# Stakeholder perceptions of Nature-based Solutions (NbS): potential, risks and ways forward

## Appendix

### Afforestation, reforestation and forest management

#### Climate risks

The predominant climate risks associated with this family of practices predominantly involve droughts, which pose significant threats particularly to seedlings and young trees. In contrast, mature forest systems are reported to demonstrate considerably greater resilience to such hazards. As illustrated in Figure 1, forest fires are identified as a critical risk factor, encompassing a complex array of contributing elements including droughts, high winds, heatwaves, tree health, species diversity, and socio-environmental factors such as land abandonment, rural depopulation, and increasing land competition. Stakeholders also highlighted that erosion poses a threat to afforestation and reforestation initiatives, especially in cases where soil degradation avoids the sustenance of the preferred tree species, necessitating time-consuming and costly land restoration interventions.

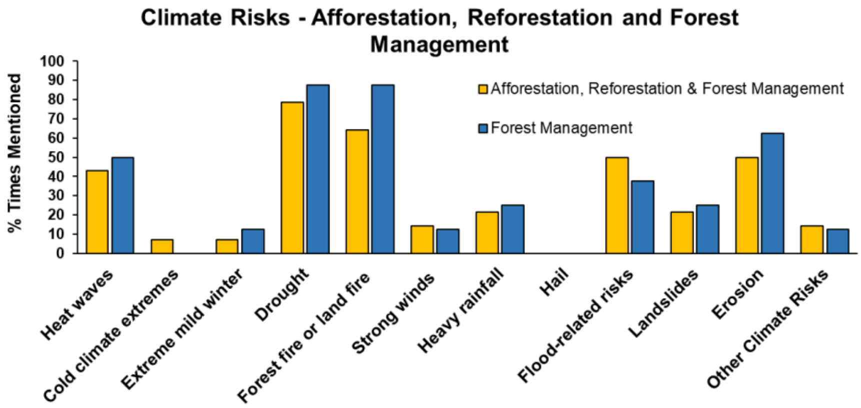


**Figure 1: climate risks in afforestation, reforestation and forest management**

However, stakeholders indicated that many of these risks can be mitigated through sensible species selection and strategic system design. This includes avoiding monocultures and incorporating a diverse age range of trees, with consideration given not only to current environmental conditions but also to projected climate scenarios for the region.

## Effects on the environment

Sustainable forestry practices are reportedly associated with beneficial outcomes for soil health and biodiversity, as illustrated in Figure 2. Well-designed forest systems facilitate the development of diverse habitats, thereby fostering complex biological interactions and nutrient cycles. A particularly interesting practice within this study is indigenous forest fire management; controlled forest fires at the beginning of the dry season consume excess biomass, with stakeholders reporting a lower incidence of larger-scale forest fires later in the season, resulting in carbon gains and improved soil quality in some cases.

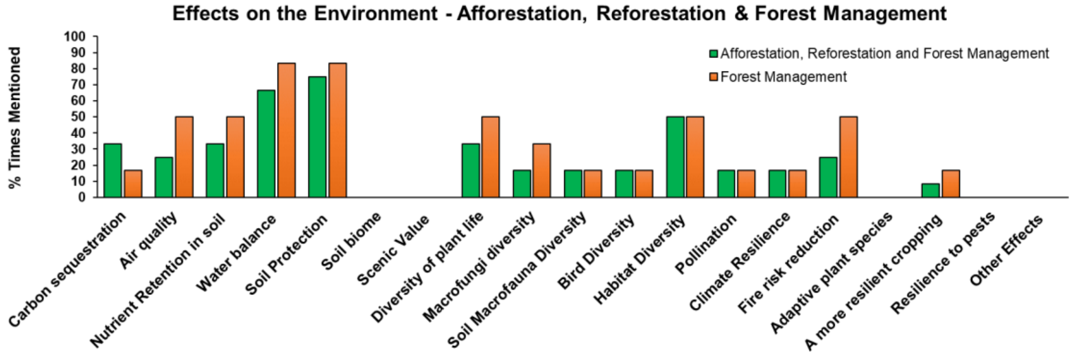


Figure 2: effects on the environment of afforestation, reforestation and forest management

# Sustainable agriculture

## Climate risks

As illustrated in Figure 3, droughts and intense rainfall events are identified as primary climate risks impacting sustainable agricultural practices. A closer examination reveals that these risks are primarily associated with increasing variability and unpredictability in precipitation patterns, characterized by extended dry periods followed by intense rainfall. This fluctuation exacerbates soil erosion and threatens crop yields. The particular practice of dry-seeded rice, while mitigating some drought-related risks, is especially vulnerable to heavy rains and strong winds. The distribution of rainfall significantly influences manure management practices; excessive rainfall following manure application leads to pronounced $N_2O$ emissions, impacting environmental and agricultural outcomes (Meijide et al., 2007).

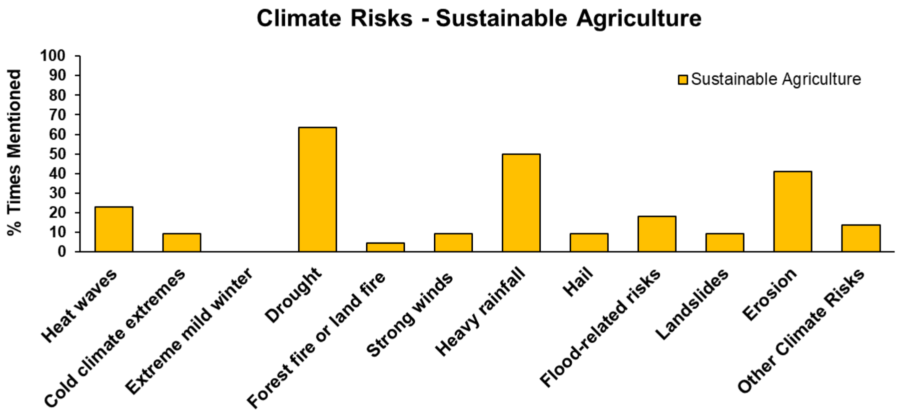


Figure 3: climate risks in sustainbale agriculture

## Effects on the environment

Reported positive environmental outcomes associated with sustainable agricultural practices are predominantly related to enhancements in soil properties, as depicted in Figure 4. In several regions, stakeholders have successfully achieved land restoration through these practices. One noteworthy adaptation involves regreening through manure application, where the manure, containing seeds of local trees and shrubs, facilitates ecosystem restoration and biodiversity enhancement upon application.

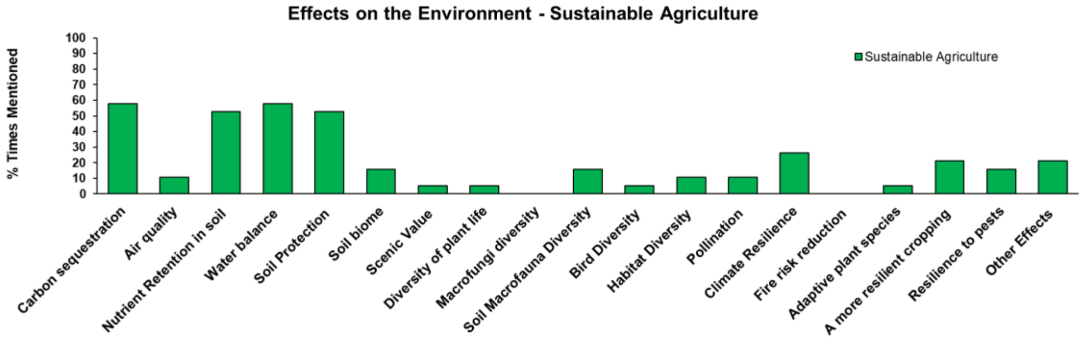


Figure 4: effects on the environment of sustainable agriculture

Many of the assessed techniques contribute to improvements in soil carbon content and structure, which enhances water retention and decreases the soil's vulnerability to erosion from heavy rainfall and wind. These improvements increase the system’s resilience to climatic extremes. Furthermore, enhanced soil structure has been reported to benefit aquifer quality and reduce reliance on external soil inputs.

However, stakeholders predominantly prioritize profit maximization, therefore any adopted measures must offer clear, tangible benefits. These benefits may include increased crop yields, additional revenue through carbon credits, or enhanced resilience without compromising yields or necessitating substantial investments.

# Agroforestry and agrosilvopastoral systems

## Climate risks

While not entirely immune, most stakeholders emphasized the notable resilience of systems involving mature trees to climate extremes. However, as illustrated in Figure 5, periods of drought or intense heatwaves are perceived as significantly detrimental to young trees and seedlings, inhibiting the system from reaching maturity and, if prolonged, negatively affecting the health of mature trees. This issue is exacerbated during droughts when animals graze on young trees due to the scarcity of their preferred food sources. Fruit-bearing trees, including nut trees, exhibit heightened vulnerability to climatic anomalies such as late frosts, strong winds, heavy rains, or droughts, which may lead to harvest failures. Additionally, unusually cold temperatures have been reported to adversely impact certain tropical agroforestry crops, such as arabica coffee. However, stakeholders noted that most risks can be mitigated through appropriate species selection and system design, taking into account not only current climate patterns but also anticipated changes due to climate change.

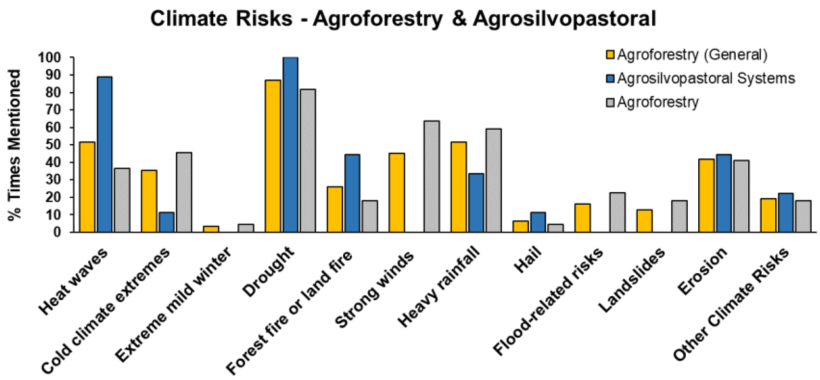


Figure 5: climate risks in agroforestry and agrosilvopastoral systems

Agrosilvopastoral systems are perceived as more susceptible to climate extremes compared to agroforestry systems. This difference is attributed to the fact that assessed agrosilvopastoral systems typically involve trees within non-actively managed grazing grasslands, whereas agroforestry systems integrate trees with actively managed crops. Disruptions in rainfall patterns and temperature fluctuations are reported to induce the germination of grasses and legumes outside their normal growing seasons, leading to the depletion of functional seeds in their usual growing period. This results in reduced soil coverage, diminished water retention, and increased susceptibility to erosion during heavy rainfall.

## Effects on the environment

The integration of trees into agricultural land is widely perceived as significantly enhancing the resilience of these systems to climate extremes and improving their overall health. As illustrated in Figure 6, stakeholders report benefits in soil health, particularly when legume trees are included, although these benefits are often localized to areas near the trees. It is important to emphasize that the reduction in nitrate leaching has been frequently highlighted as a key impact, leading to improved aquifer quality with positive implications for human health (Richards et al., 2022). Agroforestry systems are also reported to increase resilience against drought by providing shade, and to offer protection from strong winds and heavy rains, thereby playing a critical role in preventing and reversing erosion. The inclusion of trees in agricultural systems is also reported to enhance pollination and resilience against pests by fostering greater biodiversity. In addition, stakeholders noted an increase in the resilience of their business models through the diversification of income sources between crops and forestry products, as well as the opportunity to cultivate species that require more shade or protection. This diversification also provides a buffer against fluctuations in commodity prices.

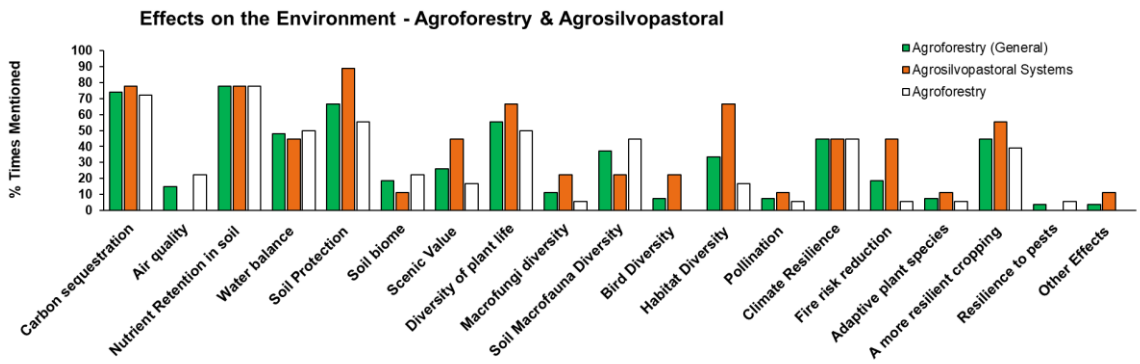


Figure 6: effects on the environment of agroforestry and agrosilvopastoral systems

In agrosilvopastoral systems, the presence of grazing animals is reported to increase system diversity by accelerating carbon and nutrient cycles. The rapid consumption of grass biomass and the contribution of nutrients through manure, especially when multiple grazing species are present, create a less competitive environment that allows a wider variety of plant species to proliferate. This process enhances the resilience of the system by closing biological cycles.

# Wetland rewetting

## Climate risks

Severe droughts are reported to have a profound impact on wetlands, often leading to their desiccation, as depicted in Figure 7 . Even artificially managed wetlands are susceptible to droughts when water reservoirs are insufficient to sustain the water table. Stakeholder responses highlights the vulnerability of peatlands to smouldering combustion when they become desiccated, a process that can result in significant carbon losses

(Turetsky et al., 2015). Heavy rainfall was also reported as a risk to agricultural lands with artificially raised water levels, complicating the use of machinery due to waterlogged conditions.

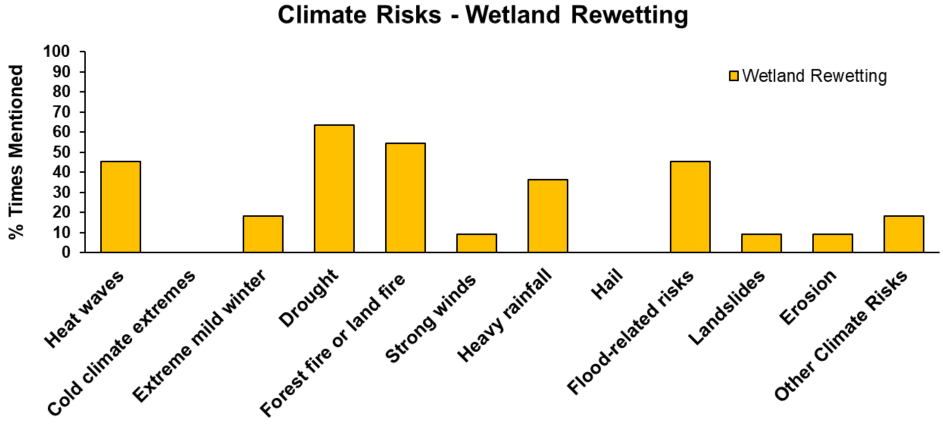


Figure 7: climate risks in wetland rewetting

Coastal tropical wetlands deserve special attention, as they are particularly vulnerable to river and coastal floods. In the case of coastal flooding, there is a reported risk of severe and long-lasting damage to soil properties due to high levels of salt infiltration, which can damage soil quality for years.

## Effects on the environment

The primary environmental benefit reported from rewetting temperate wetlands is the prevention of GHG emissions due to reduced soil oxidation. The relatively low representation of this perception in Figure 8 can be attributed to the lower awareness of carbon sequestration in wetlands among respondents from tropical regions. A significant environmental effect of wetland rewetting, not depicted in Figure 8, is the prevention of soil subsidence. This phenomenon, where the compaction of drained organic soils causes a decrease in ground level, can lead to widespread infrastructural damage and substantial repair costs.

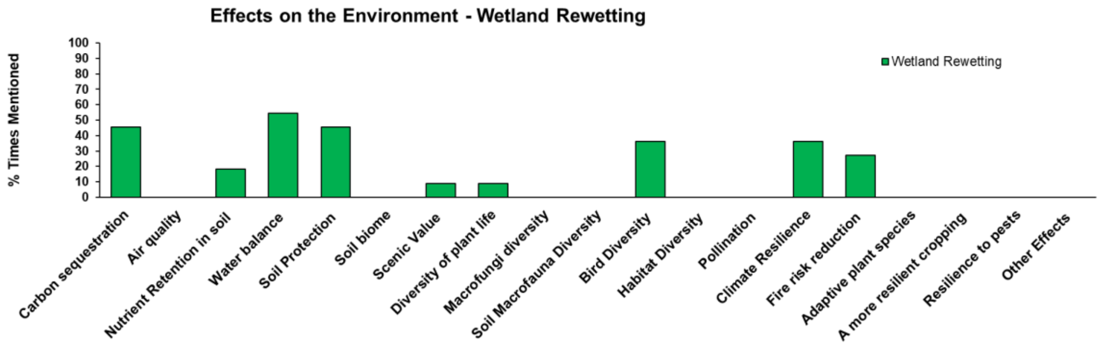


Figure 8: effects on the environment of wetland rewetting

Other commonly reported impacts of wetland rewetting include increased biodiversity and enhanced resilience against floods and heavy rainfall. The latter is particularly emphasized by stakeholders in tropical regions, who note that the increased water retention capacity of the soil plays a critical role in mitigating the effects of extreme weather events.

## Questionnaire

# Introduction to the questionnaire and interview guidelines

The goal of this questionnaire is to evaluate the resilience of Land Mitigation Techniques towards Climate Change and natural catastrophes. Land Mitigation Techniques are practices on the use of land that allow to either capture $CO_2$ or decrease the $CO_2$ emissions compared to current practices, with the goal of mitigating climate change. In this survey, we evaluate the effect large-scale implementation of LMT would have on the social and economic wellbeing of the hosting societies.

The survey consists of 5 sections:

| | |
|---|---|
| Section 1: General questions | Stakeholder profiling questions |
| Section 2: Climate-related risk factors | Climate extremes that could affect LMT |
| Section 3: Effect on the local environment | How does LMT shape the environment |
| Section 4: Interview | Impacts for upscaling LMT |
| Section 5: Closing-up questions | Short questions to record SH's subjective opinion on LMT after reflecting during the interview |

This questionnaire is to be filled by Case Study (CS) leaders during and after the interview session with the stakeholders. A list with the parameters addressed in sections 3 (effect of LMT on the local environment- WP3) and section 2 (climate-related risk factors- WP4) and the General Data Protection Regulation (GDPR) consent will be sent to the stakeholders before the interview for pre-selection. Once in the interview, the Case Study leaders will ask the stakeholder to provide details on the pre-selected parameters according to the questionnaire.

In section 4 (upscaling risks of individual LMT-WP5), CS leaders and regional leaders can use this document as a guideline for interviewing stakeholders. The topics are meant as a first direction, to be customized based upon the knowledge of the stakeholder and supplementary sources, such as literature reviews.

The central questions regarding risk are on the relevance of an event or risk type for/to a stakeholder, the effect from/to an LMT, and the stakeholder interpretation of the associated time and spatial scales.

In section 2, Climate-related risk factors, we look at the climate events that could compromise the success of LMT. The nature of these events is often more seasonal/cyclical/recurring.

In section 4, suggested interview guidelines…, events can be interpreted as both seasonal/cyclical/recurring and singular. Example: 1. Land use challenges might occur every year due to environmental conditions (cyclical). 2. There might be a development in the (distant) future that significantly challenges land use, such as an ecosystem shift (singular).

These temporal and spatial scales, and their interpretation, are likely to differ between stakeholders.

**Interview guideline step overview:**

1. Send the GDPR consent form. **The consent form must be sent out no less than 48 hours before the interview.**
2. Send the **pre-selection form** at least **48 hours** before the interview. The stakeholder will be asked to select **up to 5 parameters in sections 2 and 3.**
3. Fill in the already known information in section 1 with the goal of saving time.

4. In sections 2 and 3, ask the stakeholder to elaborate on the selected parameters and write notes in tables 1 and 2
5. In section 4, **show table 3** to the stakeholder and bring up the topics of discussion (in bold), with the help of examples of parameters within the topic (in bold, black letters). **Write the notes in each topic's tables (tables 4 to 12) and come back to table 3 after the topic has been discussed to continue to the discussion**.
6. Ask the stakeholder the **closing-up questions** at the end of the questionnaire.
7. **After the interview, write a 1-2 pages summary with the main outcomes of the interview**. The goal is to document all the ideas that couldn't be recorded by the survey.

More detailed information about the process can be found in each section.

(Our data gathering and practices are fully compliant with GDPR, and your privacy will be fully assured. For more information on our data management policy, see the GDPR consent form with contacts listed. Your name will only be used to contact you for further information. Your gender and organization will help inform the different perspectives on the issues at hand)

# 1. General Information

**LMT and site**

Assessed Land Mitigation Technique:

Locally used name of LMT:

Country:

Location:

**Contact details of the resource person**

Name*:

Gender**: Male/Female/Other (specify)

Organisation*:

Perceived age group: <25/25-35/35-45/45-55/>55

**Other information**

☐ land user ☐ SLM (Sustainable Land Management) specialist/ technical adviser ☐ other (specify): …………..

Occupation:

**Please ask the stakeholder**: What is your main interest in relation to the implementation and further upscaling of LMT in your country? (eg. Economical, protection of the environment, cultural values...)

Date:

*Your name and organisation will not be disclosed

# 2. Climate-related risk factors of LMT

In this section, you will ask the stakeholder about the exposure of LMT to climate-related extreme events, the probability (likelihood) that a specific event can occur, as well as the magnitude of the potential damage/harm (severity) of that climate-related extreme event **for the pre-selected event types.**

Also briefly describe how the extreme event(s) can affect LMT (*e.g. excessive heat limiting growth*). If the stakeholder is aware of specific critical event related thresholds values relevant to LMT, or past extreme events, please note them (*e.g. daily maximum temperatures above 30°C for 7 consecutive days, the cold wave of February 2020…*). Also, list any relevant sources of information if known, and past events that fit into the category.

| Climate-related extreme events or disasters | Mark the 5 most relevant events | Critical event threshold values for LMT | Past events | Comments |
|---|---|---|---|---|
| **2.1 Heat waves** | | | | |
| **2.2 Cold waves (unusually cold conditions at any time of the year)** | | | | |
| **2.3 Extreme cold winter conditions (e.g. frost)** | | | | |
| **2.4 Extreme mild winter conditions** | | | | |
| **2.5 Drought** | | | | |
| **2.6 Forest fire or land fire (grass, shrub, bush)** | | | | |

| Climate-related extreme events or disasters | Mark the 5 most relevant events | Critical event threshold values for LMT | Past events | Comments |
|---|---|---|---|---|
| **2.7 Strong winds**<br>(e.g. related to storm systems; if known please specify the types of weather systems that play a role, e.g. tropical cyclones, thunderstorms, etc.) | | | | |
| **2.8 Heavy rainfall** | | | | |
| **2.9 Hail** | | | | |
| **2.10 Snow** | | | | |
| **2.11 River flood** | | | | |
| **2.12 Flash flood** | | | | |
| **2.13 Storm surge / coastal flooding** | | | | |
| **2.14 Sea level rise** | | | | |
| **2.15 Landslides** | | | | |
| **2.16 Erosion** | | | | |

| Climate-related extreme events or disasters | Mark the 5 most relevant events | Critical event threshold values for LMT | Past events | Comments |
| --- | --- | --- | --- | --- |
| **2.17 Other relevant climate events not listed above** | | | | |
| | | | | |
| | | | | |
| | | | | |

Table 1

## 3. Effect of LMT in the local environment

**In your opinion, how does LMT contribute to:**

| Parameter | | Mark the 5 most relevant events | Comments |
|---|---|---|---|
| Soil, Water and Air | **3.1 Carbon sequestration** | | |
| | **3.2 Air quality**<br>(impact on reduction / increase of air pollutants like NOx, Sox, PM, NH3, etc.) | | |
| | **3.3 Nutrient Retention in soil:**<br>the capacity of a system, contributing to the reduction of nitrogen and phosphorus leaching and consequent improvement in the quality of infiltrated water | | |
| | **3.4 Water balance or "Hydric balance":**<br>Regulation of water flows due to the specific plant characteristics, under specific conditions, contributing to the management of water availability | | |
| | **3.5 Soil Protection:**<br>Control soil erosion, water infiltration, nutrient retention, atmospheric gas regulation, soil acidity and salinity | | |

| Parameter | | Mark the 5 most relevant events | Comments |
|---|---|---|---|
| | **3.6 Soil biome**<br>e.g. microorganisms contributing to soil fertility | | |
| **Diversity** | **3.7 Scenic Value of the Landscape:**<br>prevention of landscape fragmentation, ensuring ecological sustainability and maintenance or preservation of the scenic and cultural value of the national landscape. | | |
| | **3.8 Diversity of plant life or “Phytodiversity”:**<br>Flora diversity in terms of abundance, species richness and rarity. Maintenance or preservation of mosaic and non-productive and heterogeneous structures | | |
| | **3.9 Macrofungi diversity:**<br>Fungi species that contribute to nitrogen and phosphorus fixation and soil quality (e.g. mushrooms) | | |
| | **3.10 Soil Macrofauna Diversity:**<br>species of arthropods and other invertebrates that regulate habitat and soil quality (e.g. earthworms) | | |
| | **3.11 Bird Diversity:**<br>management of any mosaics or plots in the landscape to ensure bird diversity | | |
| | **3.12 Habitat Diversity:**<br>increasing ecosystem diversity changes environment’s patterns (e.g. increased resilience to plagues) | | |

| Parameter | | Mark the 5 most relevant events | Comments |
|---|---|---|---|
| | **3.13 Pollination:**<br>Ensuring the existence and distribution of pollinating agents that contribute to the pollination of neighbouring agricultural fields and ensure productivity (e.g. bees) | | |
| **Resilience** | **3.14 Climate Resilience:**<br>regulation of the concentration of GHG in the atmosphere soil carbon sequestration and systems' vegetation cover  Increased CO2 sequestration… | | |
| | **3.15 Fire risk reduction:**<br>Reduction of incidence, intensity or propagation capacity of fire episodes due to social, biophysical characteristics and system's landscape | | |
| | **3.16 Adaptive plant species**<br>(short life, drought resistance, high nutrient efficiency, high production, pest and disease resistance) | | |
| | **3.17 A more resilient cropping system** (organic agriculture, agroforestry, multi-species and multi-product) | | |
| | **3.18 Resilience to pests**<br>Pest attack patterns on plants | | |

Table 2

# 4. Interview guidelines for risks & opportunities in upscaling of LMT

**Overview:**

1. Read introduction
2. Show table 3 to the stakeholder and start a dialogue with the stakeholder about the topics (in bold), with help of the examples (in bold back) to help trigger ideas.
3. Write any relevant observations from the stakeholder in the tables referring to each topic (tables 4 to 12). If the discussed topic does not fit with any of the categories described on the tables, use the provided blank space.
4. When you've finished taking the notes, come back to table 3 to continue discussing the next topic, and continue this process until all relevant parameters have been addressed.

Estimated time needed: ~30mins.

**Introduction guidelines for CS lead:**

The following questions are meant as a (semi-structured) interview guideline. The outputs of these efforts will be used to inform a survey focused on a greater reach of stakeholders based on the breadth of information collected in the interviews. The following categories are meant as a starting point for the dialogues and customization of the (structured) interviews. CS/Regional lead can make changes as they see fit based on their literature review, expertise, and interactions with the consortium such as modelling teams.

In this part, we ask you to evaluate the risks in the implementation LMT could face from different stakeholder perspectives across 9 risk contextual categories (see Table 3).

To complete this part, it is important to define the concept of "risk". **Risks** refer to a specific possible outcome that is perceived to be negative, varies across scales: time scale, governance scale (national provincial/local-national government), area of location and size of land are highly dependent on your perspective. Therefore, we aim to gather your perception of risks in LMT you have experience with.

By **risks**, we mean the **barriers** to implementing land-use based mitigation options or potential **negative outcomes** of implementing the land-use based mitigation option.

On the opposite side of risks we have **opportunities** that can ***enable*** the implementation or scaling up of an LMT and have ***positive impacts***. Thus opportunities are also based on contextual factors as listed in Table 3 below) including technology, politics, policy, institutions, society, economy/market, businesses and the environment.

We refer to 9 main contextual categories of risk in Table 3:

| **Table 3: Contextual factors for impact: barriers and enablers to implementing LMT** |
|---|
| 1. **Technology/practice** parameters: Land-use based technology/practices risks refer to the negative impact the technology may have on people or the environment or challenges to implementing and/or scaling up the technology **(e.g. technical challenges, scalability challenges, accidents, failure of the technique to reach its targets…)** |

| Table 3: Contextual factors for impact: barriers and enablers to implementing LMT |
|---|
| 2. **Political parameters** refer to policy choices that cause dissent and disputes among political actors and groups within the same or different jurisdictions **(e.g. lack of political support, political instability, corruption…)** |
| **3. Institutional parameters** refer to implementation challenges and opportunities, lack of coordination or conflict within or across institutions, or a lack of institutional legitimacy **(e.g. institutional misalignment, long/tedious bureaucracy, exceptional institutional support, lack of institutional legitimacy, inclusion of LMT in national NDC…)**<br>*Note:* Institutions are defined as "formal and informal rules and norms that organise social, political and economic relations"[1] (North, 1990). They may include policy, education, market, religious, and cultural institutions |
| **4. Policy parameters** refer to challenges and opportunities with implementing policies such as policy instruments, regulations, strategies, programmes and initiatives **(e.g. poor policy design, challenges with policy implementation, strong policy support, lack of adequate monitoring…)** |
| 5. **Societal parameters** refer to the social support towards implementing a technology such as threatening societal groups and/or creating inequalities among them **(e.g. proximity of the technology to communities, social changes, local culture, lack of knowledge, resistance to behavioural change, preference for the new scape, negative health impacts, impact in daily life of locals…)** |
| 6. **Economy-wide factors** refer to the influence of policies on national economic indicators, which might affect specific stakeholders such as public or private organizations, local SHs **(e.g. trade imbalances, energy security, market regulation, lack of subsidies, market domination…)** |
| 7. **Business factors** refer to specific challenges and opportunities related to running a business including investment challenges, payback periods and revenue stream **(e.g. investment challenges, more diversified sources of income, high capital costs, long payback period…)** |
| 8. **Environmental factors** refer to changes in the nature/environment including human, flora and fauna ecosystems **(e.g. biodiversity loss, waste issues, increase in biodiversity…)** |
| **9. Avoided costs** derived from the implementation of LMT **(e.g. avoided infrastructure expenses due to avoided soil subsidence, avoided costs in water purification because of avoided chemical substances leaching…)** |

Table 3

Thus both risks and opportunities could take place at different temporal and spatial scales. Increased risk could be an immediate effect of a technology or practice being implemented, or it could only be relevant decades from now. The risks could also be different at different spatial scales: for example, at a local scale, there could be more immediate environmental effects that might not be relevant at a national scale. Finally, the time dimension of risks could be different at different scales: countrywide risks might not be apparent for decades, while local risks are felt more immediately.

The temporal scale is interpretable as seasonal/cyclical/recurring and singular events. In some cases, stakeholders will understand events to be part of a cycle: for example, a political season of 1-4 years, re-occurring environmental events, or implementation delays. In other cases, stakeholders will put forth singular events: while risks due to worsening climate change could be cyclical (drought every 1-4 years, heatwaves in summer, hail in

[1] North, D. (1990). Institutions, institutional change, and economic performance. New York: Cambridge University Press See in GSDRC: https://gsdrc.org/topic-guides/inclusive-institutions/concepts-and-debates/defining-institutions/

winter), the risk of an overall loss of land due to a climate shift and its change in land use (and associated cultural/institutional/economic consequences) might be a singular event risk – in the near or distant future. In these guidelines, we aim to capture both interpretations that stakeholders might have for these risks – both the cyclical, and likely more near term, worries, and the singular events.

Please rate the risk & opportunity relevance following parameters for their importance to LMT, NA if the risk does not apply. Some specific fields are included and explained for each of the categories – the applicable time scale and spatial scales. For all fields, we have included space for explaining the answer and added a comment section for any additional remarks.

In the tables below we will refrain from using the terms risks and opportunities to avoid confusion. Instead, we will talk about risks as barriers and/or negative outcomes and opportunities as enablers and positive outcomes. We will simply refer to them as negative or positive impacts. Stakeholders intuitively can talk about negative and positive aspects without having to refer to our risk and opportunity framing.

### 4.1. Land-use based mitigation technology/practices risks (barriers/negative outcomes) & opportunities (enablers/ positive outcomes)

- Applicable time scale: for which time scale is this impact most relevant (months, years, decades…)
- Applicable spatial scale:
    - Technology implementation scale (individual, household, community, municipality, sub-national, national, supranational, global)
    - Technology spatial impact scale: at which technology scale does this risk take place? (Individual, household, community, municipality, sub-national, national, supranational, global)

| LMT/Technological negative or positive impacts | Applicable time scale | Applicable spatial scale | Comments |
|---|---|---|---|
| Technical challenges: (high cost, unavailability of materials…) | | | |
| Infrastructure integration challenges | | | |
| Technological lock-in | | | |
| Scalability challenges | | | |
| Technical accidents | | | |
| Failure of LMT to reach mitigation targets and/or future reversal | | | |
| Failure of technology to reach adaptation targets | | | |
| Other technology impacts (free text) | | | |
| | | | |
| | | | |

Table 4

### 4.2. Political risks (barriers/negative outcomes) & opportunities (enablers/ positive outcomes)

- Applicable time scale: for which time scale is this impact most relevant (months, years, decades…)
- Governance scale: at which governance scale does this impact take place? (community, city, province/state/national/Supernational/Continental/global)

| Political negative or positive impacts | Applicable time scale | Applicable governance scale | Comments |
|---|---|---|---|
| Lack of political support (existence of higher priorities…) | | | |
| Political instability | | | |
| Corruption | | | |
| Other political risks (free text) | | | |
| | | | |
| | | | |

Table 5

**4.3. Institutional risks (barriers/negative outcomes) & opportunities (enablers/ positive outcomes)**

- Applicable time scale: for which time scale is this impact most relevant (months, years, decades…)
- Governance scale: at which governance scale does this impact take place? (community, city, province/state/national/Supernational/Continental/global)

| Institutional negative or positive impacts | Applicable time scale | Applicable governance scale | Comments |
|---|---|---|---|
| Institutional misalignment | | | |
| Exceptionally strong institutional support | | | |
| Lack of institutional legitimacy | | | |
| Inclusion of LMT within national NDC | | | |
| Other institutional impacts (free text) | | | |
| | | | |
| | | | |

Table 6

### 4.4. Policy risks (barriers/negative outcomes) & opportunities (enablers/ positive outcomes)

- Applicable time scale: for which time scale is this impact most relevant (months, years, decades…)
- Governance scale: at which governance scale does this impact take place? (community, city, province/state/national/Supernational/Continental/global)

| Policy negative or positive impacts | Applicable time scale | Applicable governance scale | Comments |
|---|---|---|---|
| Poor policy design | | | |
| Challenges with policy implementation | | | |
| Strong policy support | | | |
| Lack or inadequate monitoring and evaluation | | | |
| Long/tedious bureaucracy | | | |
| Other policy impacts (free text) | | | |
| | | | |
| | | | |

Table 7

### 4.5. Societal risks (barriers/negative outcomes) & opportunities (enablers/ positive outcomes)

- Applicable time scale: for which time scale is this impact most relevant (months, years, decades…)
- Societal scale: at which governance scale does this impact take place? (individual, household, community, municipality, sub-national, national, supranational, global)

| Societal negative or positive impacts | Applicable time scale | Applicable societal scale | Comments |
|---|---|---|---|
| Proximity of the technology to local communities | | | |
| Social changes | | | |
| Social injustice | | | |
| Resistance to behavioural change | | | |
| Societal resistance | | | |
| Preference for the new scape | | | |

| Societal negative or positive impacts | Applicable time scale | Applicable societal scale | Comments |
|---|---|---|---|
| Local culture (social class, social rules…) | | | |
| Capacity gap (lack of knowledge…) | | | |
| Impact daily lives and practices of local communities | | | |
| Negative health impacts | | | |
| Other societal impacts (free text) | | | |
| | | | |
| | | | |

Table 8

### 4.6. Economy-wide (barriers/negative outcomes) & opportunities (enablers/ positive outcomes)

- Applicable time scale: for which time scale is this impact most relevant (months, years, decades…)
- Spatial impact scale: at which technology scale does this impact take place? (Individual, household, community, municipality, sub-national, national, supranational, global)

| Economy-wide risks negative or positive impacts | | Applicable time scale | Applicable spatial scale | Comments |
|---|---|---|---|---|
| Trade imbalances | | | | |
| Energy security challenges | | | | |
| Market domination | | | | |
| Market regulations | | | | |
| Lack of subsidies | | | | |
| Other economic factors (free text) | | | | |
| | | | | |
| | | | | |

Table 9

**4.7 Business risks (barriers/negative outcomes) & opportunities (enablers/ positive outcomes)**

- Applicable time scale: for which time scale is this impact most relevant (months, years, decades…)
- Spatial impact scale: at which technology scale does this impact take place? (Individual, household, community, municipality, sub-national, national, supranational, global)

| Business negative or positive impacts | Applicable time scale | Applicable spatial scale | Comments |
|---|---|---|---|
| Investment challenges | | | |
| High(er) capital costs | | | |
| Long payback period | | | |
| More diversified sources of income | | | |
| Uncertain/revenue stream | | | |
| Other business factors (free text) | | | |
| | | | |
| | | | |

Table 10

**4.8. Environmental risks (barriers/negative outcomes) & opportunities (enablers/ positive outcomes)**

- Applicable time scale: for which time scale is this risk most relevant (months, years, decades…)
- Environmental scale: at which environmental scale does this impact take place? (individual, household, community, municipality, sub-national, national, supranational, global)

| Environmental negative or positive impacts | Applicable time scale | Applicable environmental scale | Comments |
|---|---|---|---|
| Land-use change | | | |
| Low emissions reductions potential | | | |
| Biodiversity loss | | | |
| Increase in biodiversity | | | |
| Water and soil management | | | |
| Other environmental factors (free text) | | | |
| | | | |
| | | | |

Table 11

### 4.9. Possibilities for avoided costs

- Applicable time scale: for which time scale is this risk most relevant (months, years, decades…)
- Spatial impact scale: at which technology scale does this impact take place? (Individual, household, community, municipality, sub-national, national, supranational, global)

| Possibilities for avoided cost | Applicable time scale | Applicable spatial scale | Comments |
|---|---|---|---|
| Avoided soil subsidence | | | |
| Avoided chemical substances leaching | | | |
| Other environmental factors (free text) | | | |
| | | | |
| | | | |

Table 12

# 5. Closing-up questions

- Which is the main constraint to the implementation of the LMT in your opinion?

- Which of the opportunities are the most promising in your opinion?

- Would you invest in LMT if you had the resources? (yes/no)

- Why (not)?

- (To be filled by CS lead): Perceived singularities/vulnerabilities of the stakeholder)

- Are you interested in participating in future workshops and questionnaires?

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