coding was done deductively and inductively. Stakeholder perceptions were analysed using narrative analysis, which aims to identify a problem, causes for the problem, and inherit solutions (Frei et al., 2020).

Table 1: List of interviewed stakeholders, with their individual reference code, gender and affiliation.

Reference code (NL = Netherlands S = Stakeholder)	**Gender**	**Stakeholder's affiliation**	**Notes**
S-1	M	Local government representative	
S-2	M	Private forest owner	
S-3	M	Larger recreational organisation representative	
S-4	M	Smaller recreational organisation representative	
S-5	F	Smaller recreational organisation representative	
S-6	F	Agricultural association representative	
S-7	M	Agricultural association representative	
S-8	M	Agricultural association representative	
S-9	F	Nature conservation organisation representative	
S-10	M	Forestry and forest management representative	
S-11	M	Forestry and forest management representative	
S-12	M	Hunting association representative	S-12 and S-13 interviewed together
S-13	M	Hunting association representative	
S-14	M	Landscape management representative	
S-15	M	Water management representative	
S-16	M	Local community representative	S-17 and S-18 interviewed together
S-17	M	Local community representative	
S-18	M	Local community representative	

RESULTS

Changes to the Kronenbergse forests

All interviewed stakeholders described changes to the Kronenbergse forests in the last decade. Recreational developments were the most discussed, although climate change related changes and agricultural changes were also brought up by stakeholder groups.

Recreational developments

Developments by the equestrian centre

All stakeholder groups, except for the larger recreational organisation, perceived that the creation of new horse-riding routes by the equestrian centre significantly altered forest structure, aesthetics, and recreational potential because parts of the forest were felled to make space for the routes. In addition, forestry, nature conservation, and local community representatives perceived that the creation of the horse-riding routes also had significant legal consequences. One forestry stakeholder claimed that while prior to the development of the routes the forest was part of the Dutch Nature Network (a provincial network of existing and planned nature areas), after the forest was cut its status was revoked by the province because the forest was so fragmented it no longer met the definition of forest. Stakeholders stated that the province and municipality require the equestrian centre to compensate for deforestation by restoring forests elsewhere, however, representatives from the local community, the nature conservation, and a smaller recreational organisation claimed that they had not yet seen any evidence that this is occurring .

Developments by the amusement park

All stakeholders, except for the large recreational organisation, perceived that both past and proposed expansions of the local amusement park have altered the forest and will continue to do so in the future. Agricultural and forestry representatives perceived that past expansions of the amusement park cause more noise and light pollution but believed this has little direct impact on the forest itself and mainly disturbs wildlife and livestock. Nature conservation and local community representatives were more critical of past and planned expansions, especially of a new zoning plan that was perceived to allow more flexibility for long-term, less regulated development and bring more visitors into the forest, thereby increasing recreational pressure and negatively impacting the ecosystem.

Climate change and changes to forest structure

Representatives from agricultural organisations and water management perceived climate change induced changes to the forest, noting that excessive rainfall has caused beech die-off, while recent droughts and bark beetle outbreaks have led to dieback of non-native pine trees planted for mining in the 1960s.

Related to the dieback of pine, agricultural association, hunting association, and recreational organisation representatives perceived that forest "maintenance" has been neglected in recent years and a result the forest looks like a "big mess" and "wilder" because dead and old trees are left in the forest to become deadwood. However, not all these stakeholders thought that the die-back of pine was related to climate change. One representative from a nature inclusive agricultural association linked perceptions of the forest as messy to Dutch culture preferences for orderliness and suggested educating the public about the ecological benefits of deadwood.

Changes to agriculture

Agricultural changes that impacted the forest in the last decades were reported by representatives of agricultural associations and forestry stakeholders. Forestry stakeholders perceived that 20-25 years ago the forest was more fragmented due to many small agricultural owners, but following a governmental funding scheme some agricultural land was converted into forest. Representatives of agricultural organisations also perceived a decrease in the amount of agricultural land surrounding the forest, particularly intensive livestock farms. However, they noted that these have often replaced with intensive arable farms which they thought may have similar negative effects on the forest due to high pesticide and water use.

Challenges and opportunities for forest restoration

The analysis revealed four narratives on the implications of land-use change on forest restoration: (1) *destruction without dialogue*; (2) *managing trade-offs*; (3) *restoration by recreation*; and (4) *farmers bear the burden* (Table 2).

Narrative 1: Destruction without dialogue

Representatives of the local community and nature conservation organisations were the only two stakeholder groups voicing this narrative. They perceived that the developments of the equestrian centre and the amusement park have negatively impacted the forest ecosystem, including by destroying species' habitats, creating noise and light pollution, increasing nitrogen levels and recreational pressure. In the case of the equestrian centre, they claimed that large areas of forest were illegally cut to construct horse-riding routes but that this was ignored or overlooked by public authorities. In the eyes of the local community representatives, these impacts were so extreme that they believed that forest restoration should no longer be prioritised because the recent and planned developments have pushed the forest past the point of return. One representative of the local community explained: "I don't ask about [forest restoration], anymore. It's too late. [The forest] was very, you could say, cute and small. Not many hectares, but you could just go for a walk on Sunday afternoon (…) but it's not nice walking there anymore (…) I don't have plans with our forest, our forest doesn't exist anymore. So, I never think 'how can we change it?`. It's too late" (S-16).

Representatives of the local community felt that the recreational developments were not adequately communicated, and their perspectives were not included in the decision-making process. In response to the proposed new zoning plan of the amusement park, a

Table 2: Narratives on how recreational developments create challenges and opportunities for forest restoration in the demonstration area

	Destruction without dialogue	**Managing trade-offs**	**Restoration by recreation**	**Farmers bear the burden**
Implications for forest restoration	Recent recreational developments have led to major forest destruction without accountability. Forest restoration, once needed, would now be pointless due to the extent of forest loss. Mandatory compensation schemes to restore forests are ineffective and lack transparency. Key stakeholders, especially the local community, are excluded from decision-making.	Recent recreational developments come at a cost for biodiversity, water management, and other ecosystem services. Forest restoration has multiple benefits, including water storage, reducing forest fire risk, increasing forest biodiversity and recreation. Mandated compensation schemes to restore forests may provide an opportunity but must be very carefully managed.	The forest is affected by climate change and disturbances—not by recreational development, which is unfairly blamed and can even benefit the forest by funding restoration. Restoration can help improve forest resilience, but it should not be prioritised over economic activities. Local opposition to the developments is unnecessary and ignores various benefits.	The impact of recent recreational developments on the forest is unclear but have negatively affected farmers who are excluded from decision-making. The equestrian centre, representing private interests, uses its financial power to dominate local agriculture. While forest restoration could enhance resilience and groundwater retention—benefiting farming—it should not come at the cost of losing agricultural land.
Solutions	More transparency, communication, and stakeholder engagement	More transparency, communication and stakeholder engagement	No solutions proposed (recreational developments are an opportunity for forest restoration)	More transparency, communication, and stakeholder engagement
Main stakeholders voicing the narrative	Nature conservation organisation, local community representatives	Landscape managers; hunting association, smaller recreational organisation	Larger recreational organisation; forestry stakeholders; smaller recreational organisation	Agricultural associations

representative of the local community explained: (…) it's a completely different situation compared to five years ago (…) and so we're really worried, many of us are not even optimistic anymore (…) they never talk about us. What is the influence of all this on the people who live around [the forest]? They simulate as if they are interested in us, but they are not" (S-16).

When representatives of the local community and the nature conservation organisation tried to voice their concerns over the planned developments, they felt that they were not properly addressed. Ultimately this led to mistrust of the forest restoration compensation scheme, especially because local community representatives claimed they were not consulted on the placement of the restoration areas. Stakeholders perceived the scheme to be lacking in transparency and unlikely to result in meaningful forest restoration: "And that whole nature compensation, I'd like to see what really comes out of that. I don't believe that only eight hectares have been felled, it's probably much more. And what will be put back? The question is what are they all counting?" (S-18). Similarly, the local community representatives did not believe that the planned expansion of the amusement park would not contribute to more forest loss, although they were informed that the park purchased non-forested land for their expansions.

In response to the perceived lack of communication and transparency by the local authorities and recreational organisations, the local community and nature conservation organisation representatives assumed the role of informing other stakeholders and opening the discussion over the park's development plans since the zoning plan was allegedly the only official source of information. When it came to solutions to the challenges described, stakeholders voicing this narrative called for more transparency, communication, engagement, and accountability from the municipality, province, and recreational organisations. Specifically, representatives of the local community wanted more power in decision-making processes regarding recreational developments. Notably, they claimed that they are not asking for the amusement park to leave, but rather just want a say in how large it's allowed to become.

Narrative 2: Managing trade-offs

This narrative was mainly voiced by water and landscape management representatives and one smaller recreational organisations. In this narrative, stakeholders perceived negative impacts of recent recreational developments on the forest, including more noise and light pollution, lower recreational value for the local community, disturbance of wildlife, and changes to water availability due to high water usage. One landscape management stakeholder commented that the high recreational pressure makes it impossible to have a large-scale approach to biodiversity conservation. While stakeholders voicing this narrative had similar perspectives to the *destruction without dialogue* narrative, they differed in that they believed that the compensation scheme could provide an opportunity for forest restoration with benefits for forest biodiversity, connectivity, water storage, and forest fire management, but only if very carefully planned and managed. Some stakeholders also perceived that the horse-riding routes could have a positive influence on biodiversity by creating open areas within the forest. The water management representative explained the

trade-offs with the development: "Yes, it is getting more crowded, so I think yes, not immediately good for the forest, but on the other hand, such a development can help improve some things in the forest. But you have to steer for that and (...) include that in such a development and such a business case" (S-15).

While the smaller recreational organisation representative perceived that the compensation schemes could be beneficial for the forest, she claimed that she could not see any evidence or any positive impacts yet: "(...) because of those expansions of [the amusement park] and the equestrian centre, they also have to compensate for forest somewhere else, so a number of other stakeholders actually did see it as an opportunity for forest restoration (...) I hope that that indeed happens, but (...) you don't see much of it yet. And I know they are also buying all kinds of areas to create new nature, but it is not yet real nature. And then I think, yes, where there was nature, yes, cherish that. And yes, new nature takes a long time, of course, before it has any value. I think it should still remain a combination" (S-5).

Like the *destruction without dialogue* narrative, stakeholders voicing this narrative called for more communication and stakeholder engagement by the municipality and province in the planning and implementation of the compensation scheme so that forest restoration benefits all stakeholders. Stakeholders voicing this narrative perceived this to be a responsibility of the municipality and province.

Narrative 3: Restoration by recreation

This narrative was mainly voiced by representatives of the larger recreational organisation, the local government, and forests and forest management. In this narrative, stakeholders perceived that recent and planned recreational developments have no or very minor impact on the forest. Instead, they mainly perceived opportunities to fund forest restoration through these developments and therefore saw them as better for the forest in the long term. The local government representative explained how compensation schemes could help improve the connectivity of forest patches: "I am sure [the equestrian centre] is an improvement for the area. I sincerely mean that, because we are now going to tackle the forest area very structurally. Because we also have got the resources for that and also the urgency, and in addition, we had to compensate a lot for what we did there. Because we actually cleared 11 hectares. And 50 hectares of nature will be returned, so that's quite a plus for the area, and it's all elements that are really connected to each other, so you actually get a robust structure" (S-1).

Instead of recreational activities, stakeholders voicing this narrative mainly saw climate change, soil acidification, and disturbances such as bark beetle outbreaks as challenges for the forest, which they thought could be addressed through forest restoration. However, stakeholders argued that forest restoration and nature conservation should not be prioritised over economic activity in the area: "Yes, you hear noise from [the amusement park]. You obviously have economic activity (...) in that area. But from the other side, we also have to be realistic. We all have to ensure that life can continue. You can't just create nature everywhere and do nothing with it (...) we will have to find a mode that the economy runs and that nature survives, because we are in a small country. But I can still just as easily see a

rabbit, a hare, or a baby deer hopping through the woods, even when the [amusement park] is playing music full blast" (S-3). Nature conservation, especially passive approaches, were viewed critically by the stakeholders voicing this narrative because of their perceived inability to generate funds for restoration.

In contrast to the stakeholders voicing the *destruction without dialogue* narrative, stakeholders voicing the *restoration by recreation* narrative thought that the local community held a disproportionate amount of power in decision-making processes related to recreational development. In some cases, they believed that the local community benefited from these developments. The representative of the larger recreational organisation elaborated that stakeholders which are most opposed to the developments of the equestrian centre should be ignored: "What I sense, because of course I live on the edge of that area, is that the screaming people are heard too much. And the large silent middle group, the ones who actually think [the equestrian centre] is doing the right thing, they say nothing. So even politically towards the province, the European community, one should not listen to the people who shout the loudest" (S-3). A forestry stakeholder argued that the recent developments benefited the local community because many other smaller, noisy recreational activities were stopped to make room for the riding routes and now the forest is calmer as a result. Since stakeholders voicing this narrative perceived recreational developments to be an opportunity for forest restoration, they did not see the need for any solutions.

Narrative 4: Farmers bear the burden

This narrative was voiced exclusively by agricultural organisations. In this narrative, stakeholders were more concerned with the impacts of recent recreational development on farmers than on the forest. Impacts on the forest were considered uncertain by some, while others perceived some minor negative impacts from light and noise pollution and disturbances such as horse riding. Forest restoration was considered beneficial to improve forest resilience to climate change and groundwater retention, which would benefit surrounding agriculture, but were not in favour of it if it meant converting agricultural land into forest. One stakeholder from a nature inclusive agricultural organisation shared his perspective on the conversion of agricultural land to forest: "We also believe in agriculture that can produce biodiversity, which can be maintained through extensification. So, we are not in favour of converting agriculture into nature, are we? Denmark has a nice decision to convert 15% of agricultural land into forests. We hope this will not happen here, because we also believe that if managed well, [agricultural land] can yield a lot of biodiversity" (S-7).

Stakeholders voicing this narrative did not perceive the equestrian centre as part of the local agricultural community and believed that it has more power in land-use decision-making because of its wealth: "(..) horse husbandry is of course an agriculture-related organisation (...) but those are people who have nothing at all to do with the area. They are located there because of the millions [of euros] they have and the space they get there. And yes, we also have our members in the region who are just very much affected by that. You see horticulture has just had to make space, because an equestrian centre had to be constructed there. There are two cattle farms (...) they were literally just destroyed in order to make space and in this

case, it was for [the amusement park]. So, we already have farmers there who are very much affected by this and with whom we also collaborate to see if we can support them in this. But then you just run into the wall of the big money, so to speak" (S-6).

As agricultural stakeholders largely viewed the impacts of recreational development on the forest to be uncertain or minor, the solutions proposed mainly concerned the impact of the developments on the agricultural community. One stakeholder perceived that the recreational organisations can silence any opposition because of the money they have, and therefore meaningful stakeholder engagement processes are needed: "You especially notice the impact that that these [recreational] projects have. I don't want to say so much, but they have a bag of money and can afford to say, well, they buy it off and then nobody talks about it anymore. You see that clearly happening" (S-6).

KEY FINDINGS

Different perspectives exist on how land-use changes impact the forest and who has decision-making power

While all stakeholders agreed that the Kronenbergse forests have undergone land-use changes in the last decade mainly related to recreational developments, stakeholder perspectives on how these changes impact the forest varied considerably across stakeholder groups, ranging from near complete destruction of the forest to providing an opportunity to restore it. In addition, there were discrepancies in stakeholder perceptions of who had the most decision-making power when it comes to land-use in the area. Representatives from the nature conservation organisation, local community, and agricultural associations perceived that the municipality, the province, and larger recreational organisation had the most power while they themselves had no power. In contrast, other stakeholders, like the larger recreational organisation, believed stakeholders opposed to the developments – including representatives of the local community - had more decision-making power.

Governance of past and present land-use changes can influence stakeholder interest in forest restoration

For representatives of the nature conservation organisation, the local community, and the agricultural associations, past and current governance of land-use changes unrelated to forest restoration influenced their interest in the latter. Local community representatives were not interested in forest restoration because they believed that the forest had already been irreversibly altered from recreational development, which they felt damaged the forest and the local community. Representatives from agricultural organisations were sceptical of forest restoration because they had already lost farms due to recreation developments and feared further losses from restoration invitiatives. In addition, the perceived lack of communication, transparency, and stakeholder engagement by the municipality, province,

and recreational organisations lead to scepticism regarding the effectiveness of mandatory forest restoration compensation schemes.

Most stakeholders called for more transparency and communication – with different goals in mind

Notably, all stakeholder groups – except those subscribing to the recreation for restoration narrative – called for more transparency, communication, and stakeholder engagement, although their goals varied. Local community and nature conservation representatives sought more information about the impacts of recreational developments on the forest and local community and platforms to voice their concerns. Stakeholders who thought that restoration may be an opportunity if trade-offs are managed focused on improving communication around mandatory restoration compensation schemes to ensure positive outcomes for multiple ecosystem services. Agricultural associations emphasised the need for engagement and transparency on how recreational development will impact the local farming community. In contrast, those who saw recreational developments as solely an opportunity for restoration did not propose related measures.

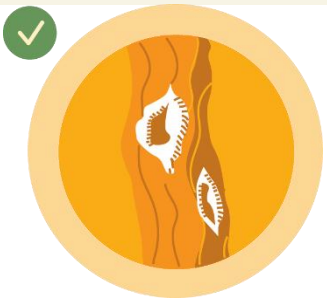
RECOMMENDATIONS

Create a shared understanding among stakeholders

The different stakeholder perspectives on the impacts of land-use change on the forest and who holds the most decision-making power led to conflicts and mistrust among stakeholders. Future stakeholder engagement should aim to create a shared understanding of land-use impacts and power dynamics which will ultimately help guide forest restoration in the future.

Include stakeholders from the start and acknowledge past grievances

This study found that even when past and present land-use changes are unrelated to forest restoration, they can shape stakeholder perceptions of it, particularly through how those changes were governed. A lack of support for restoration may stem not from the restoration itself, but from previous landscape changes and governance processes, especially lack of stakeholder engagement. This highlights the need to engage stakeholders in land-use decision making from the beginning and explore how past experiences influence stakeholder attitudes toward forest restoration and seek to amend past grievances.



Develop tailored communication strategies

The differing objectives behind stakeholder calls for more communication and stakeholder engagement suggests that a one-size-fits-all engagement process would be ineffective. Instead, communication and engagement processes should be adaptive, acknowledging that stakeholders have different stakes and histories related to land-use and forest restoration.

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