ISET

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Policy Institute

REGULATORY IMPACT ASSESSMENT OF THE DRAFT LAW ON WINDBREAKS

FINAL REPORT

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ACRONYMS

AMMAR	Agriculture Modernization, Market Access and Resilience Project
APA	Agency of Protected Areas
CBA	Cost-Benefit Analysis
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GoG	Government of Georgia
IFAD	International Fund for Agricultural Development
ISET	International School of Economics at Tbilisi State University
MEPA	Ministry of Environment Protection and Agriculture
NASP	National Agency of State Property
NEA	National Environment Agency
NGO	Non-governmental Organization
NPV	Net present value
RECC	Regional Environmental Center for the Caucasus
RIA	Regulatory Impact Assessment
SDG	Sustainable Development Goal

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1. EXECUTIVE SUMMARY

Windbreaks have a significant positive impact on the economic, social and environmental dimensions of sustainable development. While the positive impacts of windbreaks have been acknowledged by various stakeholders, due to Georgia's poor socio-economic conditions, most existing windbreaks have been destroyed and require restoration.

Research identifies the need for state intervention in order to:

- Protect soil from erosion;
- Increase soil productivity and thus agricultural production;
- Regulate windbreaks so that interested parties can work within this field;
- Create a legal basis for fines for the intentional damage of windbreaks;
- Clearly define the duties and responsibilities of the stakeholders;
- Avoid adverse experiences (e.g., fires) from the unsustainable management of windbreaks, as in the past;
- Attract financial funding from interested parties (public and private sectors, NGOs, etc.);
- Allow windbreaks to be officially registered and have a respective status, which can lead to the more efficient management of windbreaks by farmers.

In order to achieve these goals, the Government of Georgia (GoG) developed a draft law on windbreaks which creates a legal basis for:

1. Windbreak inventory/planning;
2. Windbreak status;
3. Windbreak registration;
4. Windbreak rehabilitation and development;
5. Windbreak management;
6. Windbreak utilization;
7. Execution of fines;
8. Activities raising awareness regarding windbreaks.

According to the interviews conducted for this study, the major challenge associated with the draft law is the matter of shared responsibility, namely the successful interplay and engagement of the different governmental actors alongside their private counterparts, such as farmers and shepherds. Specifically, this refers to the division of responsibilities among stakeholders. Since the rehabilitation and management of windbreaks requires the involvement of the central and local government, as well as farmers and other interested parties, a clear division of responsibilities between stakeholders is particularly important for the efficient implementation of the draft law. Yet another challenge is related to the limited state budget for windbreak rehabilitation and management. In order to overcome this challenge, it is vital to maximize joint (public-private) efforts.

The following policy options are considered in this analysis:

- **Option 0 (baseline scenario) - No policy change**

This option relies on the assumption that there is no policy change and the draft law is not adopted. This is the status quo which is associated with the future risk of increased soil erosion and reduced agricultural productivity.

- **Option 1 - Public-private ownership and management of windbreaks by farmers and municipalities**

This option follows the scheme suggested by the draft law and assumes that private owners (farmers) would be responsible for the management of windbreaks which overlap their privately registered land. While, municipalities would have to manage windbreaks which overlap state and municipal land.

- **Option 2 - Public ownership and management of windbreaks by municipalities**

This option relies on the principle that if windbreaks intersect with private land, the farmer has to sell this land to the state for compensation. In this scenario, municipalities become the owners and managers of all windbreaks throughout the country.

- **Option 3 - Public ownership and management of windbreaks by a newly established state agency (unit)**

This option is based on the assumption that, since municipalities currently lack the human and financial resources necessary for windbreak planting, rehabilitation and management, a separate agency is to be established for this purpose. The agency is thereafter responsible for all matters related to windbreaks.

The objective of this analysis is to identify the main quantitative and qualitative impacts of the proposed options to the various stakeholders, in comparison to the baseline scenario. Thus, the analysis considers only the incremental costs and benefits of Options 1, 2 and 3 in relation to the baseline scenario. A set of assumptions has been developed for each option and, where possible, the respective costs and benefits are then quantitatively assessed.

The designated options are each compared based on the set of criteria developed by the research team, in close collaboration with the stakeholders and in accordance with the objectives of the reform.

Table A1 below summarizes the results of the Multi-Criteria Analysis. Plus (+), minus (-) and zero (0) are used for ranking the options: a plus (+) is used when there is synergy between the criterion and the option's impact; a minus (-) is used when there is a trade-off between the criterion and the option's impact; and if there is no impact at all, a zero (0) is used.

Table A1: Comparison of the options

Evaluation Criteria	Option 0- baseline scenario	Option 1- Public-private ownership and management of windbreaks by municipalities and farmers	Option 2- Public ownership and management of windbreaks by municipalities	Option 3- Public ownership and management of windbreaks by a separate state agency
NPV of net benefits (GEL)	N/A	689,960,658	689,492,311	688,941,226
Reduction in soil erosion processes	-	+++	++	+
Increase in agricultural yields	-	+++	++	+
Feasibility/ease of realization	0	+	++	+++
Mitigated conflict of interests	0	++	-	-
Systemic efficiency	0	+++	++	+

Minimization of risks (e.g., fires, illegal logging, etc.)	-	+++	++	++
Coordination between managing bodies	0	+	++	+++
Availability of implementation tools	-	+	+	++

The analysis shows that Option 1 is less costly than Option 2 and Option 3. Additionally, when assessed against further criteria, Option 1 outperformed Option 2 and Option 3, as public-private ownership better satisfies the criteria related to the reduction of soil erosion processes, the increase of agricultural yields, systemic efficiency, the mitigated conflict of interest, and the minimization of risks.

The analysis shows that there is a need for windbreak restoration due to land erosion and the poor productivity of agricultural crops. The absence of a legal basis for windbreak regulation ultimately leads to the destruction of windbreaks, and the inability of interested parties to coordinate and maximize their efforts in windbreak rehabilitation, management and protection.

While the need for windbreaks is indisputable, there are significant challenges associated with the implementation of the draft law. These challenges are present a different extent within all three options developed within the analysis. Moreover, it is important to consider the greatest challenge of scarce state budget resources, which can be addressed by attracting donor funds (e.g., the Global Environmental Fund) for the management and rehabilitation of windbreaks.

2. INTRODUCTION

This Regulatory Impact Assessment (RIA) was initiated by RECC in order to improve the process of drafting the law on windbreaks in Georgia. This study was conducted by ISET Policy Institute (ISET-PI) in collaboration with RECC, in the framework of an AMMAR project, funded by IFAD and supported by GIZ.

An RIA is a tool for evaluating the various alternatives (options) developed to solve specific policy issues. They are applied when a new regulation has been drafted and there is a need to assess its potential impact on stakeholders. RIAs aim to improve policy-making procedures through the utilization of various approaches, such as openness, public involvement and accountability. The focus of an RIA is dependent on the stage of the law-making process and is directed at improving the quality of governance by increasing the transparency and legitimacy of the regulatory process (Department of Taoiseach of Ireland, Government Buildings, 2009). Many countries currently use RIAs to support their decision-making processes. Developing countries are also encouraged to use RIAs, and Georgia is no exception.

Given that 80% of former Soviet windbreaks have been destroyed over the last few decades in Georgia, land erosion has increased and, consequently, soil productivity has declined. Thus, the Agrarian Committee of the Parliament of Georgia developed their draft Law on Windbreaks,[1] which aims at defining a legal basis for the inventory, planning, registration, rehabilitation and development, and the management and utilization of windbreaks.

[1] In 2017, under the auspices of MEPA and in partnership with GIZ, RECC facilitated the process for elaboration of a framework policy document "Windbreaks Management Concept". The policy document was agreed upon by the main stakeholders and adopted by MEPA, and was further used by the Parliament's Standing Committee on Agriculture as a basis for the development of the draft law on windbreaks.

The objective of the current RIA is to evaluate the social, environmental and economic impacts of the draft law by conducting a cost-benefit analysis, alongside a multi-criteria analysis. The research team applied a so-called "RIA+" methodology, which considers the principles of the UN's 2030 Agenda for Sustainable Development, and the impact of the proposed regulation on achieving its relevant Sustainable Development Goals (SDGs).

The RIA's purpose is to contribute to evidence-based, accountable policy-making.

3. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

3.1 ORGANIZATION AND TIMING

The Regulatory Impact Assessment of the draft law on windbreaks was implemented between September 2018 - February 2019. Where, in September 2018, the RIA team started to collect information on the status of issues relating to windbreaks, as well as to identify the relevant stakeholders.

An inception workshop was held on 4 October 2018, the objective of the workshop was to present the RIA concept and methodology developed by the ISET-PI team, in collaboration with REC Caucasus. The workshop was attended by the representatives of MEPA, the Agrarian Committee of the Parliament of Georgia, NGOs, of various municipalities, etc. The presentations focused on a detailed description of the 8-step methodology employed in the RIA, as well as the potential cost and benefit categories associated with the draft law. The ISET team also presented the influence-interest matrix of stakeholders, the timeline for stakeholder consultations, the division of responsibilities among stakeholders, and a work plan containing a list of the main targets and respective deadlines. ISET's presentation was followed by a presentation by GIZ on RIA+, an approach to mainstreaming the principals of the 2030 Agenda for RIAs. After the workshop presentations, the participants provided their feedback and shared their expectations regarding the upcoming RIA study.

A second workshop on mainstreaming the requirements of the 2030 Agenda for the RIA on the draft law on windbreaks took place on the 26-27 October 2018. The draft law was presented, and the first findings of the RIA were introduced. The main objectives of the workshop were to expand the participants' understanding of the 2030 Agenda, including its SDGs and principles; to identify the most relevant SDGs to the draft law on windbreaks; and to gain applicable knowledge and experience in mainstreaming the 2030 Agenda for the current and future stages of this RIA. By applying the 2030 Agenda's integrative approach, the participants were able to identify the most relevant SDGs for the RIA on the draft law on windbreaks. The working groups analyzed the principle of shared responsibility and the proposed options of the RIA. They brought to light key insights to be considered at further stages of the RIA. The participants also discussed the need for intervention and the possible sources of finance for the various activities related to the draft law. Considering the "leave no one behind" principle, the groups sought incentive mechanisms for marginalized groups. While, the policy options requiring further analysis were agreed upon at the end of the workshop.

A comprehensive stakeholder dialogue discussing the interim results of the RIA on the draft Law on Windbreaks took place on 10-11 December 2018. The stakeholder dialogue was joined by civil society and NGO representatives, international organizations, alongside representatives from the Agrarian Committee of the Parliament of Georgia and the Ministry of Environment and Agriculture. During the two-day forum, stakeholders reviewed the associations of the draft law, with the achievements of the nationally adapted SDGs and the cross-check assumptions and causalities in regards to various issues, such as climate change (SDG 7), poverty (SDG 1) and hunger reduction (SDG 2). The stakeholders critically assessed the initial results of the RIA, providing additional information and valuable perspectives, particularly for marginalized and socially vulnerable groups. On the cost-benefits and multi-criteria analyses, the stakeholders stressed the need to better reflect social

factors, such as the needs and rationale of vulnerable groups with low household income levels, like shepherds and farmers. In order to ensure the successful implementation of the respective law, it will be essential to comprehend the behaviors of these groups, who are often left unheard, though key to the protection and maintenance of windbreaks. This request echoes the concept of leave no one behind within the 2030 Agenda.

The final results of RIA were presented on February 26, 2019.

3.2 CONSULTATION AND EXPERTISE

In order to assess the impact of the proposed regulation on the various stakeholders, the RIA team opted for a wide range of research methods, including but not limited to, a literature review of existing reports, assessments by experts, requests for official data, telephone interviews, and in-depth, face-to-face interviews with identified stakeholders, as well as the abovementioned dedicated stakeholder interventions (two workshops and a stakeholder forum).

The information collected during the analysis is detailed in the table below:

Table 1: Data and information collected during research

Type of data/information	**Source of data/information**
The concept of windbreak management	REC Caucasus
The draft law on windbreaks	Agrarian Committee of the Parliament of Georgia
Agricultural land types and ownership patterns	National Statistics Office of Georgia (GeoStat)
Productivity of annual and permanent crops	National Statistics Office of Georgia
Climate change data	Reports[2]
Data on windbreak area	Estimations based on the General Scheme of Erosion Control Measures for 1981-1990 and for the period up to 2000 (Georgia), REC Caucasus
Division of municipalities by severity of wind	The Scientific-Research Center of MEPA
Windbreak inventory costs	National Agency of State Property (NASP)
Windbreak planting, rehabilitation and management costs	REC Caucasus based on “Windbreak Management Plan Variani”
Irrigated land area	MEPA
Land value	MEPA and expert assessments
Average salaries of state employees	MEPA
Implementation of 2030 Agenda goals	MEPA, Agrarian Committee of the Parliament of Georgia, various experts and NGO representatives, and GIZ

The draft law affects many stakeholders, divided into four groups based on their relationship to the topic and their ability to affect the proposed regulation. The division of stakeholders into respective groups, and how they are best treated, is summarized in the Interest-Influence matrix (Table 2):

Table 2: Interest-Influence Matrix

High power, low interest	**High power, high interest**
Meet their needs- keep satisfied	***Significant stakeholder- work closely*** 1. Agrarian Committee of the Parliament of Georgia;

[2] Technology Needs Assessment and Technology Action Plans for Climate Change Adaptation, Georgia, ENEP, GEF, AIT, 2012- http://documents.worldbank.org/curated/en/193691468012673593/pdf/876010PUB0978100Box382175B00PUBLIC0.pdf https://drive.google.com/file/d/1tiwvAfKnNWcdgDhUw5l1VQr3Vf8z_RTO/view

1. National Agency of State Property (NASP), MESD; 2. Public Registry, Ministry of Justice; 3. Ministry of Regional Development and Infrastructure (MRDI).	2. Office of Land Resources Protection / Department of Environment and Sustainable Agriculture; 3. City Hall, Gori Municipality; 4. Gori Municipality Sakrebulo; 5. City Hall, Kareli Municipality; 6. Shida Kartli, Governor's Office; 7. City Hall, Dedoplistskaro Municipality; 8. MEPA - Environmental Supervision Department; 9. Individual farmers.
Low power, low interest	**Low power, high interest**
Least important stakeholder- require minimal effort 1. MEPA - Shida Kartli Regional Office (Gori); 2. MEPA – Climate Change Office; 3. MEPA - Biodiversity and forest policy department; 4. MEPA - LEPL - National Environment Agency (NEA); 5. MEPA - LEPL National Forestry Agency; 6. National Sheep Farming Association; 7. Wheat Producers' Association; 8. Biological Farming Association (ELKANA); 9. Centre for Biodiversity Research & Conservation (NACRES).	***Consider- keep informed*** 1. MEPA - LEPL National Nursery; 2. MEPA - LEPL Environmental Information and Education Center; 3. MEPA/LEPL Scientific-Research Center for Agriculture / Agro-Forestry Research Service; 4. MEPA - Department of Hydromelioration and Land Management; 5. REC Caucasus; 6. Integrated biodiversity management, South Caucasus, GIZ; 7. IFAD/AMMAR project; 8. Relevant experts.

The aforementioned stakeholders were all interviewed, and their responses carefully considered within this report. A detailed summary of these consultations is available in Annex Table A1.

The interviews conducted for this study revealed that a major challenge associated with the draft law is the matter of shared responsibility, namely the successful interplay and engagement of different actors across the governmental and private sectors, such as with farmers and shepherds. This principle crucially refers to the division of responsibilities among stakeholders. Since the restoration and management of windbreaks requires the involvement of the central and local government, as well as farmers and other interested parties, a clear division of responsibilities between stakeholders is particularly important for the efficient implementation of the draft law. While the responsibilities of stakeholders and the definition of activities within the draft law might require some clarification, the interviews with stakeholders showed that most are ready to fulfill the obligations envisioned in the draft law, provided additional human and financial resources are granted. However, some stakeholders are not fully aware of farmers' attitudes towards windbreaks or the challenges related to the execution of the draft law. As recognized during the interviews, an inventory of windbreaks might be challenging on privately owned agricultural land. High fragmentation of agricultural land was also mentioned as another issue which might hinder the execution of the draft law, along with the state's potential failure to apply the necessary fines.

More detailed description of responses is presented in Annex Table A2.

4. PROBLEM DEFINITION

4.1 VALUE AND IMPORTANCE OF WINDBREAKS

For national sustainable development, windbreaks have important economic, social and environmental value, dependent on the windbreak's height, length, density, location and its species of tree or shrub.

The economic benefit of windbreaks is generated through increased crop production, energy savings, protection of greenhouses from heat loss and improved livestock productivity. Along with this windbreaks cause a reduction in irrigation loss, a decline in agricultural chemical drift, and an increase in property values. (Grala, 2004)[3]

Windbreaks increase crop quality and yield in sheltered areas by providing lower temperatures throughout the day and warmer temperatures at night by increasing relative humidity, helping retain soil moisture, and reducing the physical damage caused by wind. (Stoeckeler J. , 1962) discerned that a windbreak should occupy less than 5% of a total arable land area in order to enhance crop yields. He, moreover, stated that greater crop yields are found in North and South Dakota over Kansas or Nebraska, due to higher levels of snowfalls. Analyzing six years of data, (Brandle, Hodges, Tyndall, & Sudmeyer, 2009) reported that Nebraska had a 15% yield increase for winter wheat. While, an analysis of yield increases was summarized within a worldwide study in 1986, at the First International Windbreak Conference, and indicated significant yield increases for winter wheat (23%), soybeans (15%) and corn (12%) (Kort, 1988) .While windbreaks have an overall positive impact on crop yields, the yield does decline on agricultural lands adjacent to windbreaks. Shade because of windbreak and competition between tree and crop roots for moisture are likely the primary causes of yield reduction in lands adjacent to windbreaks. (Greb, 1961) confirmed that the moisture content of an area is a key factor affecting competition between crops and windbreaks. Further reasons behind yield reduction include allelopathy, an increase of temperature and nutrient leaching after the accumulation of heavy snow (Kort, 1988)

The greatest yield increase occurs between 2 and 6 hectares (ha), and it subsequently begins to decrease as wind speeds intensify. The region of increased crop yield can be extended to between 13-25 ha. Beyond that range, the crop yield is the equivalent to that of an unsheltered field (Stoeckeler J. , 1962). (Frank, 1974) reports that wheat yield increases by 22% and 19% for irrigated and non-irrigated sheltered fields, respectively.

As for energy saving, windbreaks reduce the cost of both heating and cooling by protecting buildings from the winter wind and summer sun. Windbreaks can reduce winter heating costs up to 25 percent. The reduction in summer air conditioning expenses from windbreaks can also be quite significant: the cooling effect of one mature deciduous tree is equal to around ten room-sized air conditioners. (The Benefits of Windbreaks, 1994)

Windbreaks also protect greenhouses from heat loss in the winter. Given that heat loss from greenhouses doubles as the wind speed increases from 0 to 24 km/hour, windbreak protection can decrease heat loss by 10% to 15%. (The Benefits of Windbreaks, 1994)

Improved livestock productivity is yet another benefit created by windbreaks, and according to the literature, sheltered areas have up to an estimated 17% increase in milk production. (Austin, 2014) Additionally, there is a 20% reduction in irrigation losses as well as a reduction in agricultural chemical drift. While considering property value, it was found that farms with windbreaks have an approximate 15% higher capital value.

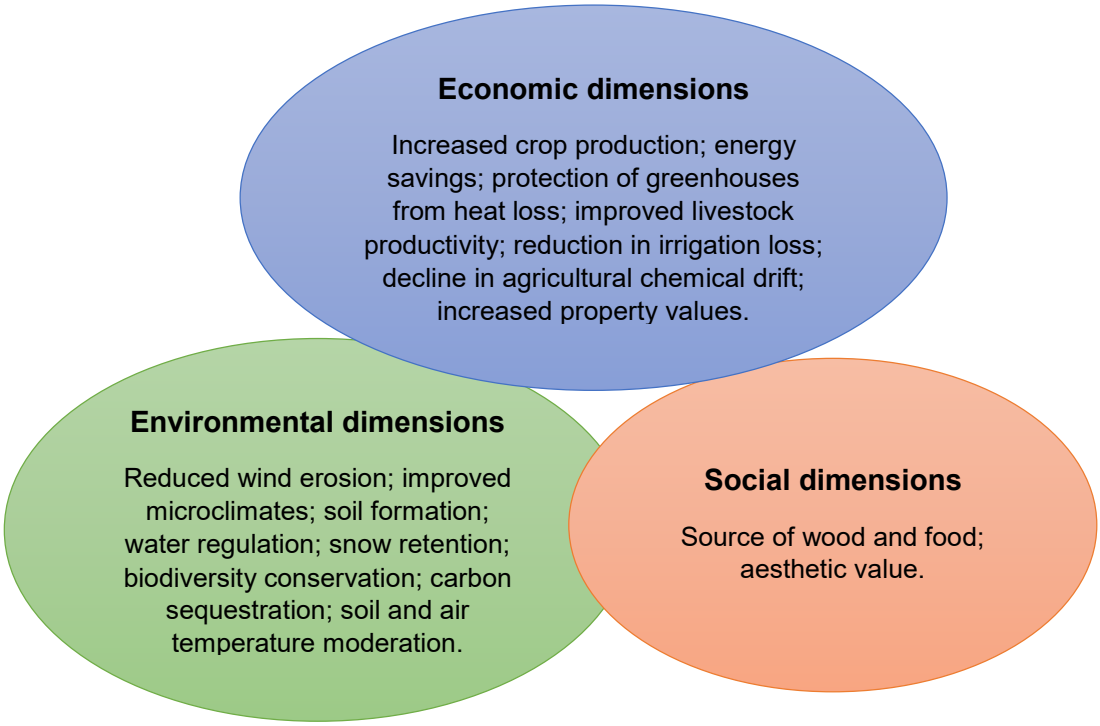
[3] The Economic Benefits of Native Shelter Belts Report, GIS approach

The environmental impact of windbreaks is reflected by a reduction in wind erosion, (Brandle, Hodges, Tyndall, & Sudmeyer, 2009) and improvements in microclimates; soil formation; water regulation; snow retention; and the support of wildlife habitats and biodiversity conservation; carbon sequestration; and soil and air temperature moderation. (Grala, 2004)

A key environmental benefit of windbreaks is carbon sequestration. It has been demonstrated that windbreaks can sequester large amounts of carbon in reduced land (5%), and reduce carbon dioxide emissions to help prevent global warming. Furthermore, windbreaks can provide shelter and sustenance for wildlife, as well as safe travel corridors between woodlots. They can moreover provide nectar and pollen for bees. While, according to estimates, at least 108 species of bird use windbreaks. (Grala, 2004)

Aside from the economic and environmental benefits, windbreaks have a **social** value as well. The social advantage of windbreaks is reflected by the fact that windbreaks are not only a source of wood and food, but as they equally hold aesthetic value. (Cable, 1999)

Figure 1: Economic, social and environmental value of windbreaks



4.2 IMPLICATIONS REGARDING THE 2030 AGENDA AND SDG ACHIEVEMENT

The economic, social and environmental benefits of windbreaks contribute to achieving various SDGs, which are discussed in more details below.

SDG 1: No poverty – By protecting crops from wind, windbreaks might build the resilience of weak crops and reduce their vulnerability to extreme weather-related events. Windbreaks reduce wind speed and soil erosion, and therefore, may help to increase crop productivity. An increase in crop yield consequently improves income from production. In addition, windbreaks might provide an adequate means of income and ensure significant mobilization of resources by producing food and wood.

SDG 2: Zero hunger – Food production depends on ecosystem services that support agriculture, soil moisture and fertility. By reducing wind speed and soil erosion, windbreaks may help increase not only crop yields, but livestock productivity as well. Windbreaks reduce animal stress caused by heavy wind, and they can improve their health and increase feeding efficiency. In addition to their role in protecting crops from wind, windbreaks can become a source of food. They can produce fruit, nuts, seeds, and roots, which can be used in the production of syrups, oils and fats. However, in the short-term there is a trade-off between using the land for windbreaks or for crops. Nevertheless, in the long run, windbreaks improve ecosystem services and may contribute to greater diversity in food production.

SDG 3: Good health and well-being – There are indirect effects of windbreaks on human health as they help to modify the climate on their land. By sequestering and eliminating certain types of air, water and soil pollution windbreaks might help to mitigate the spread of pollution. Furthermore, well-established windbreaks enhance the aesthetic value of the area, and can help improve the mental health of the local population.

SDG 6: Clean water and sanitation – Windbreaks can indirectly contribute to sustainable water use. Established windbreaks might lessen irrigation needs by reducing the evaporation of water and retaining soil moisture. In addition, protecting and restoring windbreaks might improve the ecosystem and reduce the risk of flooding. Well-established windbreaks can also increase resilience to water-related natural disasters.

SDG 7: Affordable and clean energy – Currently, the demand for biological resources, such as wood, coal, charcoal or animal waste for heating is high. As windbreaks help to moderate air temperature, they can positively affect sustainable energy use and reduce energy consumption through the decreased requirements of cooling and heating. Windbreaks not only help to save energy, but they can also be designed to provide a source of bio-energy, such as fuelwood and timber, as a result of sanitation cuts[4], and accordingly might replace other sources of energy.

SDG 8: Decent work and economic growth – Planting, protecting and maintaining windbreaks, as well as their planning, require significant human resources. Therefore, the demand for hired labor might increase at the municipal and state levels. The planting and rehabilitation of windbreaks can increase the demand for nurseries and qualified agronomists. Windbreaks may not only contribute to job creation, but they may also further promote sustained economic development by ensuring higher crop yields and increased productivity.

SDG 11: Sustainable cities and communities – Considering and integrating windbreaks into agricultural practices can help to create sustainable human settlements with inclusive green spaces. By protecting landscapes and buildings from the wind and sun, windbreaks can help save energy and reduce the cost of heating and cooling. As mentioned above, studies suggest that windbreaks can reduce heating costs by up to 25 percent in the winter and have significant cooling effects.

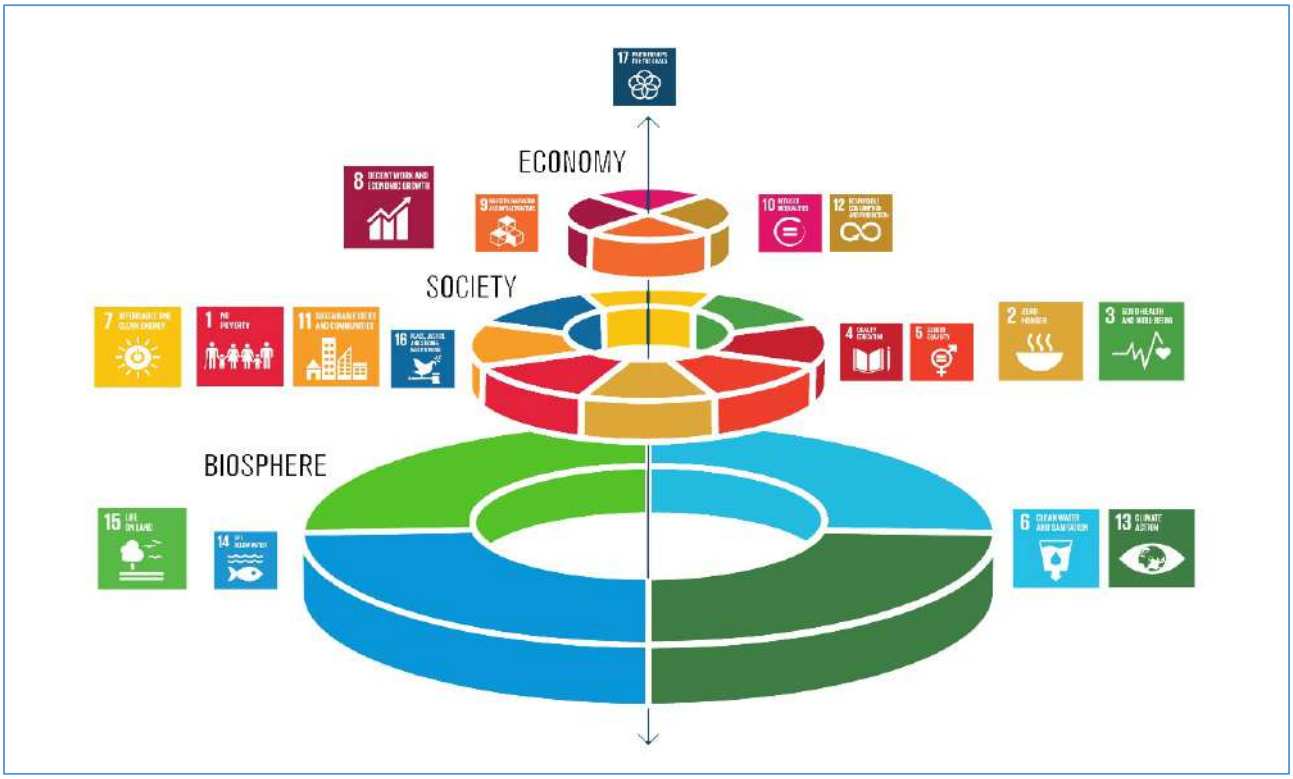
SDG 13: Climate action – Climate change not only shifts average temperatures around the world, it also alters precipitation patterns and increases the frequency and intensity of extreme weather events. Windbreaks are one of the chief constituents behind contemporary and conservation-based agriculture, which integrate climate change adaptation measures into farm practices. Windbreaks can improve ecosystem services and moderate air temperature. Moreover, they may serve as a natural buffer against extreme climate and weather events, including drifting snow, droughts and storms. On the other hand, windbreaks can potentially become a source of carbon emissions during occasional wildfires.

[4] a cutting made to remove trees that have been injured or killed (as by fire or wind) primarily to prevent spread of disease or insects

SDG 15: Life on land – Windbreaks can be designed to enhance the value of their wildlife habitats, and they can also attract further native wildlife while providing nesting sites, shelter, food, a haven from predators, and a corridor for migration. Moreover, native wildlife often carries predatory parasites that can be a food complement or alternative to pesticides. Windbreaks thus increase biodiversity and improve ecosystem services, therefore, along with SDG 2 and SDG 13, this goal directly refers to windbreaks and is the most relevant to their conservation.

The SDGs related to windbreaks are depicted in Figure 2 below:

Figure 2: SDGs related to windbreaks



Source: TEEB, 2010

As to the synergies and trade-offs, the planting and rehabilitation of windbreaks is connected to most of the goals, though with relatively few trade-offs in case of certain SDGs (Figure 3).

Figure 3: Synergies and trade-offs with SDGs

	SYNERGIES	TRADE-OFFS
1 NO POVERTY 2 ZERO HUNGER	• Increased crop production; • Increased productivity; • Improved soil quality; • Increased income.	• Increased cost of windbreak management; • Increased cost for small farmers; • Reduction of production on lands adjacent to windbreaks; • Opportunity costs for farmers, due to the inability to produce on areas under windbreaks.

	• Reduction of pollution; • Aesthetic value, positively contributing to mental health.	N/A
	• Reduction of irrigation losses; • Reduction in irrigation needs.	N/A
	• Availability of wood for heating in the case of sanitation cutting of trees.	N/A
	Increased employment; • Promoting sustainable economic development.	• Increased governmental spending on the planting and rehabilitation of windbreaks, over other projects.
	• Protection of settlements from the wind and sun; • More green spaces.	N/A
	• Carbon sequestration; • Soil and air temperature moderation.	N/A
	• Reduction in deforestation; • Biodiversity conservation.	N/A

It is also noteworthy that most impacts are expected to be achieved in the long-term, however there is positive impact on achieving SDG 8 in the short-term though increased employment from the planting and rehabilitation of windbreaks.

While windbreaks are inherently related to various SDGs, the most common interrelations include:

- SDG 1 - No poverty;
- SDG 2 - Zero hunger;
- SDG 6 - Clean water and sanitation;
- SDG 13 - Climate action;
- SDG 15 - Life on land.

In the light of the 2030 Agenda, Georgia has developed a nationally adopted SDG matrix that features the country's major goals over several years. Table 3 shows how the articles of the draft law contribute to the achievement of these nationally adopted SDGs and defines the connection between the draft law and the national targets and indicators.

Table 3: The link between the draft law and nationally adopted SDG indicators

Goals and Georgia's Adjusted Targets	Georgia's Adjusted Indicator - Target 2030	Connection of the draft law to national targets	Article of the draft law
Goal 1. End poverty in all its forms everywhere			
1.1 By 2030, eradicate extreme poverty for all people everywhere in Georgia, currently measured as people living on less than $1.9 a day	1.1.1: Proportion of population living below the international poverty line: < 1 %.	The draft law is related to this goal in two ways: 1. The establishment of windbreaks contributes to an increase in agricultural productivity, which leads to higher production and thus higher incomes from the sales of agricultural produce; 2. Based on agreements with the state, farmers can benefit from the non-functional use of windbreaks which positively affects their income.	2: (objective of the draft law); 23.2: (functional use of windbreaks); 24.1 - 24.2: (non-functional use of windbreaks).
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture			
2.3: By 2030, increase the agricultural productivity and income of small-scale food producers, in particular women, family farmers, fishers, including, through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	2.3.1: Increase the volume of production by 100%, per agricultural enterprise by class of farm/pastoral enterprise size; 2.3.2: Average income of the rural population (from employment/self-employment/agricultural product sales) per family farm: 700 GEL.	By creating suitable soil and microclimate conditions for agricultural crops production, windbreaks have a direct positive impact on the productivity of agricultural crops. The draft law is related to this goal in the following ways: 1. The establishment of windbreaks contributes to an increase in agricultural productivity, which leads to higher production and thus higher incomes from the sales of agricultural produce; 2. Based on agreements with the state, farmers can benefit from non-functional use of windbreaks which positively affects their income; 3. Windbreaks contribute to farm adaptation strategies to climate change and related extreme weather events and thus increase the proportion of agricultural land area farmed in a sustainable manner.	2: (objective of the draft law); 23.2: (functional use of windbreaks); 24.1 - 24.2: (non-functional use of windbreaks).
2.4: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that	2.4.1 Proportion of agricultural area under permanent and annual crops (used by agricultural enterprises): 90%		

progressively improve land and soil quality.			
Goal 3. Ensure healthy lives and promote well-being for all ages			
3.4: By 2030, reduce by one third the premature mortality rate from non-communicable diseases, through prevention and treatment, and promote mental health and well-being.	3.4.2: Suicide mortality rate: to be decreased by one third.	Windbreaks help farmers cope with climate change related challenges (droughts, flooding, etc.), which might reduce mortality rate from non-communicable diseases. The benefits from the non-functional use of windbreaks are related to their recreational and aesthetic values, which positively affects mental health and might reduce the probability of depression and thus the risk of suicide.[5]	23.2: (functional use of windbreaks); 24.1 - 24.2: (non-functional use of windbreaks).
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all			
7.2: By 2030, increase substantially the share of renewable energy in the energy mix of Georgia	7.2.1 The share of renewable energy (Hydro, geothermal and solar, biofuel and waste) in the energy mix will be about 30% in 2030	Since the windbreak maintenance process requires the sanitary cutting of trees, those trees can be a source of biofuel. This benefit arises from a non-functional use of windbreaks.	24.1 - 24.2: (non-functional use of windbreaks).
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all			
8.5: By 2030, implement effective state policy in order to achieve productive employment and decent work for all women and men, including young people and persons with disabilities, and equal pay for work of equal value.	8.5.2: Unemployment rate by 2030: 9.5%.	Since planning, planting, rehabilitation, maintenance and protection of windbreaks require additional human resources, this will increase employment. Although the overall increase is expected to be marginal. The draft law also envisions the establishment of a committee responsible for decision-making regarding the establishment of new windbreaks.[6]	15.4: (planning of windbreaks- planting and rehabilitation); 16.1 - 16.3: (windbreak planting and rehabilitation activities). 19.1 - 19.5: (protection of windbreaks); 21.1 - 21.3: (windbreak maintenance activities).
Goal 13. Take urgent action to combat climate change and its impacts			

[5] Note: the draft law does not specifically mention the beneficial recreational or aesthetic values resulting from the non-functional use of windbreaks, however such benefits are clear and should be taken into account.
[6] Note: the draft law does not specifically state that additional human resources will be utilized for the implementation of such activities, though given that pre-existent resources are very limited, there is clearly a need for additional resources.

13.2: Integrate climate change measures into national policies, strategies and planning.	13.2.1: By 2030, 15% reduction of GHG emissions compared to the Business as Usual (BAU) scenario, based on the integration of different mitigation measures in policy documents, e.g., the Low Emission Development Strategy, the Climate Action Plan for 2021-2030 and Nationally Determined Contributions (NDC).	According to the draft law, the planning process of windbreak planting and rehabilitation is a complex process, which should take into account current and forecasted climate change trends and the impact of those trends on requirements for land erosion and irrigation. Windbreaks can also contribute to the reduction of GHG emissions.	15.2: (planning of windbreaks- rehabilitation and planting).
Goal 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss			
15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.	15.3.1: Proportion of land that is degraded over the total area.	Since windbreak planting and rehabilitation directly contributes to the reduction in land erosion processes, all the articles of the draft law related to the planting, rehabilitation, maintenance and protection of windbreaks contribute to the achievement of this goal.	16.1 - 16.3: (windbreak planting and rehabilitation activities); 19.1 - 19.5: (protection of windbreaks); 21.1 - 21.3: (windbreak maintenance activities).
15.5: Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2030, protect and prevent the extinction of threatened species.	15.5.1: Improve the conservation status of species in the Red List.	The draft law creates a legal basis for protecting windbreaks from illegal logging, grazing, fire, disease and other negative anthropogenic impacts. Protected windbreaks will result in the conservation of species and habitats within those windbreaks. While the latter positively affects biodiversity. During windbreak planting and rehabilitation, it is required to protect biodiversity and offer preference to endemic species, thus this also positively affects biodiversity.	19.1 - 19.5: (protection of windbreaks); 22.1: (specific requirements for windbreak planting and rehabilitation).

4.2.1 VULNERABLE GROUPS

The efficient implementation of the draft law requires the careful identification and consideration of marginalized groups. This is further in line with the concept of “leave no one behind”, one of the main principles of the 2030 Agenda.

Due to certain differences between the challenges prevalent in western and eastern Georgia, vulnerable groups are divided into two geographical groups. For instance, fires are more severe in the east rather than the west of Georgia. Although, logging and overgrazing are common in windbreaks on both sides of the country.

The following marginalized groups will be most affected the by the law:

- **Farmers**
  - Small
  - Medium & Large
- **Herders**
  - Shepherds
  - Cowherds
- **Rural dwellers in need**

Farmers - The consultations with various groups of stakeholders, including farmers, revealed that the most vulnerable groups affected by this law are small-scale farmers, those who manage around 1 ha of land, typically divided into 2-3 plots. The 2014 agricultural census shows that 77.1% of agricultural holdings (approximately 442,000) have less than 1 ha of utilized land (National Statistics Office of Georgia, 2014). The vast majority of these farmers cannot make a living from the cultivation of such small plots of land, therefore they conceivably lack either the resources or/and the motivation to invest in windbreaks.

Small-scale farmers will be affected by the law for the following reasons: (i) windbreaks might be planted on their arable land, which would reduce the size of their plots; (ii) windbreaks can cast a shadow on parts of their land and thus hinder the cultivation of crops; and (iii) the planting and maintenance of windbreaks require significant resources (human, financial, etc.), which small farms often lack.

Mid and large-scale farmers will face the same costs related to windbreaks as described for small farms. However, medium and large farms have a greater availability of resources, and they might be able to undertake the maintenance of windbreaks, providing they are offered adequate incentive mechanisms. It should be noted that farmers often lack long-term vision and it is hard for them to believe in the benefits of windbreaks; they often look solely at short-term productivity increases, and thus investing in windbreaks has less immediate appeal. Nevertheless, persuading medium and large farms to plant and maintain windbreaks is considerably easier compared to influencing small-scale farmers.

Nevertheless, every farmer, regardless of plot size, faces challenges related to the damage of windbreaks caused by third parties, such as the threats of fire, illegal logging, and overgrazing.

Herders - There are two types of **shepherd**: (i) those who bring their flock from winter to summer pastures and sometimes use windbreaks as part of their migratory route through crop fields or for grazing their sheep (and often goats, horses and donkeys); and (ii) the so-called partisan shepherds, who either do not migrate at all, or migrate between summer and winter pastures. In winter, there is not enough biomass fodder, thus they graze and rest their flocks in windbreaks. Moreover, when herding sheep to water or back to the pastures, shepherds often use windbreaks as a migratory route, causing significant damage to the area.

Furthermore, some shepherds make fires on pastures, hoping to generate fresh grass thereafter. These fires not only potentially damage the humus soil, but often also spread to the windbreaks. This challenge exists predominantly in the eastern part of Georgia, where sheep farming is most often practiced.

Cowherds- Cattle herding is common in every region of Georgia (Nakhiri).[7] Cowherds move cattle to their pastures every day. Often, when pastures are limited or are in bad condition, the cattle subsequently graze or rest in windbreaks.

Rural dwellers in need- Heating homes with wood is common in rural areas of Georgia. Although it is prohibited, often windbreaks are cut down to heat rural homes. The sale of this wood to neighboring villagers is often also an additional source of income for deprived rural inhabitants.

4.3 CHALLENGES

Throughout Georgia more than 100,000 ha have been degraded by soil erosion.[8] Experts suggest a reduction in the area of windbreaks has contributed to this trend, and it threatens the productivity of the soil. Currently, the majority of Georgian windbreaks (around 80%, according to expert estimates) have been destroyed, while the remainder are left without supervision.

The main challenge related to windbreaks is the **absence of a respective legal base and thus vague institutional responsibilities**. A general obligation for protecting soil from erosion has been determined by the active legislation (Parliament of Georgia, 2003), however the institutions accountable and their responsibilities towards the execution of this legislation have not yet been established. The responsibilities of local self-governing bodies regarding windbreaks are also unclear.

Another significant problem is related to the ownership of windbreaks. The law on agricultural land ownership (Parliament of Georgia, 1996), grants the possession of windbreaks to the owners of the adjacent land, however, it does not determine their corresponding responsibilities, obligations or rights.

The prevailing complications of land registration throughout the country are also true for windbreaks. Moreover, in the registration process, windbreaks are not considered as separate land. Correspondingly, information about windbreaks under private ownership and those remaining under state ownership simply does not exist.

The restoration and planting, as well as maintenance, of windbreaks is very much challenged by the shortage of necessary resources. While the lack of physical protection of windbreaks, from Illegal logging, fire and grazing, remains a major threat to the windbreaks (Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ)., 2017).

Illegal logging- Due to the energy crisis in the 1990s, windbreaks were almost completely demolished by the local population for firewood. The proportion of windbreaks that were destroyed is particularly high in certain municipalities. For instance, in the Dedoplistskaro and Signagi municipalities, 75% of windbreaks were cut down by the local populace. Such illegal logging has also led to severe soil erosion, which has negatively affected agricultural productivity. While the illegal logging of windbreaks might be less intensive than in the 1990s, it is still a threat.

Fires- The most critical factor of particular harm to windbreaks to date, is the practice of burning the remnants from harvests in agricultural fields. In windy conditions, fires are often spread to windbreaks and can easily cause destruction. Such was the case in July and August 2015, where widespread fires in Shiraki almost completely destroyed the windbreaks restored with the support of GIZ. After harvesting crops, burning waste products is a widely employed practice, caused by the following circumstances:

[7] Nakhiri is a Georgian word meaning the cattle gathered from different farmers, who jointly herd them to their pastures.
[8] Technology Needs Assessment and Technology Action Plans for Climate Change Adaptation, Georgia, ENEP, GEF, AIT, 2012

- After a harvest, a great volume of biomass remains, and fire removes the need to break the remnants into small pieces;
- For farmers, the removal of biomass from their land is financially disadvantageous, due to high related expenses;
- Some farmers believe that burning the remaining biomass increases land productivity.

While ploughing the land around windbreaks can halt the spread of fire, unexpected strong winds may still spread the fire to windbreaks.

Fires are caused not only by farmers, but by local and nomadic shepherds, who burn dry pastures to speed the growth of new grass in the spring. Occasionally shepherds intentionally make fires in windbreaks, because the area within windbreaks is considered "no one's land". While in some cases, fires are started elsewhere and spread to windbreaks via strong winds.

Overgrazing - Cattle, sheep and goat grazing is a significant factor negatively affecting windbreaks. Limitations on pastures led to the grazing of cattle in windbreaks. The grass in windbreaks represents an additional source of food for herds during the period of transhumance, when livestock are moved from their summer to winter pastures and vice versa. The grazing of livestock in windbreaks causes the annihilation of sprouting plants and hinders their renovation and renewal.

4.4 POLICY CONTEXT

The draft law on windbreaks affects other laws and some might require amendments if the law is adopted. The draft law package contains annexes which outline the proposed changes to the related laws.

1. **Local Self-Government Code:**

    - Local authorities should support windbreak rehabilitation, planting, and protection;
    - Local authorities should elaborate management plans (projects) for windbreak rehabilitation/planting and apply to the Sakrebulo for approval;
    - Municipalities can owners of windbreaks.

2. **Forest Code** - The forest code should not cover windbreaks;
3. **Law on Public Registry** - The term "windbreak" should be added as an additional category of agricultural land;
4. **Tax Code of Georgia** - Once the term "windbreak" has been included as a category of agricultural land, land with windbreak status will be exempt from property tax;
5. **Administrative Offences Code of Georgia** - Article 151 will be added to this code,[3] which will regulate the illegal logging or damaging (including fires) of windbreaks. The first crime will be fined at 500 GEL and the fine will increase up to 1000 GEL if repeated.

4.4.1 INTERNATIONAL EXPERIENCE

Various international experiences regarding windbreak ownership and management are rather mixed. Within EU regulations,[9] member states are required to protect existing windbreaks and, where needed, build additional ones. In most countries, windbreak ownership and management is regulated by agricultural code (e.g., France, Switzerland, Belgium), while in certain nations it is governed by forestry code (e.g., Moldova, Azerbaijan) or

[9] REGULATION (EU) No 1306/2013, Article 93

melioration law (e.g., Ukraine, Russia). Occasionally, windbreaks are regulated by separate law, as in Great Britain. The windbreak management policies of different countries are reviewed briefly below.

Great Britain and France have relatively well-established windbreak management policies. For example, in **France** the major stakeholders of windbreak ownership and management include the prefect, land owner, departmental land development commission, and the municipal or inter-municipal land development commission. These stakeholders collaborate in the following ways (Parliament of France):

- Prefects authorize linear afforestation and hedge growth for protection, as identified by the municipal land development commission;
- At the request of an owner, a prefect may, on the advice of the departmental land development commission, order the protection of tall stems orchards;
- The authorization of destruction is given after hearing the opinion of the departmental land development commission;
- In cases where plant elements have been identified by the municipal land development commission, a prefect forwards a request for judgement from the departmental land development commission, which responds within three months;
- The municipal or inter-municipal planning commission may, in the framework of the procedures governed by the law, request a prefect to repeal the enacted protection verdict.

The law recognizes three form of rights for neighbors with a common hedgerow:

1. The right to benefit from fruit and other produce within a hedge. Each neighbor has the right to half the produce, irrespective of whether or not it might fall on one side of the hedge. If a tree should die or be cut, each neighbor has the right to half;
2. Each neighbor has the right to require that shared trees are cut, though neither party can proceed unilaterally. Joint agreements appear implicit, rather than explicitly stated in the law;
3. In relation to the hedge itself, each neighbor can destroy the hedge, up to a limit, on their own property. However, they consequently may be required to construct a wall or fence in lieu of the missing hedge.

In **Great Britain**, where windbreaks (hedgerows) are regulated by a special law, The Hedgerow Regulations 1997 (House of Parliament of United Kingdom, 1997), the land is under shared (public and private) ownership and local planning authorities have a control function.

Windbreaks are mentioned in **Ukraine's** law about land melioration.[10] Article 8 of the law states that windbreaks should be formed to fight wind and water erosion, and to improve soil and climate conditions for agricultural production. Article 13 of the law proposes that the state is responsible for organizing the establishment of windbreaks. The law fundamentally defines the need for planting windbreaks and states the parties generally responsible for such planting. However, it does not provide any details regarding ownership or utilization of windbreaks.

The ownership of windbreaks is an often-debated topic in Ukraine.[11] As of 2016, windbreaks, of over 300 ha, are located on both state and community lands. The formal protection, maintenance and rehabilitation of those windbreaks is non-existent, which gives rise to illegal logging. Currently, windbreaks are under the jurisdiction of the State Service of Ukraine for Geodesy, Cartography and Cadastre (StateGeoCadastre)- a central executive

[10] http://uazakon.ru/zakon/zakon-o-milioratsii-zemel.html
[11] https://zn.ua/ECOLOGY/zaschitnye-lesonasazhdeniya-ukrainy-nicheynaya-zemlya-_.html

body that is coordinated by the Cabinet of Ministers of Ukraine, via their vice prime minister, the minister of Regional Development, Construction and Housing of Ukraine.

The following alternatives for management and ownership of windbreaks have been considered:

1. Transferring management of windbreaks to the state agency responsible for agro-melioration with respective state funding;

2. Transferring windbreaks to the National Forest Agency, which, though, is only ready to take responsibility if provided with respective state funds for windbreaks' inventory, maintenance, protection from fires and illegal logging, as well as additional human resources;

3. Transferring one part ownership of a windbreak to farmers and communities, with no more than 5 ha to a single owner, and another section - neighboring to forests - to the National Forestry Agency, while leaving control and supervisory functions with the National Forestry Agency.

In **Moldova,** windbreaks are regulated by the Forest Code (Parlament of the Republic of Moldova, 1997). Windbreaks (protective forest belts located on agricultural lands) do not belong to the forest fund. Forest vegetation outside National Forest Land (NFL) includes; the protection belts located on agricultural land and on river and water basin protection areas; protection belts, tree and shrub plantations alongside passageways; and groups of trees and solitary trees in cities and towns. Moldova has 491,000 ha of woodland vegetation outside the NFL, including 298,000 ha of protection belts (for agricultural fields, roads, rivers and water basins, etc.) and 192,000 ha of additional forestry vegetation, which also substantially contributes to preserving the ecological balance (Galupa, Ciobanu, Scobioală, Stângaciu, & Lozan, 2011). Such forestry vegetation is not well-developed, nor is it managed by well-justified plans or designs (Galupa, Ciobanu, Scobioală, Stângaciu, & Lozan, 2011).

The key manager of public property forests is Agency Moldsilva, which owns 82.1% or 336,600 ha of the total NFL. The remaining forests and lands with forest vegetation are owned by the I- and II-tier Local Public Authorities (LPAs), the Ministry of Transport and Road Infrastructure, and the Agency Moldova Waters. These lands are primarily include forest belts for agricultural field protection, road protection belts, and forest belts for water protection, as well as forests in rural areas, administered by municipalities and district councils.

Agency Moldsilva also preserves forest regeneration and afforestation, the expansion of lands covered with forest vegetation, and the establishment of water protection belts and anti-erosion forests. While afforestation on degraded lands, not part of the forest fund, is compulsory and is carried out by their owners under special programs and projects agreed upon by the state forestry authorities, state environmental authorities and approved by the local public administration authorities.

The financing of forest-growing and the planting of protective forest belts (design, planting forests and belts, and their care before the formation of forest plantations), on land that is not a part of the forest fund, is appropriated from the state budget and the budgets of administrative-territorial units. The state provides benefits to landowners who carry out similar work on their plots in accordance with the Law on Land Reclamation of Degraded Lands (No. 1041-XIV, 15 June 2000).

In **Romania**, the area other than forest is 16.9 million ha, of which an estimated 38 percent is characterized by degradation. For most of this area, the only method to reinstate a productive cycle is through afforestation.[12]

[12] National Report on the Implementation of the UNCCD in Romania, Bucharest, 2000

In recent years, when 99% of the land was state property, there was a simple process of shifting degraded land from the agricultural sector to the forest fund for afforestation projects. At present, however, the situation has changed completely with the ongoing privatization of agricultural land.

According to the Land Law of 1991, degraded or polluted lands with productive potential are established within restoration perimeters. Owners are obliged to subject these lands to restoration projects, maintaining their ownership, even if afforestation is done at the state's expense. Individual owners, or those in associations, with degraded lands that are not constituted within the restoration perimeters, can make improvements utilizing free planting materials, chemicals and technical assistance from the state.

While, Law 83/93 stipulates that private owners of agricultural land, if they agree to follow forestry regulations, will receive an afforestation bonus from the state budget, in compensation for afforestation or the planting of windbreaks.[13]

Reforestation or shelterbelt planting programs may be difficult to introduce in Romania, due to the denationalization of large state and cooperative farms, which were divided among inhabitants of the countryside as individual or family farms. The creation of rationally functioning networks of shelterbelts, within highly fragmented estates, is awkward because of the need to obtain the agreements of the owners.[14]

This brief review of international experiences reveals that, while France and Great Britain are ahead of Georgia in terms of regulating windbreaks, other countries still face similar challenges.

4.4.2 THE NEED FOR INTERVENTION

Even though windbreak planting and rehabilitation produces the wide range of benefits previously discussed, the economic nature of those benefits are akin to public goods, which are frequently subject to the overexploitation of resources, leading to the so-called "tragedy of commons". While markets allocate private goods efficiently, state intervention is usually required for the efficient (or even reasonable) allocation of public goods. Because individuals (farmers) face free-riding incentives when it comes to protecting windbreaks, state policies are often put in place to ensure that individuals contribute to conservation costs.

Thus, there is a need for state intervention in the case of windbreaks in order to:

- Protect soil from erosion;
- Increase soil productivity and thus agricultural production;
- Regulate windbreaks so that interested parties can work in this field;
- Create a legal basis for fines in case of intentional damage to windbreaks;
- Clearly define the duties and responsibilities of stakeholders;
- Avoid negative experiences (e.g., fires) from the unsustainable management of windbreaks, as in the past;
- Attract financial funds from interested parties (public and private sectors, NGOs, etc.);
- Allow windbreaks to be officially registered and have a respective status, which can lead to the more efficient management of windbreaks by farmers;
- Increase farmers' awareness to register their agricultural land.

[13] http://www.fao.org/docrep/w3722E/w3722e23.htm

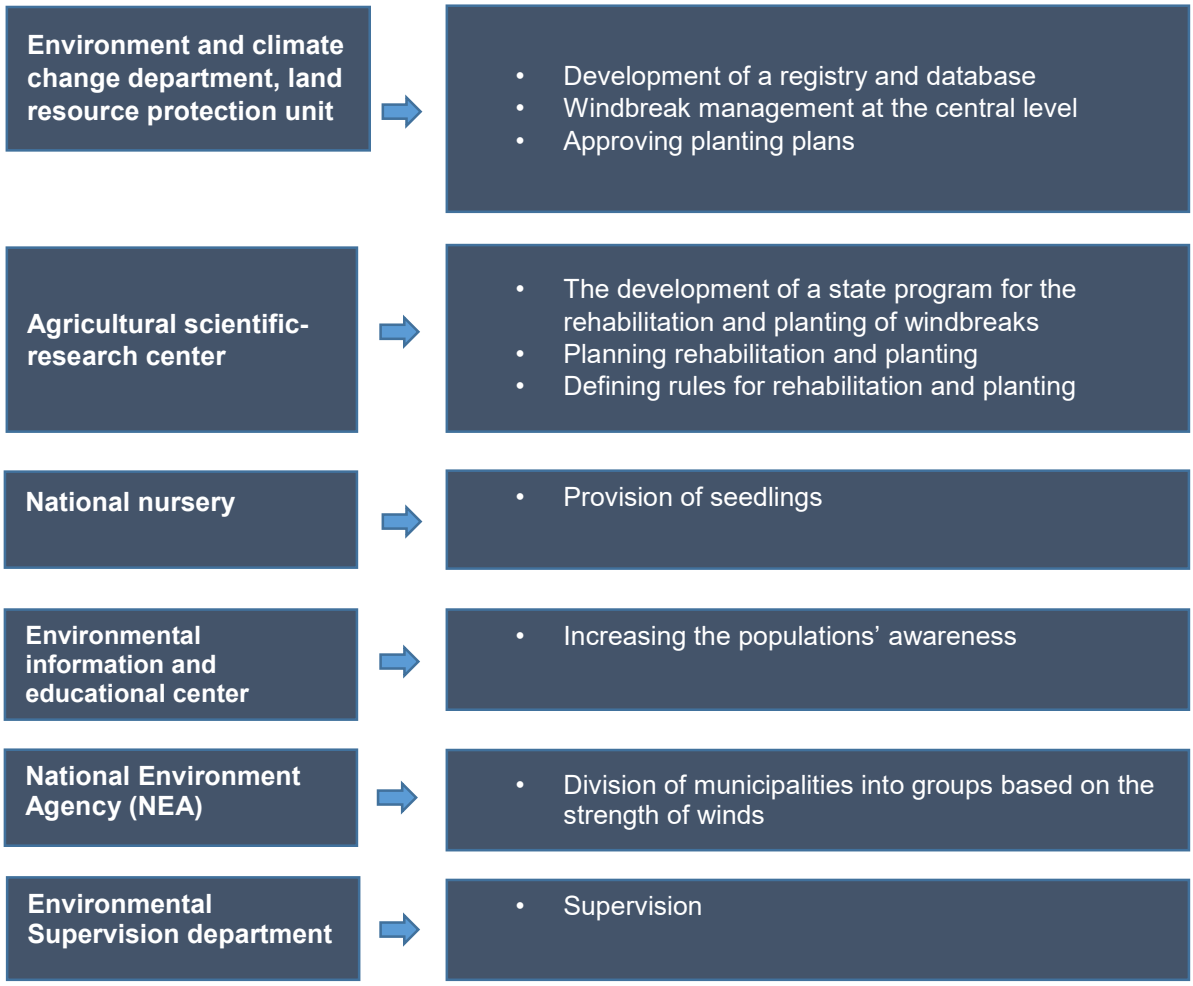
[14] https://books.google.ge/books?id=VFnMBQAAQBAJ&pg=PA305&lpg=PA305&dq=windbreak+management+in+romania&source=bl&ots=hHKcQ2Xi3B&sig=ulU8jSOhba4uOgJwKfu0CFe8ERk&hl=en&sa=X&ved=2ahUKEwiHrujg8ZzeAhVKDCwKHStVD2YQ6AEwDXoECAkQAQ#v=onepage&q=windbreak%20management%20in%20romania&f=false

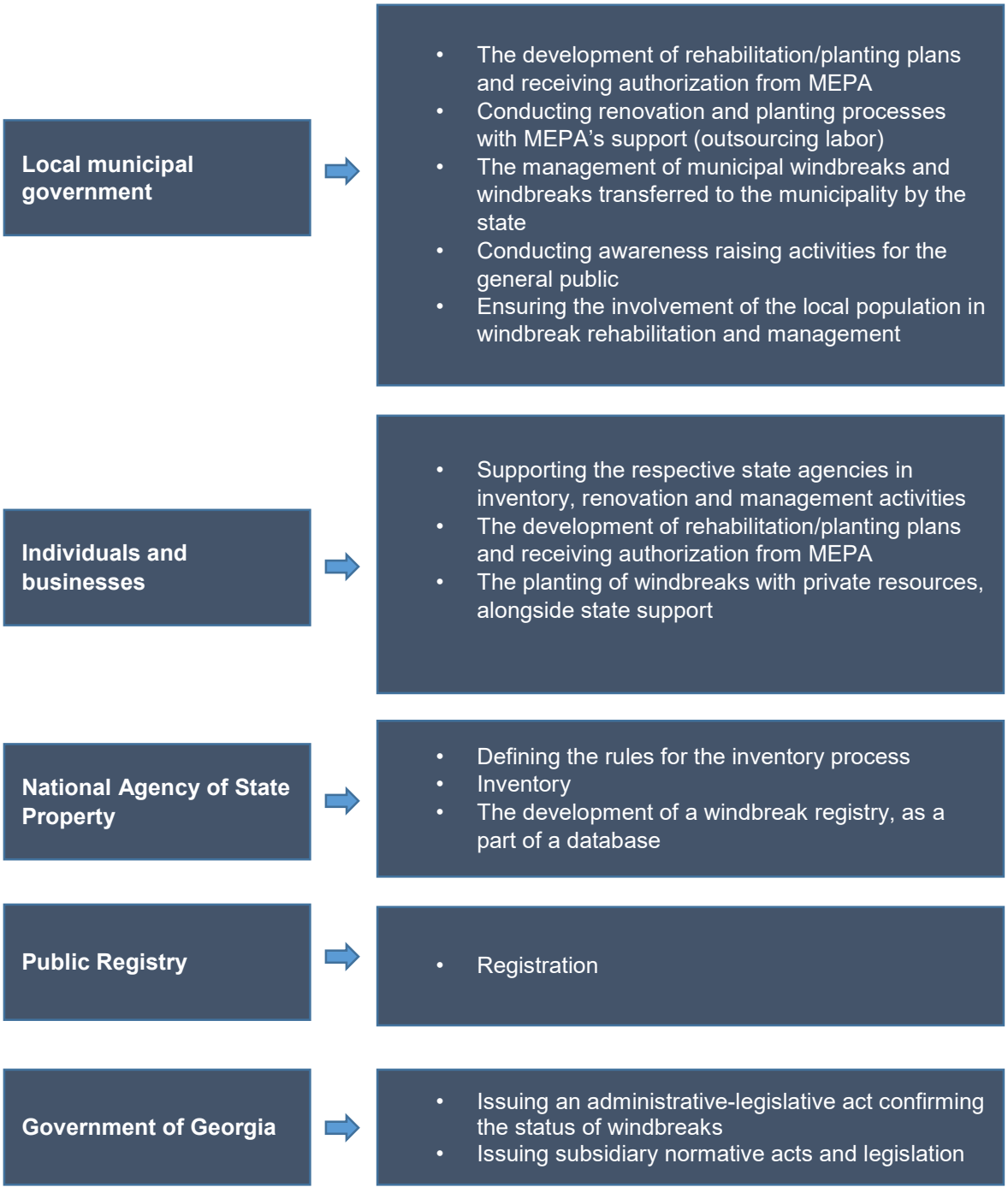
On the whole, one can conclude that in order to ensure the sustainable management of windbreaks, a corresponding legislative base is essential. In order to reach this goal, the Agrarian Committee of the Parliament of Georgia, together with MEPA, have initiated the development of the draft law on windbreaks.

4.4.3 DIVISION OF RESPONSIBILITIES AMONG STAKEHOLDERS

The draft law on windbreaks envisions the following division of responsibilities (Figure 4):

Figure 4: Division of responsibilities among stakeholders





4.4.4 UNSETTLED ISSUES

The draft law on windbreaks is intended to fully cover issues related to the management of windbreaks in Georgia, and to consider the respective changes to the related laws, such as the Local Self-Government Code, the Forest Code of Georgia, the Law on Public Registry, the Tax Code of Georgia and the Administrative Offences Code of Georgia. However, the stakeholder consultations suggest there are still certain issues that are either not covered by the draft law or are still under discussion. Such issues are described below:

Status of windbreak areas - Windbreak areas initially under the property of a municipality should, under guarantee, maintain their status if transferred to private ownership.

Subject of the law- It is unclear as to the main subject regulated by the law, either the windbreak area or the windbreaks itself.

Control of windbreaks - The term “control” is not well-defined by the law. The term is used frequently throughout the law, though its related, exact responsibilities are not clear. The law should clarify the types of control functions that are assigned to the Ministry (e.g., overall supervision), municipality and private owners (e.g., physical protection).

Responsibility of municipalities - The main issue regarding the draft law is the responsibility of municipalities. Under the current conditions, municipalities will be obliged to maintain windbreaks. Municipalities of their own accord should allocate financial resources for the management of windbreaks. If the law is adopted, changes are required in the Organic Law of Georgia Local Self-Government Code. The code will need to outline that municipalities will be responsible for planning and conducting the restoration, planting, maintenance, protection and use of windbreaks. If municipalities receive a delegation of powers, then financial resources ought to be included in their budgets.

Moving to the normative acts - Some articles of the draft law might be designated as normative acts, such as: article 6, sections 2 and 5 of article 19, and sections 2 and 3 of article 22.

Stakeholders - The implementation of the law on windbreaks will require finances from the governmental budget, therefore the involvement of the Ministry of Finance will be necessary.

Details - Sections 4 and 6 of article 22 require a list of endemic species.

Renting windbreaks - The stakeholders have mixed opinions on farmers’ willingness to rent windbreaks. In the long-term, it is desirable for the state not to bear the full cost of windbreak rehabilitation and management, however, it is currently unclear as to whether famers are interested in renting windbreaks.

Support in cases of illegal logging/grazing etc.- It is not yet clear whether farmers will be financially supported by the state if windbreaks are illegally damaged.

4.5 BACKGROUND TO THE BASELINE SCENARIO

The establishment of windbreaks in Georgia started, on a relatively wide scale, from the 1960s, nevertheless, in Dedoplistskaro the implementation of windbreaks originated in the 1930s. During the Soviet period, a significant part of Shida Kartli, outer Kakheti, and the Shiraki valley were covered by various types of windbreak. Only in the Dedoplistskaro region did the area of windbreaks exceed 1770 hectares. While in the Shiraki valley, the total length of the windbreak area reached 1800km.

Over recent decades, most Georgian windbreaks have been destroyed, which has led to the significant consolidation of wind erosion. The protection, restoration and maintenance of windbreaks is very important for maintaining soil fertility and for increased harvests, especially considering climate change.

The intensity of wind erosion depends on the condition of the soil surface, the quantity of vegetation biomass and the strength of the wind. Further expansion of the processes of erosion increases the risks to the living vegetative cover.

The development of the agricultural sector in Georgia is hindered significantly by the process of soil erosion. In Eastern Georgia, more than 20% of arable land (110,000 hectares) has been degraded by wind erosion. Wind erosion has had a considerable impact in the soil of the Shida and Kvemo Kartli regions, and particularly in the outer Kakheti and Shiraki valley. Wind erosion is also apparent in the Akhalgori, Akhalkalaki, Akhaltsikhe, Bolnisi, Gardabani, Gori, Gurjaani, Dedoplistskaro, Dmanisi, Tetritskharo, Kaspi, Marneuli, Mtskheta, Sagarejo, Kareli, and Khashuri municipalities. While the Dedoplistskaro municipality is notably vulnerable to this process, where 37% of arable land has been degraded by wind erosion.

Wind erosion in eastern Georgia is not only related to strong winds, but also to droughts, especially in the winter. Over the last 50 years, the intensity of winds and droughts has significantly increased. Considering the forecasted climate change, soil erosion processes are expected to further intensify in the future.

The establishment of windbreaks is a widely recognized guard in the fight against wind erosion, as they significantly decrease the strength of the wind. In regions with prevalent wind erosion (Shida Kartli, outer Kakheti, and the Shiraki valley), the yield of the main crops and the productivity of the soil are heavily dependent on the existence of windbreaks. Moreover, windbreaks vastly improve the local microclimate, decrease the loss of moisture in soil, and correspondingly reduce the necessity for irrigation. The figures below show the current situation regarding: the productivity of crops in Georgia, the amount of agricultural land, land ownership patterns, irrigation related data, and climate change related trends. These are each affected or affect windbreak policy in the country. While, low productivity of agricultural crops remains one of the major challenges to Georgian agriculture (Table 4).

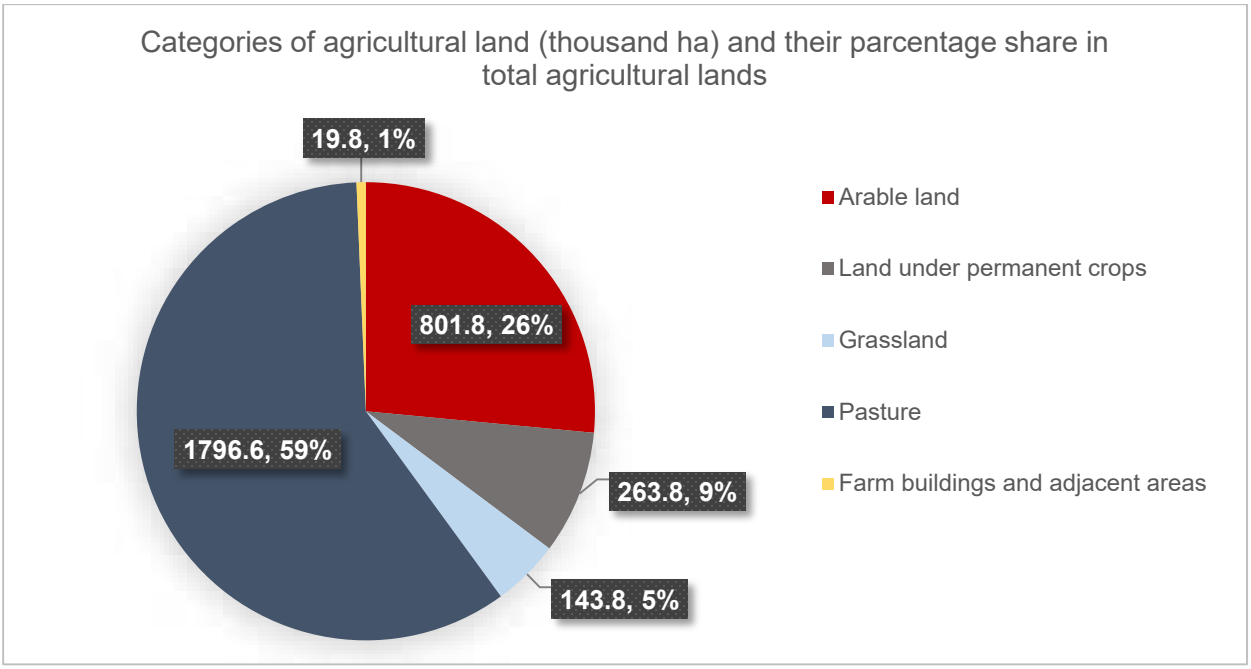
Table 4: Average yield of annual crops

Average yield of annual crops (tons/ha)				
Crop	**2014**	**2015**	**2016**	**2017**
Wheat	1.4	2.6	2.6	2.2
Barley	1.3	1.8	2	2
Oats	1.4	1.4	1.7	1.7
Maize	2.3	1.7	2.6	1.8
Haricot beans*	0.6	0.6	0.7	0.7
Sunflowers	0.7	0.7	0.9	0.5
Potatoes	11.7	8.3	12.3	9
Vegetables	6.6	6.9	8.2	7.3
Melons	23.1	22	22	25.8
Hay of annual grasses	3.6	4.3	3.6	3.4
Hay of perennial grasses	4.1	4.7	3.7	3.7

Source: Geostat, 2018

Since the area of a windbreak depends on the amount of arable land and the land required for permanent crops, these statistics are important to consider. The latest data (Figure 5) shows that pastures represent 59% of all agricultural land in Georgia, while arable land and permanent cropland represent 26% and 9%, respectively.

Figure 5: Distribution of agricultural lands, by categories

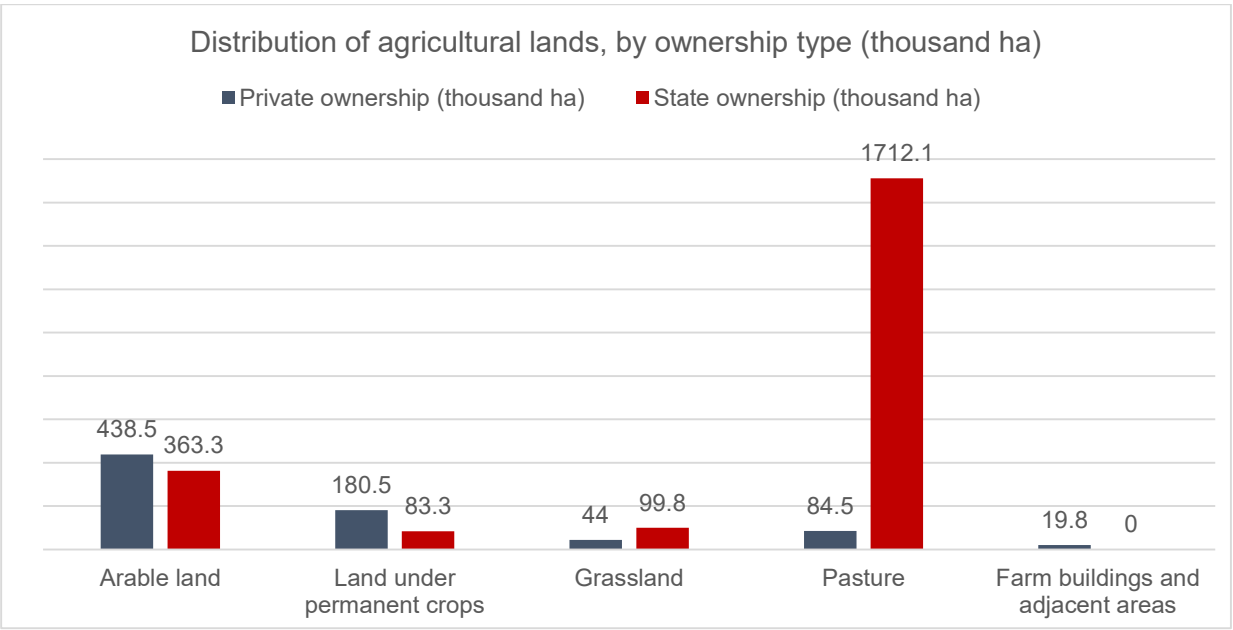


Source: Statistical publication on Georgia's Natural Resources and Environmental Protection, 2013

Note: The figures presented in the publication of 2013 are based on land fund data of 2003 and include the disputed zones of Georgia – Abkhazia and Ossetia

In ownership of agricultural land, pastures are largely owned by the state, while arable land and permanent cropland are mostly privately owned (Figure 6). Although private ownership is more common in the case of arable land, state ownership is still quite high.

Figure 6: Distribution of agricultural land, by ownership type

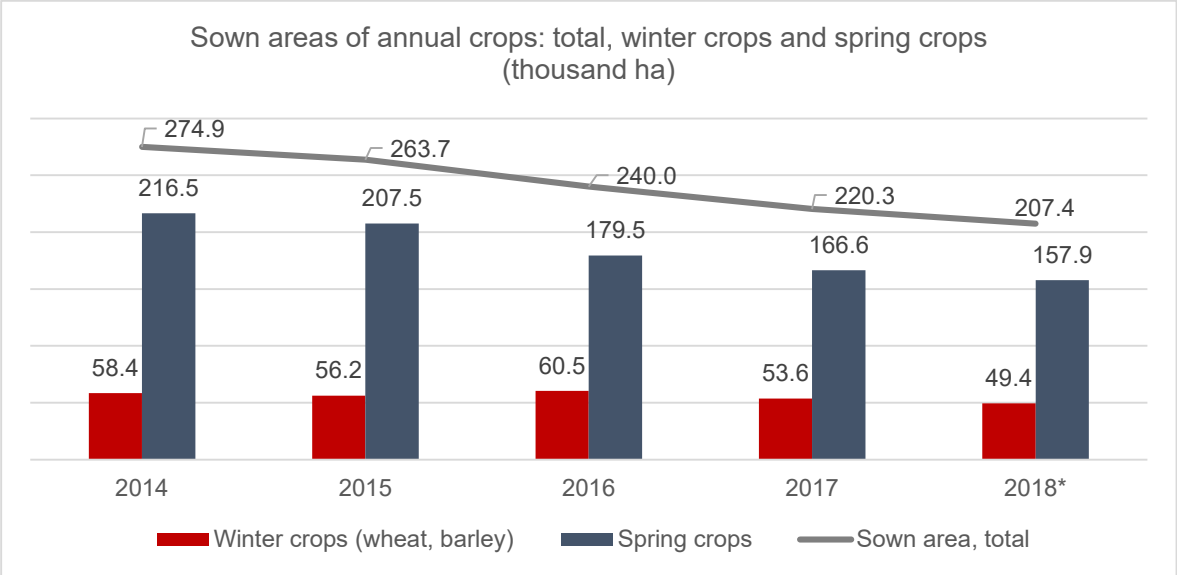


Source: Statistical publication on Georgia's Natural Resources and Environmental Protection, 2013

Note: The figures presented in the publication of 2013 are based on the land fund data of 2003 and include the disputed zones of Georgia – Abkhazia and Ossetia

One current major challenge to Georgian agriculture is the poor proportion of sown areas of total arable land. While the latest data for arable land is only available from 2013 (Figure 6), and thus cannot be compared to the data for 2017-2018 (Figure 7), it is clear that most arable lands (70%) have not been sown, unless the amount of arable land has significantly decreased since 2013. For instance in 2017, the sown area for annual crops was 220,300 ha (Figure 7), lower than previous years.

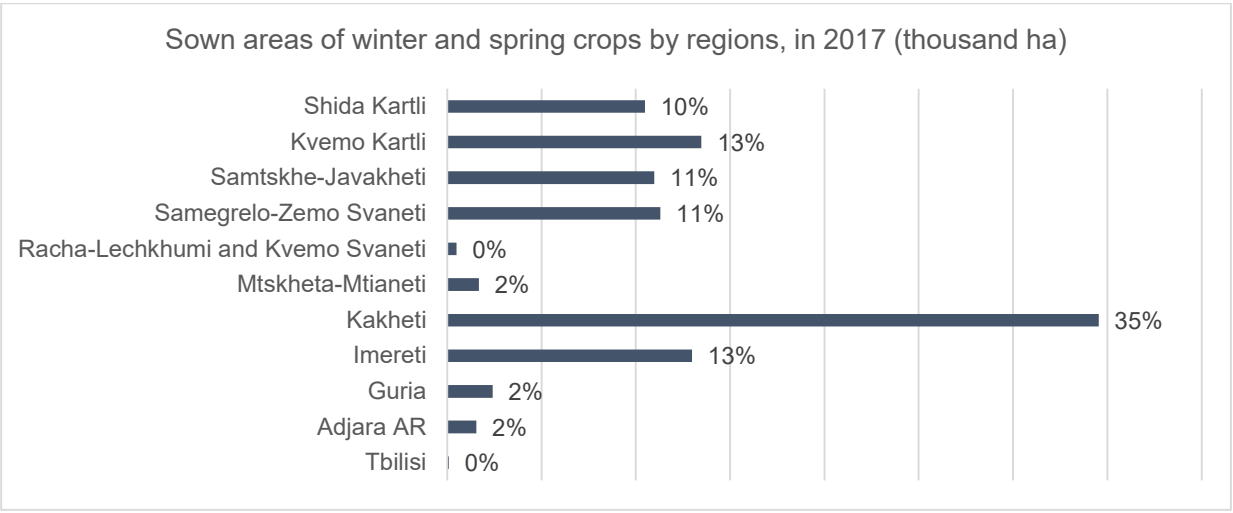
Figure 7: Sown areas of annual crops



Source: Geostat, 2018

As for the regional distribution of sown annual crops (Figure 8), Kakheti leads with the highest share, 35%, of total sown areas. Kakheti is followed by the regions of Kvemo Kartli and Imereti, where the sown areas of annual crops constitute 13% of the Georgian total.

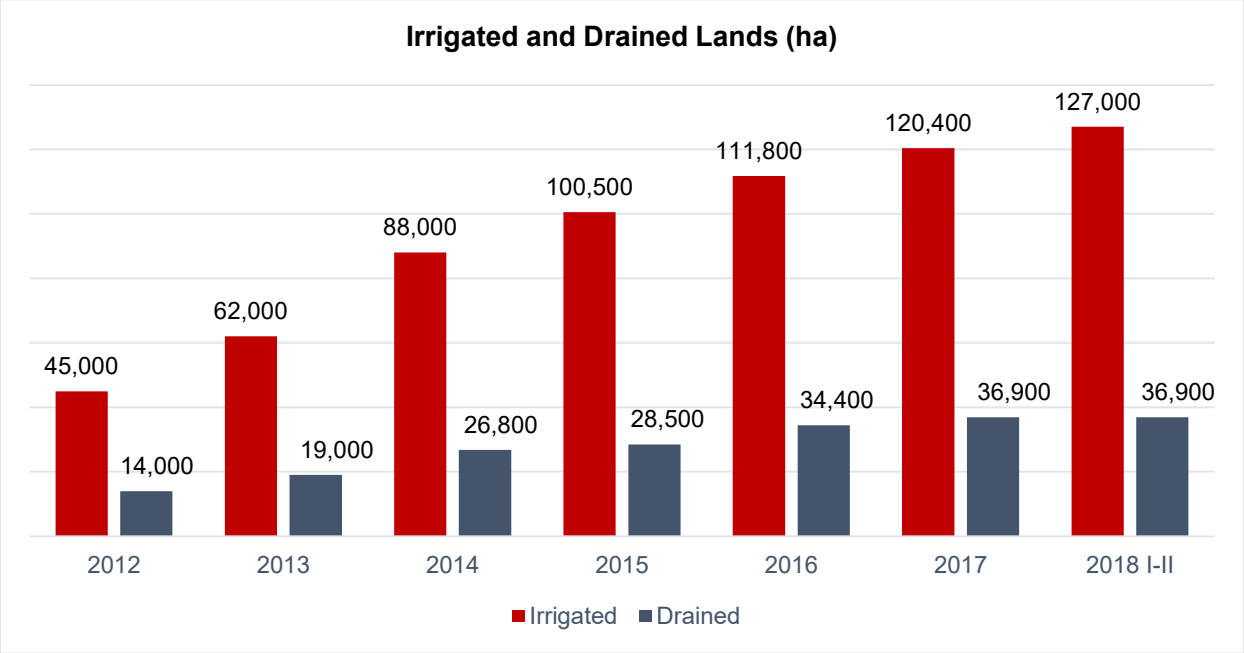
Figure 8: Sown areas of annual crops, by regions



Source: Geostat, 2018

As windbreaks represent an important melioration tool, it is important to consider the development of irrigated and drained areas (shown for the period of 2011-2018 in Figure 9). While irrigated areas have increased over time, and reached 127,000 ha in 2017, they still represent a very small share of the country's total arable land, revealing the lack of irrigation systems in Georgia.

Figure 9: Irrigated and drained land



Source: MEPA, 2018

Note: 2018 only includes I and II quarters

The ability of windbreaks to retain soil moisture can serve as a climate change adaptation measure. Due to climate change, it is expected that precipitation during the vegetative period will significantly decrease in 2071-2100[15]. It is also predicted that in the future dry areas will increase by 55%, while areas with high precipitation will decrease by 42%, mostly in East and South Georgia (Table 5).

Table 5: Areas with low, medium and high precipitation (km^2)

Years	Low precipitation areas (precipitation 600 mm and below)	Medium precipitation areas (precipitation 600-900 mm)	High precipitation (precipitation 900 mm and above)
1966 - 1990	14,665	46,386	8,113
2071 - 2100	22,799	41,699	4,673

Source: Climate Change Adaptation Measures in Agriculture, 2017

[15] Climate Change Adaptation Measures in Agriculture, 2017

5. OBJECTIVES OF THE DRAFT LAW

5.1 GENERAL AND SPECIFIC OBJECTIVES

The restoration of windbreaks is mentioned in the Agriculture Development Strategy of Georgia (2015-2020),[16] the Georgian Climate Change Strategy (2014),[17] the Second National Program against Desertification,[18] the Disaster Risk Reduction National Strategy (2017-2020),[19] alongside various regional development strategies.

The general objectives of the draft law are to support the sustainable management of windbreaks in order to reduce soil erosion, as well as to help to maintain appropriate soil conditions and macroclimates.

Based on the general objectives, the specific objectives of the draft law are as follows:

- The reduction of soil erosion;
- An increase in agricultural productivity.

Beyond those two specific objectives, the draft law indirectly supports:

- An increase in biodiversity;
- A reduction in irrigation costs.

5.2 OPERATIONAL OBJECTIVES

In order to achieve the general and specific objectives of the draft law, certain operational objectives have been defined. They include the creation of a legal basis for:

1. Windbreak inventory/planning;
2. Windbreak status;
3. Windbreak registration;
4. Windbreak rehabilitation and development;
5. Windbreak management;
6. Windbreak utilization;
7. Execution of fines;
8. Activities raising awareness of windbreaks.

The operational objectives of the draft law, along with the indicators developed to measure target progress, are presented in Table 6 below:

Table 6: Operational objectives and respective indicators

OBJECTIVE	INDICATOR	RESPONSIBILITY	TIMEFRAME
1. Define legal basis for inventory and planning			
1.1: Adoption of the draft law	The law on windbreaks and subsidiary legislation	MEPA	Finalized by 2019
1.2: Inventory of windbreaks	Database with inventory information	NASP	Finalized by 2019

[16] Approved by decree #167, 11 February 2015, of the Georgian government
[17] The third Georgian national notification regarding climate change
[18] Approved by decree #742, 29 December 2014, of the Georgian government
[19] Approved by decree #4, 11 January 2017, of the Georgian government

1.3: Planning windbreak planting and rehabilitation based on inventory results	State program on windbreak planning	MEPA	Finalized by 2020
2. Define legal basis for windbreak status			
2.1: Granting the status of windbreaks to respective areas	Number of decisions issued	Government	N/A
3. Define legal basis for windbreak registration			
3.1: Registration of windbreaks by Public Registry	Amount of land registered as windbreaks	Public Registry	N/A
4. Define legal basis for windbreak rehabilitation, planting and management			
4.1: Developing projects for windbreak planting and rehabilitation	Number of projects and management plans developed	Farmers, MEPA, municipality	N/A
5. Define legal basis for windbreak utilization			
5.1: Agreeing with windbreak users on the terms of windbreak utilization (functional use)	Number of agreements between potential users and municipalities	Municipality	N/A
6. Define legal basis for execution of fines			
6.1: Ensuring the execution of fines for illegal logging, grazing, fire and other illegal activities, or activities which might have negative impacts on windbreaks	Number of executed fines	MEPA	N/A
7. Raise awareness regarding windbreaks			
7.1: Conducting awareness raising campaigns for the benefit of windbreaks	Number of awareness raising campaigns conducted	MEPA	N/A
8. Rehabilitate and plant windbreaks			
8.1: Rehabilitating windbreaks where possible	Area rehabilitated (ha)	Municipality and MEPA	Finalized by 2035
8.2: Planting windbreaks where needed	Area planted (ha)	Municipality and MEPA	Finalized by 2035
9. Properly manage windbreaks			
9.1: Ensuring high survival rate of trees	Survival rate of planted trees in windbreaks (%)	Municipality and MEPA	N/A
9.2: Keeping track of the windbreak areas damaged from various causes	Damaged windbreak area (ha)	Municipality and MEPA	N/A
9.3: Ensuring the replanting of trees in damaged areas	Replanted area (ha)	Municipality and MEPA	N/A
10. Reduce land erosion			

10.1: Ensuring a reduction in land erosion	Amount of eroded agricultural land due to severe winds (ha)	MEPA	N/A
11. Increase agricultural productivity			
11.1: Ensuring an increase in agricultural productivity	Productivity of crops due to windbreaks (kg/ha)	MEPA and Geostat	N/A
12. Increase biodiversity			
12.1: Supporting biodiversity through the rehabilitation of windbreaks	Number of species associated with windbreaks	MEPA	N/A
13. Decrease irrigation costs			
13.1: Ensuring the reduction of irrigation costs	Irrigation costs (GEL/ha)	MEPA	N/A

6. POLICY OPTIONS

The RIA policy options assess the impact of the activities suggested by the draft law on windbreaks to farmers, municipalities and the central government. The policy options were derived from a literature review and an analysis of international practices, as well as interviews with the stakeholders. The following policy options are considered within this analysis:

- Option 0 (baseline scenario) - No policy change;
- Option 1 - Public-private ownership and management of windbreaks by farmers and municipalities;
- Option 2 - Public ownership and management of windbreaks by municipalities;
- Option 3 - Public ownership and management of windbreaks by a newly established state agency (unit).

Before the final options were selected, other policy options were additionally discussed, though they were discarded for various reasons. One of these options was the full private management of windbreaks, which was discarded because most stakeholders believed that farmers might not have strong enough incentives to sustainably manage their windbreaks. Another possibility related to the public ownership and management of windbreaks by the existing state agency, namely the National Forest Agency (NFA). However, this option was rejected because, while NFA has experience in managing forests, the forest code does not cover windbreaks and thus is out of the scope and mandate of NFA.

Below is a detailed description of the options, including their major characteristics and the risks associated with each:

Option 0 - Baseline scenario

This option assumes that there is no policy change and that the draft law is not adopted. This is the status quo, which is associated with the future risk of increased soil erosion and reduced agricultural productivity.

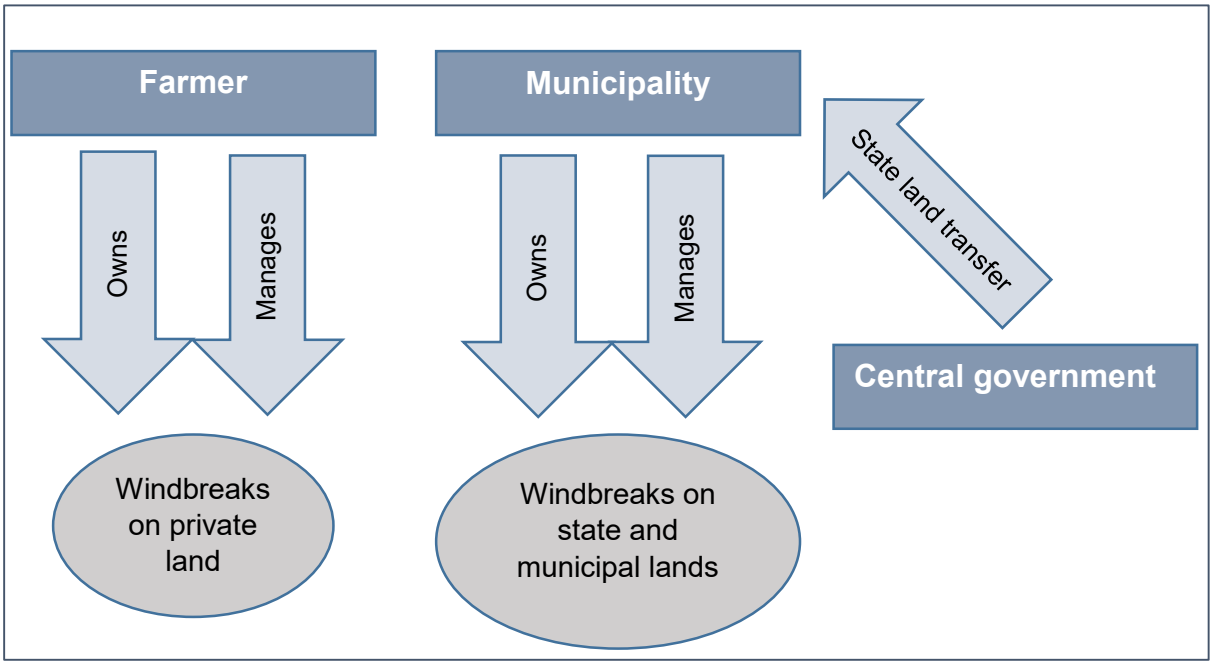
Status quo is characterized by the destruction of a high proportion of windbreaks (80%), due to poor socio-economic conditions, as well as the inadequate execution of fines for illegal logging.

In the baseline scenario, windbreaks do not have any legal status. The ownership of windbreaks is yet another ambiguous matter. Since a full inventory of windbreaks has not been completed, it is unclear what share of windbreaks overlap with private land and what proportion overlaps with state land. Consequently, windbreaks are not currently managed by either farmers or municipalities.

Option 1 - Public-private ownership and management of windbreaks by farmers and municipalities

This option follows a scheme suggested by the draft law and works on the assumption that private owners (farmers) will be responsible for the management of those windbreaks that overlap their private, registered land. While municipalities have to manage windbreaks which overlap state and municipal land. This option is illustrated in Figure 10 below:

Figure 10*:* Distribution of ownership and management functions in Option 1



This option assumes full implementation of the proposed legislation and has the following characteristics:

1. The development of a state program regarding windbreak planting and rehabilitation;
2. An inventory of windbreaks;
3. The development of windbreak management plans;
4. Windbreak rehabilitation and management;
5. Physical protection of windbreaks;
6. Capacity building of additional staff at the municipal level;
7. State subsidies to grain producers;
8. Fines for illegal logging.

The development of a state program regarding windbreak planting and rehabilitation

The process of windbreak planting and rehabilitation is initiated by the development of a state program that defines the notions behind windbreak policy. The state program thus represents the basis for windbreak strategy. According to the draft law, the state program requires development by the Agricultural scientific-research center. The center is also responsible for the planning of rehabilitation and planting, as well and defining the rules of rehabilitation and planting, of windbreaks.

An inventory of windbreaks

Creating an inventory of windbreaks is a process aimed at the identification and description of windbreak territories, with the objective to plan rehabilitation and registration. It is intended for NASP to conduct the inventory and design a windbreak registry. The latter should contain statistical information about the state of

windbreaks and their respective trees (varieties, ages, etc.) The windbreak registry should be a part of a database, managed by MEPA, containing information about all of Georgia's windbreaks. The inventory represents the basis for windbreak planning.

The development of windbreak management plans

Windbreaks must be rehabilitated and adequately managed, based on management plans developed by windbreak owners or renters. In this option, a management plan will be developed either by a municipality or farmers, following rules defined by the Agricultural scientific-research center. The development of management plans might also require the involvement of forest experts. Management plans are to contain the requirements (activities) necessary to properly maintain windbreaks.

Windbreak rehabilitation and management

Windbreak rehabilitation and management are the responsibility of the owner of a windbreak (farmer or municipality). Municipalities will likely outsource groups of workers for windbreak rehabilitation and supervise their work. The same is true for farmers. As for management, management activities include the replanting of windbreaks, irrigation, and other maintenance related activities. While, management also includes the biological protection of windbreaks.

Physical protection of windbreaks

Farmers and municipalities are responsible for ensuring the physical protection of windbreaks, and additional staff are to be hired at a municipal level, for general monitoring and supervision. The physical protection of windbreaks entails actions to reduce illegal logging, illegal grazing, damage caused by fire, and other negative anthropogenic impacts.

Capacity building of additional staff at the municipal level

In the baseline scenario, no single person is responsible for windbreak rehabilitation or management, thus in Option 1, there is a need to train additional staff, hired at the municipal level, on the best practices behind windbreak management.

State subsidies to grain producers

Since grain farmers in East Georgia are known for scouring their fields with fire, the option assumes the inclusion of a subsidy as an incentive to abandon this practice. As hiring machinery to remove harvest waste from fields is more costly than typical harvesting machinery, the state covers the difference in cost via such subsidies.

Fines for illegal logging

The successful implementation of intervention (windbreaks restoration) depends greatly on the execution of fines, this factor is considered in the analysis. While, a stricter execution of fines, along with incentives, is expected to positively affect the implementation of the draft law.

Risks

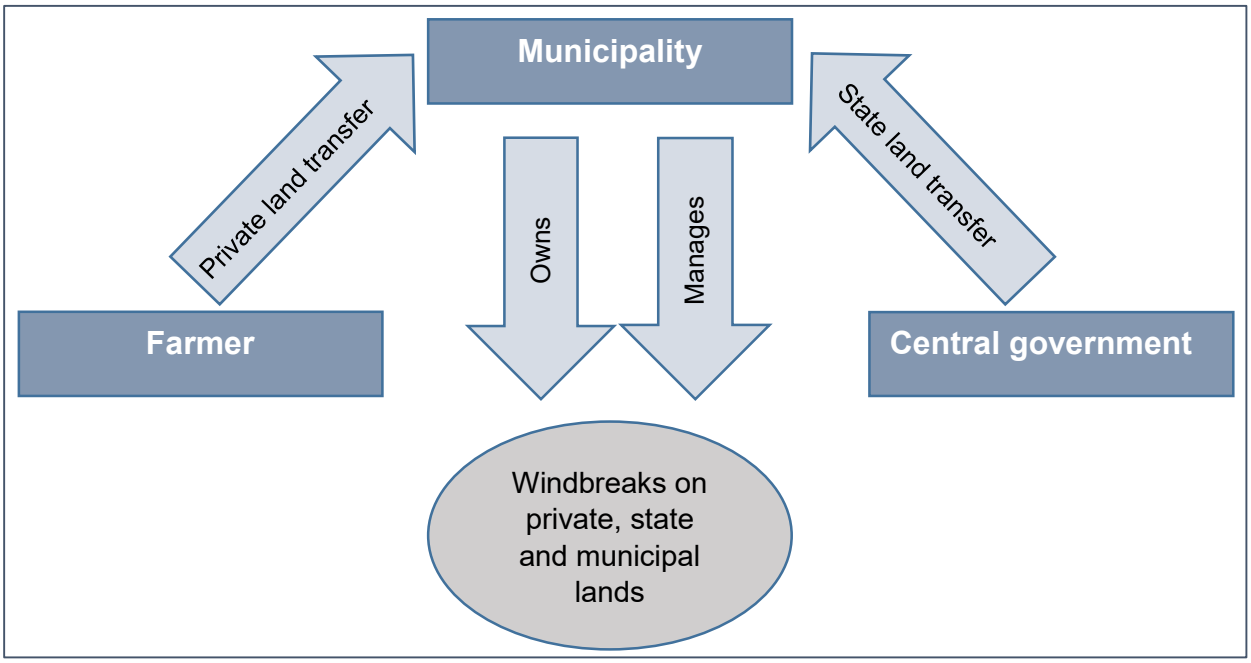
There is a risk that farmers will not properly maintain their windbreaks. In the absence of proper supervision from municipalities, a farmer might overexploit a windbreak. There is also a risk that municipalities, intended to care for windbreaks, will not receive the necessary funds from the state and their responsibilities will be expanded

without sufficient monetary support. There is a further risk that, despite awareness raising campaigns and incentives offered to farmers, individuals will continue to make fires in their fields or engage in illegal logging and grazing.

Option 2 - Public ownership and management of windbreaks by municipalities

The second option suggests that, when windbreaks coincide with private land, farmers will sell their land for compensation from the state. In this scenario, municipalities own and manage all the windbreaks in the country. This option is derived from international practices (Figure 11).

Figure 11: Distribution of ownership and management responsibilities in Option 2



Option 2 maintains the same characteristics as Option 1, and contains an additional feature:

1. Farmers receive compensation from the state.

Farmers receive compensation from the state

In cases where a windbreak area is owned by a farmer, and they are unwilling to take responsibility for its rehabilitation and management, the state purchases this area and compensates the farmer for the value of land.

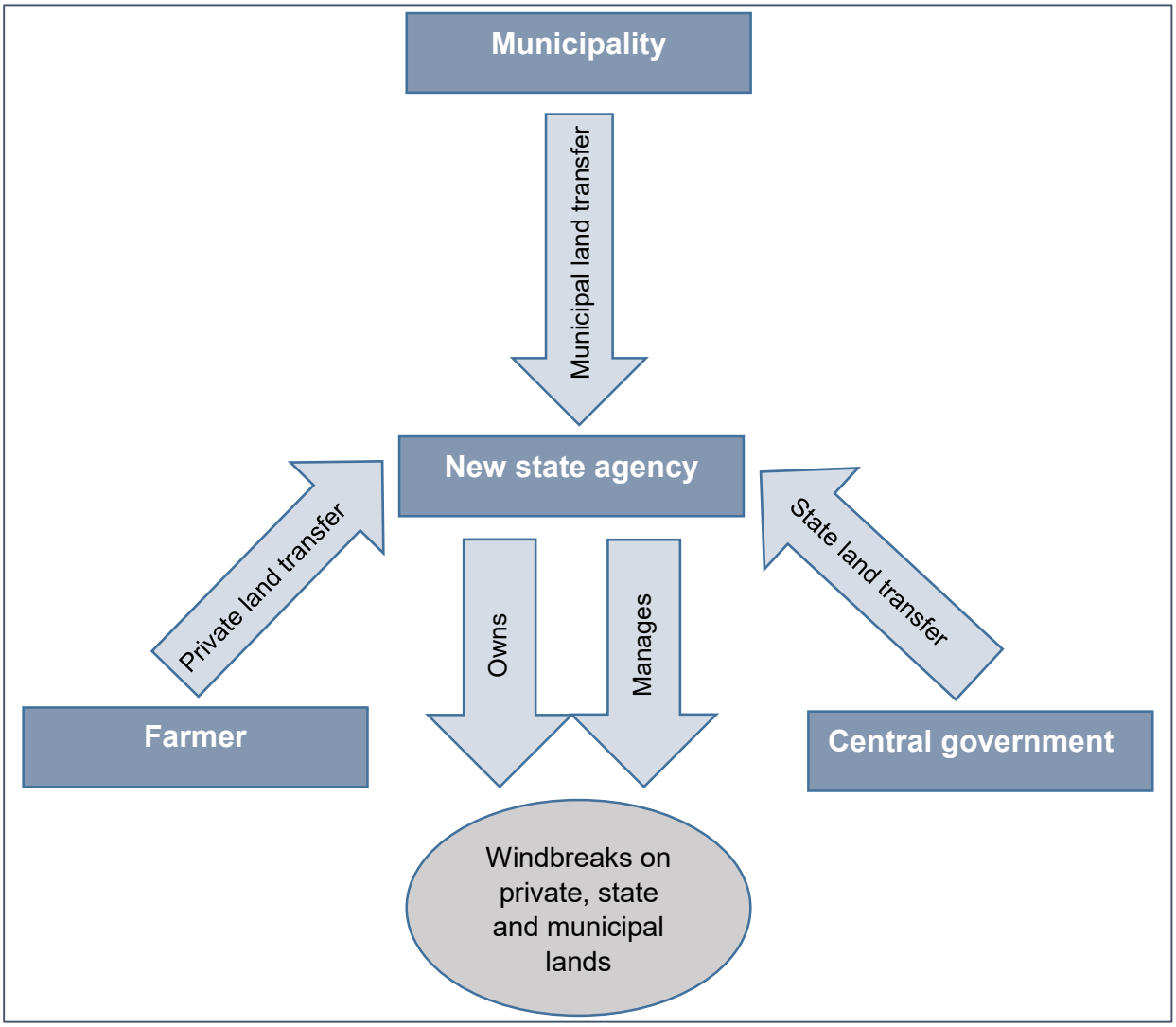
Risks

All the risks associated with Option 1 are equally relevant in Option 2, except for the risks related to the management of windbreaks by farmers, because in Option 2 all windbreaks are managed by municipalities. However, there is the additional risk that farmers might not be willing to sell their land to the municipality. In these cases, the implementation of the draft law will be hindered if farmers go to court, thus the process of windbreak rehabilitation might be prolonged by such opposition.

Option 3 - Public ownership and management of windbreaks by a newly established state agency (unit)

Municipalities currently lack the human and financial resources for windbreak planting, rehabilitation or management, consequently there is to be a separate agency established for this purpose (Figure 12). This Option is identical to Option 2, nevertheless it entails greater costs to the central government for the human resources to be hired for the new agency.

Figure 12: Distribution of ownership and management responsibilities in Option 3



Option 3 retains the same features as Option 2, with one additional characteristic:

1. A new entity is established for windbreak rehabilitation and management.

A new entity is established for windbreak rehabilitation and management

A new agency is established in order to manage windbreaks and coordinate all related activities. This agency is similar to NFA, which manages forests, or APA, which manages protected areas.

Risks

All the risks associated with Option 2 are still relevant in Option 3, along with some additional risks. The establishment of the new agency will increase the level of bureaucracy for the management of windbreaks.

Moreover, there is also a risk of duplicating certain activities, as municipalities are already required to be involved in local activities, even if they are not responsible for managing windbreaks.

7. ANALYSIS OF IMPACTS

7.1 METHODOLOGICAL APPROACH

The objective of this analysis is to identify the main quantitative and qualitative impacts of the suggested options for the various stakeholders in comparison to the baseline scenario. Thus, the analysis only considers the incremental costs and benefits of Options 1, 2 and 3 with regard to the baseline scenario. A set of assumptions is developed for each option, however before describing the assumptions that are specific to each suggested option, it is important to consider the assumptions that are common to all options (Table 7).

Table 7: Macroeconomic variables

Variable	Value	Source
Discounted rate	0.08551	National Bank of Georgia (average real interest paid on a 10-year government bond)
GEL/USD exchange rate (reference date - Nov 30, 2018)	2.6744 GEL/USD	National Bank of Georgia

The other general assumptions common to all policy options are listed below:

Framework

1. All values are real and prices are constant;
2. The analysis covers for 22 years;
3. There are three types of stakeholder in the analysis: farmers, municipalities and the central government;
4. There is no technological adoption (except for irrigation) by farmers, and crop production mix does not change over the years;
5. Non-operated state land gradually becomes operated as farmers rent 1% of state land annually;
6. The share of a municipality's non-operated land, from the total of non-operated land, is the same as the share of a municipality's operated land;
7. Operated land is not equivalent to cultivated land, where cultivated land constitutes 79% of operated land;
8. An inventory is conducted every five years and is financed by the state;
9. The share of executed fines increases over the years, from 1% to 17%;
10. Illegal logging decreases over the years, from 1% to 0.01%, due to an improved enforcement of fines.

Windbreak area

11. Windbreak areas are calculated per municipality and there are six types of area:

    - Windbreak areas to be planted on operated private land;
    - Windbreak areas to be rehabilitated on operated private land;
    - Windbreak areas to be planted on private non-operated land;
    - Windbreak areas to be rehabilitated on private non-operated land;

- Windbreak areas to be planted on state non-operated land;
- Windbreak areas to be rehabilitated on state non-operated land.

12. The municipalities are divided into six groups based on their location, in the East or West Georgia, and the severity of the wind (categories: I - very strong winds, II - strong winds or III - weaker winds):
    - Category I in East Georgia;
    - Category II in East Georgia;
    - Category III in East Georgia;
    - Category I in West Georgia;
    - Category II in West Georgia;
    - Category III in West Georgia.
13. Municipalities in East Georgia are more prone to winds, therefore windbreaks in East Georgia draw more lines and have a greater distance between the lines, than those municipalities in the West in the same category of wind severity;
14. Windbreak areas are proportional to the amount of arable land and land under permanent crops (pastures are not considered);
15. The proportion of windbreak area to the sum of arable land and land under permanent crops equals 2% in category I municipalities in East Georgia;
16. For the other municipal groups, the proportion of windbreak area to the sum of arable land and land under permanent crops is corrected, with the help of correction coefficients calculated based on the differences between the number of lines in the windbreak and the distance between lines, set for various groups of municipalities;
17. Windbreaks are planted and rehabilitated over 15 years, and the average planted and rehabilitated area equals 870 ha per year;
18. Where, 13% of windbreaks are planted on private land and the remainder on state land.

Activities

19. An inventory of windbreaks happens in year 1, conducted by NASP and costs in total around 31 million GEL;
20. The planning of windbreaks occurs in year 2 and an external expert is hired to support MEPA in windbreak program planning;
21. Planting and rehabilitation of windbreaks starts from year 2;
22. Around 80% of windbreaks require replanting, because of destruction, and 20% require rehabilitation;
23. The planting of windbreaks happens in the following order: category I municipalities, category II municipalities and then category III municipalities;
24. Rehabilitation costs are higher in the planting year, but remain the same in all other years.

Benefits and costs

25. Due to windbreaks, the productivity of crops increases by 11%-25%: depending on the crop the average normative value of production varies from 1,200 GEL/ha to 19,240 GEL/ha, with the average normative price at 8,260 GEL/ha;
26. Two chief crops are identified per municipality, based on their largest sown areas; subsequently the total municipal sown areas are proportionally redistributed between those two crops;
27. Since windbreaks can used non-functionally, it is assumed that there are no alternative costs for farmers on areas under windbreaks;
28. Irrigation savings are calculated only on the irrigated area affected by windbreaks;
29. The value of land increases due to windbreaks;
30. The cost of seedlings is covered by the state, irrespective of windbreak ownership;

31. Farmers pay fines for illegal logging and the amount of the fine is defined per tree and amounts to 333 GEL (with 2,518 trees per ha);
32. One additional member of staff responsible for windbreaks is hired in every municipality to oversee the planting and restoration processes; to report to their municipality and central government; to support awareness raising campaigns; and all other activities related to windbreaks;
33. Additional staff are hired for monitoring purposes within each municipality, depending on the size of windbreaks. For municipalities with a windbreak area in the range of 0-299 ha, no additional monitoring staff are hired; while for municipalities with a windbreak area ranging from 300 ha to 500 ha, two additional monitoring officers are hired; and for municipalities with a windbreak area of more than 500 ha, one car is provided, in addition to two newly hired monitoring officers;
34. Municipalities engage in staff capacity building activities, with the cost of capacity building at 1,000 GEL per person, to be incurred by the state;
35. Municipalities conduct awareness raising activities, with the cost of those activities at 25,000 GEL per year, to be incurred by the state.

The analysis of impacts depends significantly on windbreak area distribution, which has been calculated based on the previously discussed assumptions. In category I municipalities in East Georgia, the proportion of windbreak area to the sum of arable land and land under permanent crops equals 2%. While for the additional municipalities, the proportion was modified with the help of a correction coefficient, derived from the indicators presented in Table 8.

Table 8: Share of land under windbreak per municipality category

Name of protected crop	**Distance between lines in windbreak for each category of municipality (meters)**		
	Category I	**Category II**	**Category III**
Annual crops	2	2	2
Perennial crops	2	2	2
Average	**2**	**2**	**2**
	Average number of lines needed per category		
East Georgia	5	4	3
West Georgia	4	3	2
	Area based on number of lines and distance between lines		
East Georgia	10	8	6
West Georgia	8	6	4
	Correction coefficient for the area under the windbreak, as a percentage of arable land and land under permanent crops		
East Georgia	1	0.8	0.6
West Georgia	0.8	0.75	0.5
	Share of land under windbreak, as a percentage of arable land and land under permanent crops		
East Georgia	0.020	0.016	0.012
West Georgia	0.016	0.015	0.010

Thus, in category III municipalities (the weakest winds) in West Georgia, the share of windbreaks equals 1%. Overall, the proportion of windbreaks varies ranging from 1%-2% depending on the municipal category. The data on the amount of arable land and land under permanent crop is available per municipality,[20] therefore, with the proportions calculated above, it is possible to derive windbreak areas per municipality. The calculations show

[20] This data is available, per municipality, for operated land (owned or rented by agricultural holding), while the data on state owned land is only available on the aggregated level. In order to distribute state owned land by municipality, the same proportion of operated land was applied by the research team.

that windbreak area per municipality varies widely, from the lowest area of 2 ha in the Poti municipality to the greatest of 1,175 ha in the Dedoplistskaro municipality. The average area per municipality is 187 ha, while the total windbreak area equals 12,888 ha.

The planting and rehabilitation of windbreaks is to be conducted over 15 years and the process, reliant on the category of the municipalities, is planned in the following order (Table 9):

Table 9: Plan for windbreak rehabilitation and planting, by year

Year	Municipalities ordered by year of rehabilitation									
Year 3	Dedoplistskaro									
Year 4	Signagi									
Year 5	Gori									
Year 6	Kareli	Kaspi	Khashuri							
Year 7	Sagarejo									
Year 8	Poti	Samtredia	Abasha	Senaki	Khobi					
Year 9	Martvili	Zugdidi								
Year 10	Mtskheta	Kutaisi	Khoni	Terjola	Tskaltubo					
Year 11	Kobuleti	Lanchkhuti	Chokhatauri	Batumi						
Year 12	Akhalkalaki	Ninotsminda	Tsalka							
Year 13	Marneuli	Bolnisi	Dmanisi							
Year 14	Dusheti	Kazbegi	Ozurgeti	Chkhorotskhu	Tsalenjikha	Zestaponi	Baghdati	Vani	Tkibuli	
Year 15	Akhaltsikhe	Aspindza	Adigeni	Borjomi	Tetritskaro	Tianeti	Telavi			
Year 16	Akhmeta	Kvareli								
Year 17	Gurjaani	Lagodekhi	Shuakhevi	Khulo	Qeda	Sachkhere	Oni	Ambrolauri	Mestia	Lentekhi

Note: Rehabilitation starts in year 2, after the inventory and planning are finalized in year 1

7.2 QUALITATIVE IMPACT

The qualitative impacts of the selected options are summarized below:

Table 10: Qualitative impacts of the options

IMPACT	BASELINE SCENARIO	OPTION 1	OPTION 2	OPTION 3
	Currently, there are no financial resources allocated to windbreaks in	The draft law has both positive and negative effects on the state budget. On the positive side, as fines for illegal activities are enforced, the government	The expected impacts are similar to Option 1, but in Option 2 the governmental costs are expected to be higher, because planting and	The expected impacts are similar to Option 2, but in

Administrative / State budget	the state budget.	might generate income from these charges. In addition, the government might benefit from having decreased carbon footprints. On the negative side, there might be public administrative costs which include: • Developing the state program; • Additional human resources; • Creating an inventory; • Purchasing seedlings and protective tubes; • Transfers to municipal budgets including: o Management plans for windbreaks on state land; o Planting on state land, including seedling costs; o Rehabilitation on state land, including seedling costs; o Management costs; o Additional human resources; o Capacity building; o Increasing awareness; o Logging on state land; o Monitoring on state and private land.	rehabilitation, and management and maintenance of windbreaks, on both private and state land, are undertaken by the municipalities. Besides which, the government must redeem private windbreaks from farmers at an additional cost.	Option 3 the governmental costs are expected to be higher, because a new governmental agency is to be established to undertake all activities regarding windbreaks.
Economic	Currently, the development of the agricultural sector in Georgia is hindered significantly by soil erosion processes.	The planting and rehabilitation of windbreaks, and their management and maintenance, will have significant economic impacts that can be divided into positive and negative extents. The positive economic impacts of windbreaks are generated through increased crop production, energy saving, protection of greenhouses from heat loss, improved livestock productivity, reduction in irrigation loss, decline in agricultural chemical drift, and	The expected impacts are qualitatively similar to those discussed in Option 1, but in Option 2, the overall management cost of windbreaks are higher, because the government must redeem private windbreaks territory from farmers and undertake necessary management activities.	The expected impacts are qualitatively similar to those discussed in Option 1 and Option 2, but in Option 3, a new governmental agency is established, which requires additional financial and human resources.

		increases in property value. Increased crop and livestock productivity imply an increase in secondary agri-food production. In addition, there are further employment opportunities generated through planting, rehabilitation, management, and monitoring actions. On the negative side, there might be an opportunity cost on private operated land under windbreaks. Windbreaks might negatively affect small farmers as they can shadow part of the land and shrink a plot under cultivation.		
Social	There are farmers who use windbreaks as a source of wood, but also herders who use windbreaks for grazing their livestock.	There are potentially both positive and negative social impacts associated with this reform. On the positive side, there is a favorable effect on the livelihoods of the rural poor, those who are mostly involved in agriculture and depend on agricultural production in terms of food and raw materials. Other positive social impacts include aesthetic and spiritual benefits, which are considered important social benefits. On the negative side, the reform might worsen the socio-economic conditions of marginalized societal groups, including small farmers and herders. The potential negative effects on small farmers includes: • Small farmers plots might shrink, as windbreaks could be planted on their arable land; • Windbreaks can shadow part of farmers' lands and shrink crop production; • Maintenance of windbreaks requires	The expected social impacts are qualitatively similar to those discussed in Option 1.	The expected social impacts are qualitatively similar to those discussed in Option 1.

		capital and human resources from the farmers. As for herders, they use windbreaks for grazing their livestock, due to poor pasture conditions or the lack of availability of pastures.		
Environmental	Wind not only deteriorates agricultural crop production, but it also causes soil degradation. In prominent wind erosion regions, the productivity of the main crops and soil productivity depends heavily on the existence of windbreaks.	Windbreaks have several positive effects on the environment, including reduced wind erosion, and improved microclimates and soil formation. Windbreaks ameliorate microclimates significantly, decrease the loss of moisture in the soil and correspondingly reduce the necessity for irrigation. Windbreaks help snow retention, support wildlife habitats and biodiversity conservation, and moderate soil and air temperature. Another environmental benefit of windbreaks is reduced carbon sequestration.	The expected environmental impacts are qualitatively similar to those discussed in Option 1.	The expected environmental impacts are qualitatively similar to those discussed in Option 1.
Farmers	There are farmers who use windbreaks as a source of wood, but also herders who use windbreaks for grazing their livestock.	On the positive side, farmers can benefit from various monetary and non-monetary incentive mechanisms offered by the government, in exchange for planting and maintaining windbreaks. On the negative side, farmers have high costs associated with the management and maintenance of windbreaks.	The expected impacts are qualitatively similar to those discussed in Option 1, but in Option 2, the overall costs are lower for farmers, as the management and maintenance of windbreaks are completed by the municipalities.	The expected impacts are qualitatively similar to those discussed in Option 2.

7.3 COST-BENEFIT ANALYSIS

The analysis is based on the assumption that economic trends are exogenous to the reform. This allows us to produce more reliable estimates of the costs and benefits associated with the selected options.

Option 0 - Baseline scenario

There are no quantifiable costs or benefits associated with the baseline scenario. Instead, we focus on the quantification of the incremental costs of Options 1, 2 and 3, that are assumed on the basis of the information collected.

Option 1 - Public-private ownership and management of windbreaks by municipalities and farmers

In this scenario, windbreaks are owned and managed by municipalities and farmers. It is assumed that farmers are to be provided with provisions from the central budget in the form of the value of seedlings, although, all other costs related to windbreak planting, rehabilitation and management, including the development of a management plan, are covered by the farmers. In addition, farmers have the opportunity cost of the privately operated land under windbreaks. Funding for windbreak rehabilitation, maintenance and management plans on state lands are transferred from the central budget to the municipal budget. Furthermore, creating an inventory, awareness raising activities, and capacity building for newly hired municipal personnel are funded by the government.

QUANTIFIED COSTS

Farmers

- **Management plans for windbreaks on private land**: Each windbreak should have a management plan. The cost of developing management plans depends on the windbreak area and is estimated at 1,080 GEL per ha.
- **Seedling and tube cost:** The cost of seedlings is around 3 GEL per tree. Considering the number of trees per ha (2,518), the cost of seedlings is estimated at 7,554 GEL per ha. In addition, seedlings need to be protected by tubes, or other tools, at an additional cost of 2 GEL per tree. The cost of such protective tubes is 5,036 GEL per ha. It is assumed that 15% of seedlings will require replanting in the second year, which accounts for a further 1,133 GEL per ha.
- **Planting on private land, other than seedling cost:** Planting includes all other costs (preparing soil, digging holes, hoeing, mowing, watering) related to establishing windbreaks, except the cost of seedlings, and accounts for 4,786 GEL per ha.
- **Rehabilitation on private land:** In areas where old windbreaks require rehabilitation, the cost of preparing the soil is higher as the remains of the old windbreaks must be cleared. Accordingly, the costs of rehabilitation are higher and account for 5,619 GEL per ha.
- **Management costs:** These include the costs of hoeing, mowing, and watering within the first five years of planting. The frequency of each activities decreases year-by-year, therefore, the management cost declines, from 3,497 GEL per ha in the first year to 996 GEL per ha by the fifth year.
- **Land rental:** It is assumed that farmers rent 1% of non-operating state land every year, where the annual cost of rent is 100 GEL per ha.
- **Replanting costs from illegal logging:** It is expected that by the fifth year after planting, 1% of windbreaks on private land will have been illegally logged and the logging rate will decrease by 0.001 percentage point annually. It is proposed that farmers buy seedlings to replant windbreaks on private land, where the total costs of replanting, including buying seedlings, plastic tubes and preparing soil, will be 11,442 GEL per ha.
- **Fines:** Farmers pay fines for illegal logging. While, the amount of the fine varies dependent on the number of trees cut and their age.

Municipalities

- **Management plans for windbreaks on state land:** Each windbreak should have a management plan. The cost of developing management plans depends on the windbreak area and is estimated at 1,080 GEL per ha.
- **Seedling and tube cost:** The cost of seedlings is around 3 GEL per tree. Considering the number of trees per ha (2,518), the cost of seedlings is estimated at 7,554 GEL per ha. In addition, seedlings need

to be protected by tubes, or other tools, at an additional rate of 2 GEL per tree. The cost of such protective tubes is 5,036 GEL per ha. It is assumed that 15% of seedlings will require replanting in the second year, which accounts for a further 1,133 GEL per ha.

- **Planting on state land, excluding seedling costs:** Planting includes all other costs (preparing soil, digging holes, hoeing, mowing, watering) related to establishing windbreaks, except the cost of seedlings, and accounts for 4,786 GEL per ha.
- **Rehabilitation on state land, excluding seedling costs:** Rehabilitation is costlier than planting, due to the higher expense of preparing the soil, where all other costs are the same as planting. In total, the cost of windbreak rehabilitation is 5,619 GEL per ha.
- **Management costs:** These include the costs of hoeing, mowing, and watering within the first five years of planting. The frequency of each activities decreases year-by-year, therefore, the management cost declines, from 3,497 GEL per ha in the first year to 996 GEL per ha by the fifth year.
- **Additional human resources:** One additional permanent member of staff will be hired on the municipal level and will be responsible for supervising windbreak related activities in their respective municipality. The annual salary of the additional personnel will be 9,600 GEL.
- **Capacity building:** It is assumed that the newly hired permanent personnel will be trained. The amount of money allocated to such capacity building accounts for 1,000 GEL per person.
- **Increasing awareness:** Awareness increasing activities regarding windbreaks will be funded by the central budget and transferred to municipal budgets. Annually, 25,000 GEL will be allocated for these activities.
- **Replanting costs due to illegal logging:** It is expected that by the fifth year after planting, 1% of windbreaks on private land will have been illegally logged and the logging rate will decrease by 0.001 percentage point annually. It is proposed that municipalities buy seedlings and replant windbreaks, where the total costs of replanting, including buying seedlings, plastic tubes and preparing soil, will be 11,442 GEL per ha.
- **Monitoring costs:** It is assumed that monitoring costs are transferred to municipal budgets from the state budget. Monitoring costs differ according to the windbreak area. For municipalities with 300-500 ha under windbreaks, two monitoring officers are to be allocated. The annual salary of each officer is assumed to be 13,200 GEL. Monitoring officers will be equipped with one GPS device (800 GEL), two pairs of binoculars (200 GEL each), and two uniforms (400 GEL each). It is assumed that new uniforms will be provided annually. For municipalities with windbreaks of 500 ha and over, an additional car (a Suzuki Jimny) will be provided and at a cost of 66,860 GEL (the equivalent of 25,000 USD). New cars will be required every 10 years. While, the operational costs for the car (fuel and maintenance), considered in the analysis, equal 0.3 GEL/ha.[21]

The central government

- **Developing the state program:** One expert is hired to develop the windbreaks program. The expert will be reimbursed 1,000 GEL per day. It is estimated that expert will complete the work within 20 days, thus in total, 20,000 GEL will be allocated for expert reimbursement.
- **Additional human resources:** One additional permanent member of staff will be hired in MEPA's land resources protection unit, to be involved in the planning and developing of the windbreak database. The annual salary of the additional personnel will be 9,600 GEL.
- **Inventory:** An inventory process for private and state lands will be funded by the central budget and will be conducted one year before the planting and rehabilitation of windbreaks. The cost of the inventory is dependent on the windbreak area and is estimated at 2,346 GEL per ha. It is assumed that the inventory

[21] Based on the data from Vashlovani protected area

process will be completed every five years after planting. In the case of a re-inventory process, the costs are estimated to be 703.8 GEL per ha, 30% of the primary inventory (2,346 GEL per ha).

- **Seedling and tube costs:** Farmers are provided with seedlings to plant windbreaks, with the expense covered by the central government. The cost of seedlings is around 3 GEL per tree. Considering the number of trees per ha (2,518), the cost of seedlings is estimated at 7,554 GEL per ha. In addition, seedlings need to be protected by tubes, or other tools, at an additional rate of 2 GEL per tree. The cost of such protective tubes is 5,036 GEL per ha. It is assumed that 15% of seedlings will require replanting in the second year, which accounts for a further 1,133 GEL per ha.
- **Transfers to municipal budgets:** The funding for windbreaks planting, rehabilitation, maintenance and management plans on state lands are transferred from the central budget to municipal budgets. This transfer also includes the monitoring costs and salaries of additional permanent personnel in a municipality.

QUANTIFIED BENEFITS

Farmers

- **Productivity increase on private land:** Farmers will have increased productivity per ha (depending on the crop) from windbreaks, the expected average productivity increase is assumed to be 16% per ha. Productivity increases are predicted to start in the fifth year after planting (year 6 in the analysis). Normative values are used by crop type to calculate the productivity increases, and the average normative value of a crop is approximately 8,260 GEL per ha.
- **Productivity increase on newly operated rented land:** It is assumed that farmers will rent state land, starting from the second year of windbreak planting from the analysis. The proportion of state land rented by farmers will increase by the rate of 1% per year. An average normative value (8,260 GEL/ha) is used to calculate the productivity increase on rented land.
- **Irrigation cost savings:** Farmers will benefit from irrigation saving, as windbreaks reduce irrigation needs, on average, by 20%. The average annual growth rate of irrigated land is 14% and the average price of water is 60 GEL per ha.
- **Seedling and tube costs:** Farmers are provided with funds from the central budget in the form of seedlings and protective tubes.
- **Increased land value:** Windbreaks increase the value of land, and farmers benefit from the difference between the land value in year 1 (1,754 GEL/ha) and the residual value (1,456 GEL/ha) the land would have in the absence of a windbreak: the amortization rate is equal to 1%. For private land, this benefit is only calculated in year 22 (the last year of the analysis).

Municipalities

- **Additional funds from the state budget for windbreak rehabilitation and maintenance:** Municipalities receive funds from the central government for windbreak rehabilitation, maintenance and the development of management plans. The funds start from the first year, when the windbreaks are first planned.
- **Increased land value:** Windbreaks increase the value of land, and municipalities benefit from the difference between the land value in year 1 (1,754 GEL/ha) and the residual value (1,456 GEL/ha) the land would have in the absence of a windbreak: the amortization rate is equal to 1%. This benefit is only calculated in year 22 (the last year of the analysis) for state land.
- **Increased rental income:** Revenues from land rent, paid by farmers, on land which is state property. It is assumed that annually 1% of this land will be rented to farmers, at a price of 100 GEL per ha.

The central government

- **Carbon sequestration:** Windbreaks reduce the carbon footprint, estimated at 0.5 t/ha, while the price of a CO_2 permit is 15 USD/ton, in the GEL equivalent. The value of the sequestered carbon is multiplied by the area of planted and rehabilitated windbreaks.
- **Income from fines:** Fines executed for illegal logging are additional income for the state. The amount of a fine is calculated based on the number of trees cut, the total value of fines issued, corrected by the share of executed fines. The fines are calculated per tree and equal 333 GEL.

Option 2 - Public ownership and management of windbreaks by municipalities

In this scenario, windbreaks are owned and managed by various municipalities. In this instance, the state buys land from farmers and provides compensation for its value. Funding for windbreak rehabilitation, maintenance and management plans, as well as compensations for farmers, is transferred from the central budget to municipal budgets. Furthermore, inventory, awareness increase activities and capacity building of the newly hired municipality personnel, are also funded by the government.

QUANTIFIED COSTS

Farmers

- **Land rental:** It is assumed that farmers rent 1% of non-operated state land every year, where the annual cost of rent is 100 GEL per ha.
- **Fines:** Farmers pay fines for illegal logging. While, the amount of the fine varies dependent on the number of trees cut and their age.

Municipalities

- **Management plans for windbreaks on private and state land:** Each windbreak requires a management plan. The cost of developing management plans depends on the windbreak area and is estimated at 1,080 GEL per ha.
- **Seedling and tube costs:** The cost of seedlings is around 3 GEL per tree. Considering the number of trees per ha (2,518), the cost of seedlings is estimated at 7,554 GEL per ha. In addition, seedlings need to be protected by tubes, or other tools, at an additional cost of 2 GEL per tree. The cost of such protective tubes is 5,036 GEL per ha. It is assumed that 15% of seedlings will require replanting in the second year, which accounts for a further 1,133 GEL per ha.
- **Planting on private and state land:** Planting includes all other costs (preparing soil, digging holes, hoeing, mowing, watering) related to establishing windbreaks, except the cost of seedlings, and accounts for 4,786 GEL per ha.
- **Rehabilitation on private and state land:** In areas where old windbreaks require rehabilitation, the cost of preparing the soil is higher as the remains of the old windbreaks must be cleared. Accordingly, the costs of rehabilitation are higher and account for 5,619 GEL per ha.
- **Management costs:** These include the costs of hoeing, mowing, and watering within the first five years of planting. The frequency of each activities decreases year-by-year, therefore, the management cost declines, from 3,497 GEL per ha in the first year to 996 GEL per ha by the fifth year.
- **Compensation for farmers:** Where windbreaks have to be planted on private land, the state buys land from farmers and compensates them for the value of the land. It is assumed that land is valued at 1,754 GEL per ha.
- **Additional human resources:** One additional permanent member of staff will be hired on the municipal level and will be responsible for supervising windbreak related activities in their respective municipality. The annual salary of additional personnel will be 9,600 GEL.

- **Capacity building:** It is assumed that newly hired permanent personnel will be trained. The amount of money allocated to such capacity building accounts for 1,000 GEL per person.
- **Increasing awareness:** Awareness increasing activities regarding windbreaks will be funded by the central budget and transferred to municipal budgets. Annually, 25,000 GEL will be allocated for these activities.
- **Replanting costs from illegal logging:** It is expected that by the fifth year after planting, 1% of windbreaks on private land will have been illegally logged and the logging rate will decrease by 0.001 percentage point annually. It is proposed that municipalities buy seedlings to replant windbreaks where required. The total costs of replanting, including buying seedlings, plastic tubes and preparing soil, will be 11,442 GEL per ha.
- **Monitoring costs:** It is assumed that monitoring costs are transferred to municipal budgets from the state budget. Monitoring costs differ according to the windbreak area. For municipalities with 300-500 ha under windbreaks, two monitoring officers are to be allocated. The annual salary of each officer is assumed to be 13,200 GEL. Monitoring officers will be equipped with one GPS device (800 GEL), two pairs of binoculars (200 GEL each), and two uniforms (400 GEL each). It is assumed that new uniforms will be provided annually. For municipalities with windbreaks of 500 ha and over, an additional car (a Suzuki Jimny) will be provided and at a cost of 66,860 GEL (the equivalent of 25,000 USD). New cars will be required every 10 years. While, the operational costs for the car (fuel and maintenance), considered in the analysis, equal 0.3 GEL/ha. [22].

The central government

- **Developing the state program:** One expert is hired to develop the windbreaks program. The expert will be reimbursed 1,000 GEL per day. It is estimated that expert will complete the work within 20 days, thus in total, 20,000 GEL will be allocated for expert reimbursement.
- **Additional human resources:** One additional permanent member of staff will be hired in MEPA's land resources protection unit, to be involved in the planning and development of the windbreak database. The annual salary of additional personnel will be 9,600 GEL.
- **Inventory:** An inventory process for private and state lands will be funded by the central budget and will be conducted one year before the planting and rehabilitation of windbreaks. The cost of the inventory is dependent on the windbreak area and is estimated at 2,346 GEL per ha. It is assumed that the inventory process will be completed every five years after planting. In the case of a re-inventory process, the costs are estimated to be 703.8 GEL per ha, 30% of the primary inventory (2,346 GEL per ha).
- **Transfers to municipal budgets:** The funding for windbreak seedlings, protecting pipes, planting, rehabilitation, maintenance and management plans on state lands, are transferred from the central budget to municipal budgets. This transfer also includes the monitoring costs and salaries of additional permanent personnel in a municipality. There will also be a transfer from the state budget to municipal budgets compensating farmers 1,754 GEL per ha.

QUANTIFIED BENEFITS

Farmers

- **Productivity increase:** Farmers will have increased productivity per ha (depending on the crop) from windbreaks, the expected average productivity increase is assumed to be 16% per ha. Productivity increases are predicted from the fifth year after planting. Normative values are used by crop type to

[22] Based on the data from Vashlovani protected area

calculate the productivity increases, and the average normative value of 11 crops is approximately 8,260 GEL per ha.

- **Productivity increase on newly operated land:** It is assumed that farmers will rent state land, starting from the second year of windbreak planting from the analysis. The proportion of state land rented by farmers will increase by the rate of 1% per year. An average normative value (8,260 GEL/ha) is used to calculate the productivity increase on rented land.
- **Irrigation cost savings:** Farmers will benefit from irrigation saving, as windbreaks reduce irrigation needs, on average, by 20%. The average annual growth rate of irrigated land is 14% and the average price of water is 60 GEL per ha.
- **Compensation for farmers:** Where windbreaks have to be planted on private land, the state buys land from farmers and compensates them for the value of the land. It is assumed that land is valued at 1,754 GEL per ha.
- **Increased land value:** Windbreaks increase the value of land, and farmers benefit from the difference between the land value in year 1 (1,754 GEL/ha) and the residual value (1,456 GEL/ha) the land would have in the absence of a windbreak: the amortization rate is equal to 1%. For private land, this benefit is only calculated in year 22 (the last year of the analysis).

Municipalities

- **Additional funds from the state budget for windbreak rehabilitation and maintenance:** Municipalities receive funding from the central government for windbreak rehabilitation, maintenance and the development of management plans. The funds start from the first year, when windbreaks are planted.
- **Additional funds from the state budget for farmers' compensation:** The state transfers money to municipalities. The state also provides compensation to pay for the land where windbreaks will be planted. It is assumed that land is valued at 1,754 GEL per ha.
- **Increased land value:** Windbreaks increase the value of land, and municipalities benefit from the difference between the land value in year 1 (1,754 GEL/ha) and the residual value (1,456 GEL/ha) the land would have in the absence of a windbreak: the amortization rate is equal to 1%. This benefit is only calculated in year 22 (the last year of the analysis) for state land.
- **Increased rental income:** Revenues from land rent, paid by farmers, on land which is state property. It is assumed that annually 1% of this land will be rented to farmers, at a price of 100 GEL per ha.

The central government

- **Carbon sequestration:** Windbreaks reduce the carbon footprint, estimated at 0.5 t/ha, while the price of a CO_2 permit is 15 USD/ton, in the GEL equivalent. The value of the sequestered carbon is multiplied by the area of planted and rehabilitated windbreaks.
- **Income from fines:** Fines executed for illegal logging are additional income for the state. The amount of a fine is calculated based on the number of trees cut, the total value of fines issued, corrected by the share of executed fines. The fines are calculated per tree and equal 333 GEL.

Option 3 - Public ownership and management of windbreaks by a separate state agency

In this scenario, windbreaks are owned and managed by a separate state agency. This ensures that the state buys land from farmers and provides compensation for the value of the land. Funding for windbreak rehabilitation, maintenance and management plans, as well as compensations for farmers, is transferred from the central budget to municipal budgets. Furthermore, creating an inventory, developing awareness increasing activities and capacity building for newly hired municipal personnel are all funded by the government.

QUANTIFIED COSTS

Farmers

- **Land rental:** It is assumed that farmers rent 1% of non-operating state land every year, where the annual cost of rent is 100 GEL per ha.
- **Fines:** Farmers pay fines for illegal logging. While, the amount of the fine varies dependent on the number of trees cut and their age.

Municipalities

- **Management plans for windbreaks:** Each windbreak requires a management plan. The cost of developing management plans depends on windbreak area and is estimated at 1,080 GEL per ha.
- **Seedling and tube costs:** The cost of seedlings is around 3 GEL per tree. Considering the number of trees per ha (2,518), the cost of seedlings is estimated at 7,554 GEL per ha. In addition, seedlings need to be protected by tubes, or other tools, at an additional cost of 2 GEL per tree. The cost of such protective tubes is 5,036 GEL per ha. It is assumed that 15% of seedlings will require replanting in the second year, which accounts for a further 1,133 GEL per ha.
- **Planting on private and state land:** Planting includes all other costs (preparing soil, digging holes, hoeing, mowing, watering) related to establishing windbreaks, except the cost of seedlings, and accounts for 4,786 GEL per ha.
- **Rehabilitation on private and state land:** In areas where old windbreaks require rehabilitation, the cost of preparing the soil is higher as the remains of the old windbreaks must be cleared. Accordingly, the costs of rehabilitation are higher and account for 5,619 GEL per ha.
- **Management costs:** These include the costs of hoeing, mowing, and watering within the first five years of planting. The frequency of each activities decreases year-by-year, therefore, the management cost declines, from 3,497 GEL per ha in the first year to 996 GEL per ha by the fifth year.
- **Compensation for farmers:** Where windbreaks have to be planted on private land, the state buys land from farmers and compensates them for the value of the land. It is assumed that land is valued at 1,754 GEL per ha.
- **Additional human resources:** One additional permanent staff will be hired on the municipal level and will be responsible for supervising windbreak related activities in their respective municipality. The annual salary of additional personnel will be 9,600 GEL.
- **Capacity building:** It is assumed that newly hired permanent personnel will be trained. The amount of money allocated to such capacity building accounts for 1,000 GEL per person.
- **Increasing awareness:** Awareness increasing activities regarding windbreaks will be funded by the central budget and transferred to municipal budgets. Annually, 25,000 GEL will be allocated for these activities.
- **Replanting costs from illegal logging:** It is expected that by the fifth year after planting, 1% of windbreaks on private land will have been illegally logged and the logging rate will decrease by 0.001 percentage point annually. It is proposed that farmers buy seedlings to replant windbreaks on private land, where the total costs of replanting, including buying seedlings, plastic tubes and preparing soil, will be 11,442 GEL per ha.
- **Monitoring costs:** It is assumed that monitoring costs are transferred to municipal budgets from the state budget. Monitoring costs differ according to the windbreak area. For municipalities with 300-500 ha under windbreaks, two monitoring officers are to be allocated. The annual salary of each officer is assumed to be 13,200 GEL. Monitoring officers will be equipped with one GPS device (800 GEL), two pairs of binoculars (200 GEL each), and two uniforms (400 GEL each). It is assumed that new uniforms will be provided annually. For municipalities with windbreaks of 500 ha and over, an additional car (a Suzuki Jimny) will be provided and at a cost of 66,860 GEL (the equivalent of 25,000 USD). New cars

will be required every 10 years. While, the operational costs for the car (fuel and maintenance), considered in the analysis, equal 0.3 GEL/ha.

The central government

- **Developing the state program:** One expert is hired to develop the windbreaks program. The expert will be reimbursed 1,000 GEL per day. It is estimated that expert will complete the work within 20 days, thus in total, 20,000 GEL will be allocated for expert reimbursement.
- **Additional human resources:** A separate state agency will be formed and include five permanent staff members. The annual salary of additional personnel will account for 66,000 GEL.
- **Inventory:** An inventory process for private and state lands will be funded by the central budget and will be conducted one year before the planting and rehabilitation of windbreaks. The cost of the inventory is dependent on the windbreak area and is estimated at 2,346 GEL per ha. It is assumed that the inventory process will be completed every five years after planting. In the case of a re-inventory process, the costs are estimated to be 703.8 GEL per ha, 30% of the primary inventory (2,346 GEL per ha).
- **Transfers to municipal budgets:** The funding for windbreak seedlings, protecting pipes, planting, rehabilitation, maintenance and management plans on state lands are transferred from the central budget to municipal budgets. This transfer also includes the monitoring costs and salaries of additional permanent personnel in a municipality. There will also be a transfer from the state budget to municipal budgets compensating farmers 1,754 GEL per ha.

QUANTIFIED BENEFITS

Farmers

- **Productivity increase:** Farmers will have increased productivity per ha (depending on the crop) from windbreaks, the expected average productivity increase is assumed to be 16% per ha. Productivity increases are predicted to start in the fifth year after planting. Normative values are used by crop type to calculate the productivity increases, and the average normative value of 11 crops is approximately 8,260 GEL per ha.
- **Productivity increase on newly operated land:** It is assumed that farmers will rent state land, starting from the second year of windbreak planting from the analysis. The proportion of state land rented by farmers will increase by the rate of 1% per year. An average normative value (8,260 GEL/ha) is used to calculate the productivity increase on rented land.
- **Irrigation cost savings:** Farmers will benefit from irrigation saving, as windbreaks reduce irrigation needs, on average, by 20%. The average annual growth rate of irrigated land is 14% and the average price of water is 60 GEL per ha.
- **Compensation for farmers:** Where windbreaks have to be planted on private land, the state buys land from farmers and compensates them for the value of the land. It is assumed that land is valued at 1,754 GEL per ha.
- **Increased land value:** Windbreaks increase the value of land, and farmers benefit from the difference between the land value in year 1 (1,754 GEL/ha) and the residual value (1,456 GEL/ha) the land would have in the absence of a windbreak: the amortization rate is equal to 1%. For private land, this benefit is only calculated in year 22 (the last year of the analysis).

  Land rental: It is assumed that farmers rent 1% of non-operating state land every year, where the annual cost of rent is 100 GEL per ha.

Municipalities

- **Additional funds from the state budget for windbreak rehabilitation and maintenance:** Municipalities receive funds from the central government for windbreak rehabilitation, maintenance and the development of management plans. The funds start from the first year, when windbreaks are planted.
- **Additional funds from the state budget for farmers' compensation:** The state transfers money to municipalities. The state also provides compensation to pay for the land where windbreaks will be planted. It is assumed that land is valued at 1,754 GEL per ha.
- **Increased land value:** Windbreaks increase the value of land, and municipalities benefit from the difference between the land value in year 1 (1,754 GEL/ha) and the residual value (1,456 GEL/ha) the land would have in the absence of a windbreak: the amortization rate is equal to 1%. This benefit is only calculated in year 22 (the last year of the analysis) for state land.
- **Increased rental income:** Revenues from land rent, paid by farmers, on land which is state property. It is assumed that annually 1% of this land will be rented to farmers, at a price of 100 GEL per ha.

The central government

- **Carbon sequestration:** Windbreaks reduce the carbon footprint, estimated at 0.5 t/ha, while the price of a CO_2 permit is 15 USD/ton, in the GEL equivalent. The value of the sequestered carbon is multiplied by the area of planted and rehabilitated windbreaks.
- **Income from fines:** Fines executed for illegal logging are additional income for the state. The amount of a fine is calculated based on the number of trees cut, the total value of fines issued, corrected by the share of executed fines. The fines are calculated per tree and equal 333 GEL.

7.4 SUMMARY

The results of the CBA and qualitative analysis are summarized in the table and diagrams below:

Table 11. Summary of results

	OPTION 1	OPTION 2	OPTION 3
Quantitative impacts (NPV of net benefits)	689,960,658 GEL	689,492,311 GEL	688,941,226 GEL
Qualitative impacts (if quantitative not possible)	**POSITIVES:** 1. Sustainable management of windbreaks, as private owners who planted and rehabilitated windbreaks will be motivated to protect them; 2. Utilization of existing resources (e.g., infrastructure, human resources etc.); 3. Lower risk of conflicts between farmers and municipalities. **NEGATIVES:** 1. Higher costs for farmers due to windbreaks planting and management costs;	**POSITIVES:** 1. Lower costs for farmers; 2. Utilization of existing resources (e.g., infrastructure, human resources etc.). **NEGATIVES:** 1. Higher pressure on municipalities; 2. Risk of conflicts between municipalities and farmers (locals); 3. The risk that the state will not transfer required funds to municipalities.	**POSITIVES:** 1. Lower costs for farmers; 2. Better coordination and easier reporting. **NEGATIVES:** 1. Higher costs for the state; 2. Increased risk of double management; 3. Increased bureaucracy; 4. The risk of conflict with farmers; 5. Insufficient use of existing recourses (infrastructure, human resources etc.).

	2. The risk of lack of coordination between municipalities and farmers; 3. The risk of lower protection of windbreaks as small-scale farmers might overexploit windbreaks; 4. The risk that the state will not transfer required funds to municipalities.		

Figure 13: Comparison of the discounted benefits and costs of the policy options

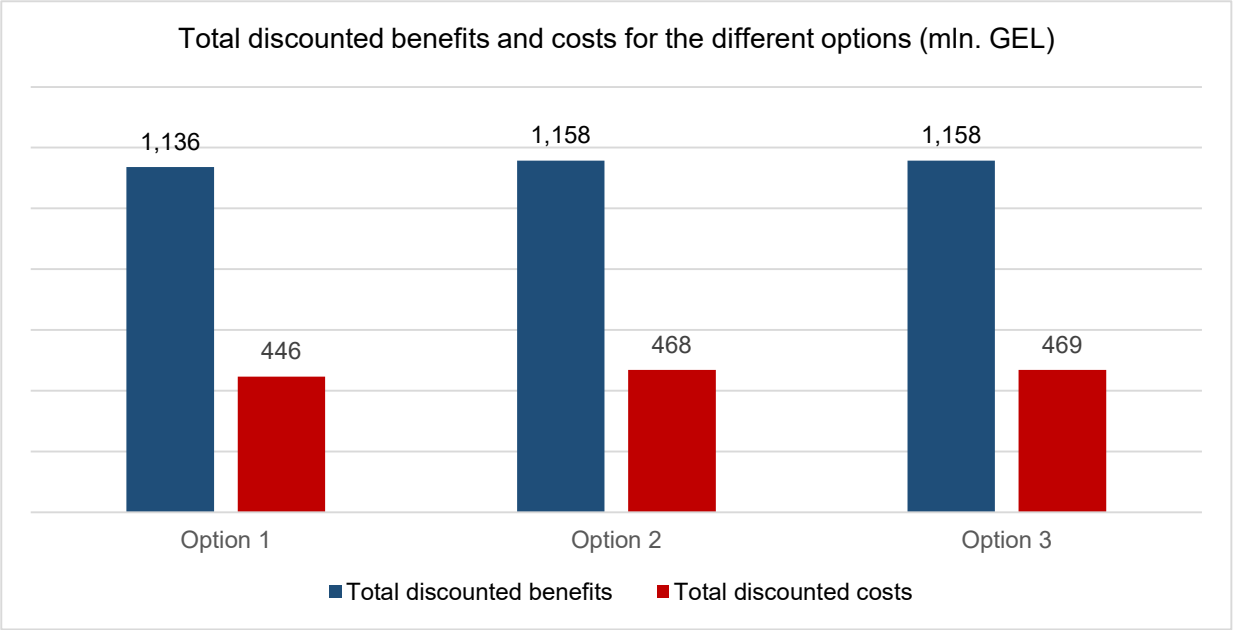


Figure 14: Comparison of the discounted net benefits of the policy options, by stakeholder groups

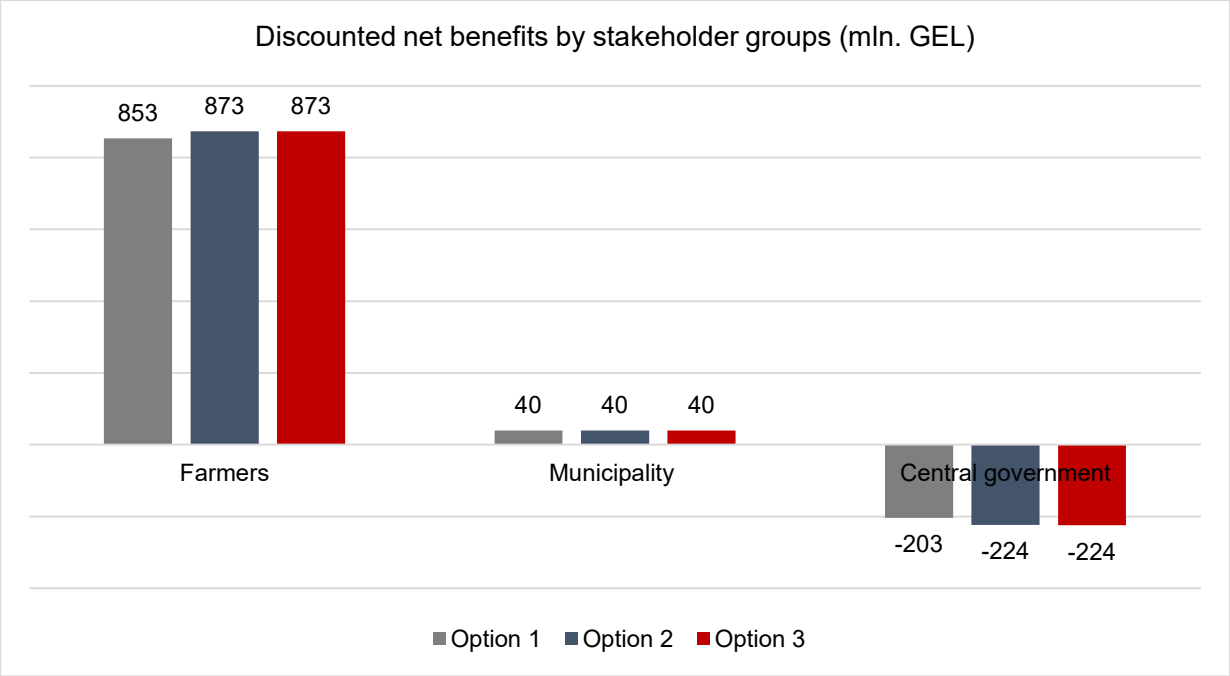


Figure 15: Discounted net benefits for farmers, by years

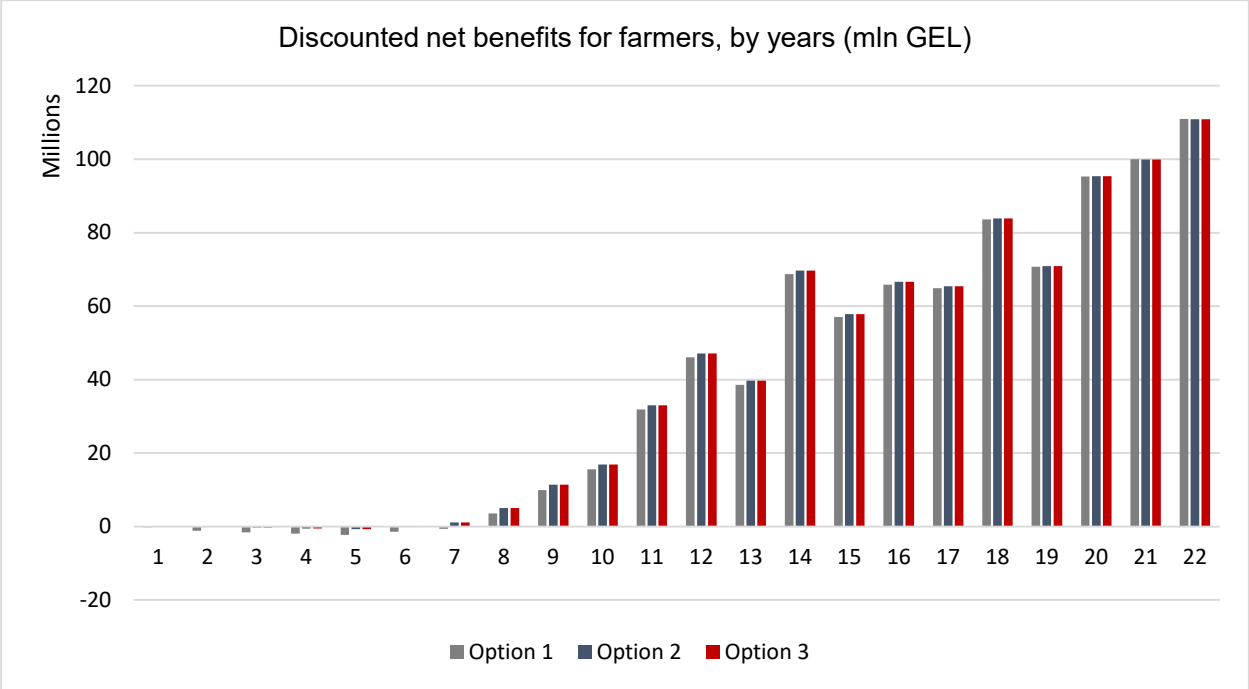


Figure 16: Discounted net benefits for municipalities, by years

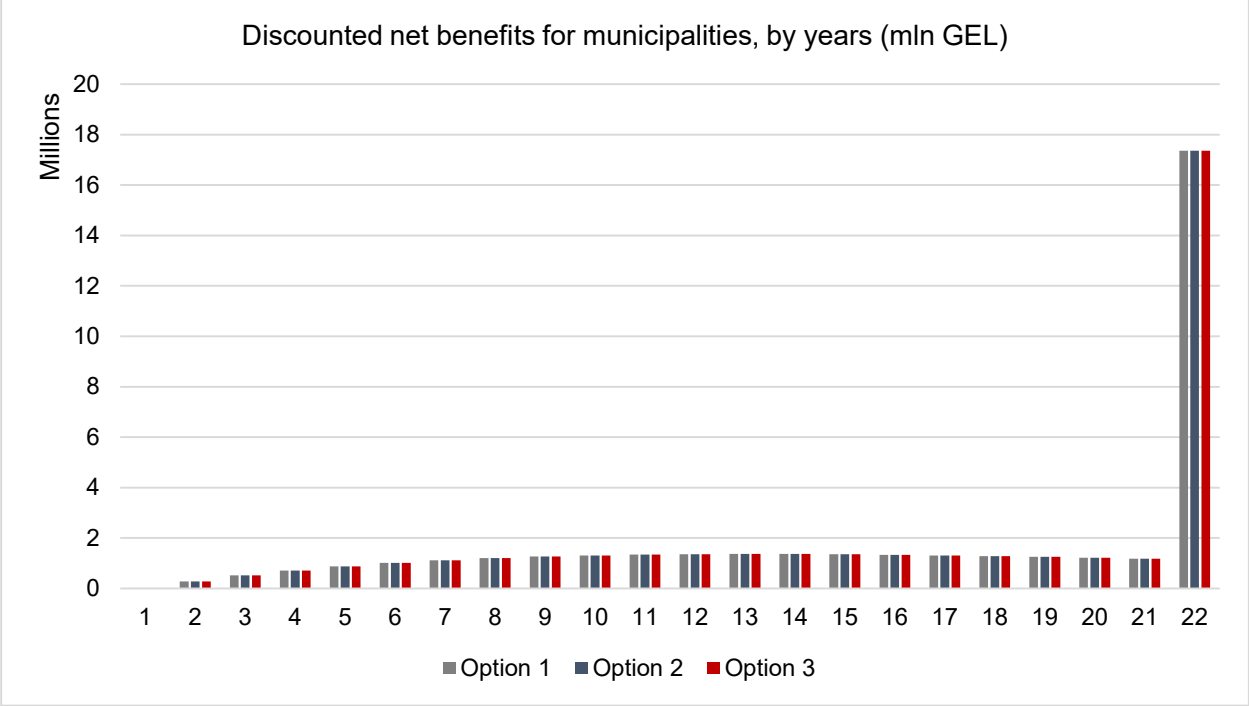
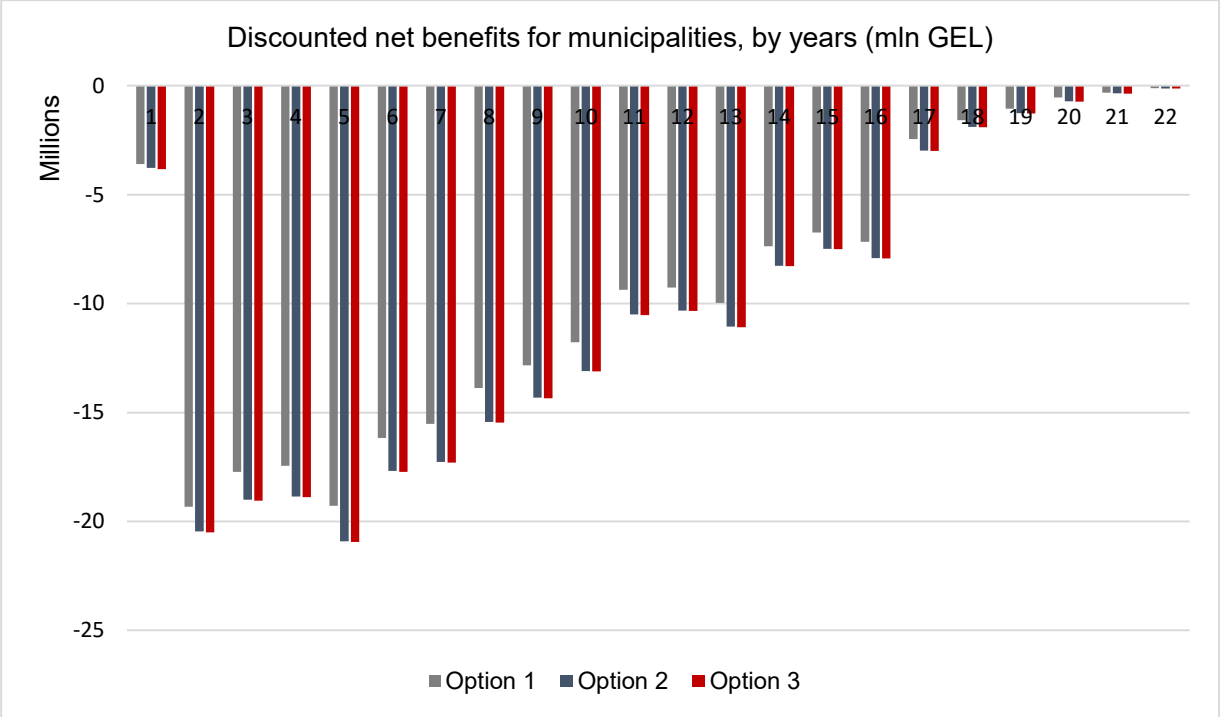


Figure 17: Discounted net benefits for the central government, by years



A more detailed analysis of the benefits and costs is presented in the Annex (Figures A1-A6).

7.5 SENSITIVITY ANALYSIS

A sensitivity analysis was performed in order to ascertain the robustness of the results considering the changing parameters. In the framework of the sensitivity analysis, it was assumed that enforcement and execution of the draft law on windbreaks will be completed utilizing existing resources, as suggested by the main stakeholders. The following costs were thus annulled in all three scenarios:

- Expert reimbursement for compiling a state strategy on windbreaks- MEPA will oversee this responsibility;
- There is no need to hire new employees at the municipal level;
- There is no need for capacity building (training) on windbreaks;
- There is no need to hire additional monitoring officers- either municipality representatives or Information-Consultation Centers (ICCs) can control windbreak areas;
- The inventory process does not require additional financial resources- it could be completed by NASP, using existing resources;
- There is need to hire new employees at the central level.

The analysis reveals that the low-cost scenario does not have a significant effect on the final results, as Option 1 is preferable to both Option 2 and Option 3 due to the higher net discounted benefits.

Figure 18: Total discounted benefits and costs for different options (mln. GEL)

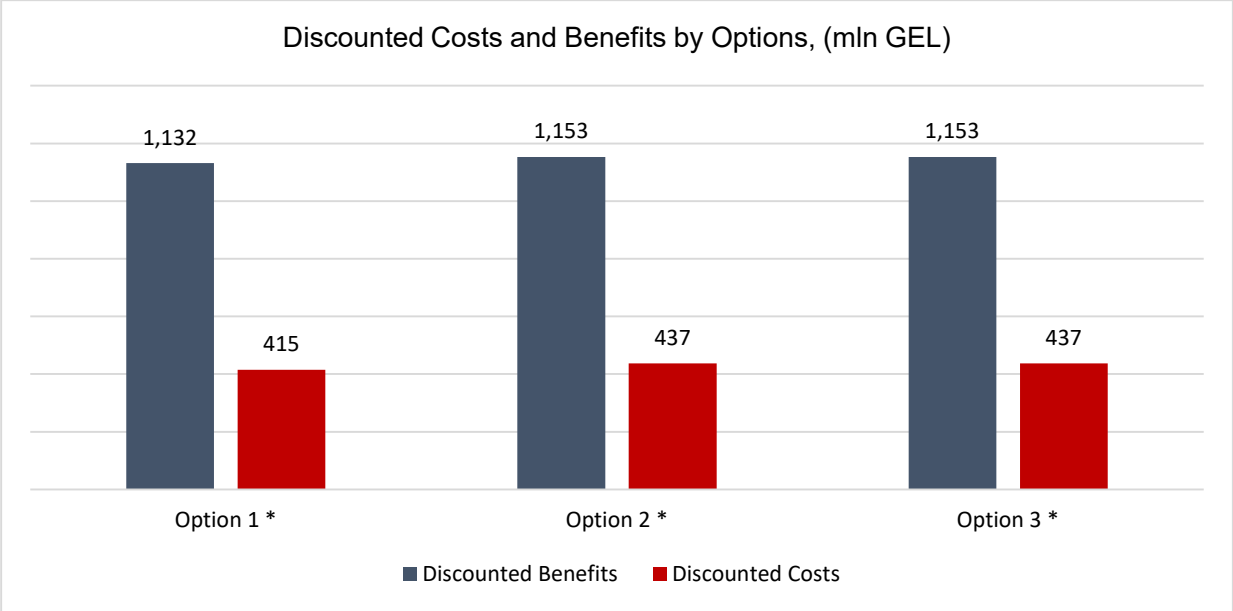
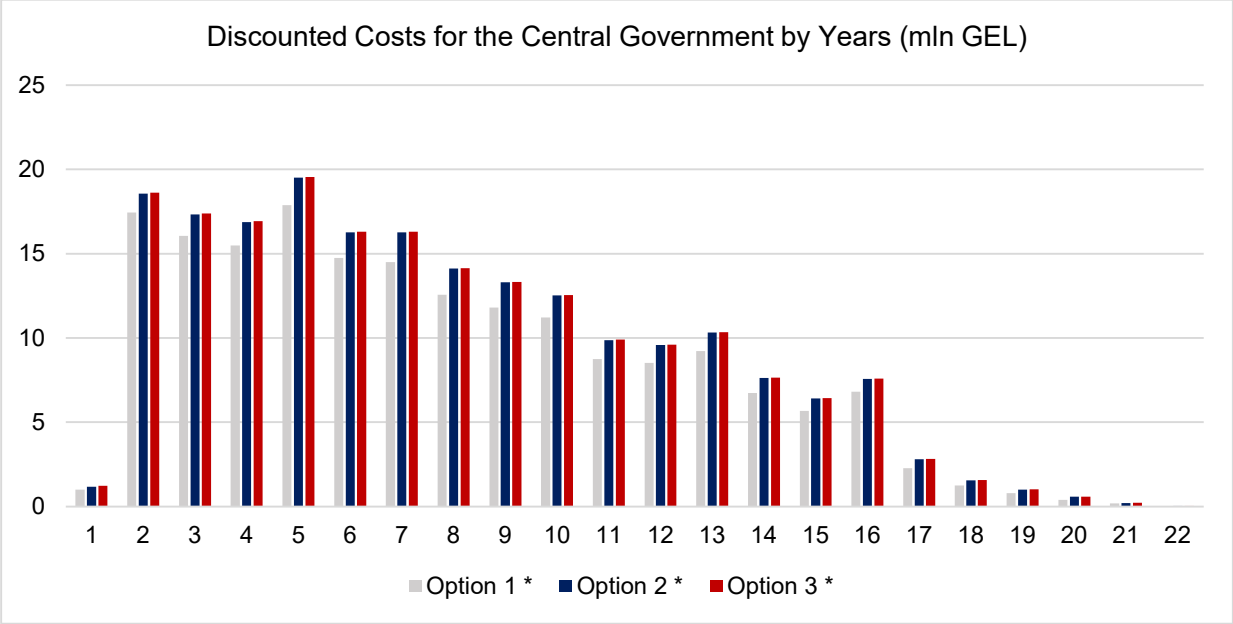


Figure 19: Discounted *c*osts for *the* central government, by *y*ears



Risks

There is the risk that the execution of the law will not be effective in the absence of awareness increase campaigns and proper supervision from monitoring officers. This implies that farmers might overexploit the windbreaks by illegal logging and grazing.

A further risk is related to municipalities lack of capacity to plant, restore, and manage windbreaks; therefore, increasing the responsibilities of the existing staff, without building their capacity, which might prolong the process of law enforcement and execution.

8. MULTI-CRITERIA ANALYSIS

The options are compared based on a set of criteria developed by the research team, in accordance with the objectives of the reform. These criteria were developed in close collaboration with the stakeholders.

Comparing the three alternatives to identify a preferential option, the participants were asked to evaluate, during the stakeholder workshop (10 December), the options based on a number of criteria in addition to the NPV. The criteria are as follows:

1. Reduction in soil erosion processes - Capability to achieve this objective of the draft law;
2. Increased agricultural yields - Capability to achieve this objective of the draft law;
3. Feasibility - Ease of realization and concrete implementation of the option;
4. Mitigated conflict of interests - The capability to eliminate disagreements between the existing managing bodies;
5. Systemic efficiency - Potential to utilize the existing capital and human resources;
6. Minimization of risks (e.g., fires, illegal logging, etc.);
7. Coordination between the managing bodies;
8. Availability of implementation tools - Leveraging the managing bodies to enforce the law.

Table 11 summarizes the results of the multi-criteria analysis. Plus (+), minus (-) and zero (0) are used for ranking the three options, where a plus (+) is used when there is a synergy between a criterion and the option's impact; a minus (-) when there is trade-off between the criterion and the impact; and if there is no impact at all, zero (0) is used.

Table 12: Comparison of the options

Evaluation Criteria		Option 0- Baseline scenario	Option 1- Public-private ownership and management of windbreaks by municipalities and farmers	Option 2- Public ownership and management of windbreaks by municipalities	Option 3- Public ownership and management of windbreaks by a separate state agency
NPV of net benefits (GEL)		N/A	689,960,658	689,492,311	688,941,226
Reduction in soil erosion processes		-	+++	++	+
Increase in agricultural yields		-	+++	++	+
Feasibility/ease of realization		0	+	++	+++
Mitigated conflict of interests		0	++	-	-
Systemic efficiency		0	+++	++	+
Minimization of risks (e.g., fires, illegal logging, etc.)		-	+++	++	++
Coordination between managing bodies		0	+	++	+++
Availability of implementation tools		-	+	+	++

The first and the second evaluation criteria- “reduction in soil erosion processes” and “increase in agricultural yields” are the main objectives of the draft law. Public-private ownership and management of windbreaks (Option 1) appears to be the best arrangement to foster the process, because this will promote fruitful interactions between the public and private sectors. Furthermore, farmers have a greater inherent interest in taking care of windbreaks than the state, as they directly benefit from increased productivity.

As for the “feasibility and ease of realization”, Option 3 has advantages over its counterparts. If windbreaks are owned and managed by a separate state body, the process will be easy to plan, to organize and to control, unlike when the responsibilities are distributed between the different stakeholders (farmers and municipalities).

Considering the “Mitigated conflict of interests”, Option 1 is the best alternative with regard to this criterion. In order to avoid conflicts of interest, all the affected stakeholders should be engaged in the process, and Option 1 ensures the involvement of farmers in windbreak management. While the other two options essentially exclude private ownership and management of windbreaks, which might provoke a conflict between farmers and state bodies.

The “Systemic efficiency” criteria again reveals that Option 1 has the greatest potential to apply existing capital and human resources, while in Option 3, the state has to hire additional members of staff to establish the new agency.

“Minimization of risks (e.g., fires, illegal logging, etc.)”– Option 0 has negative effect on risk minimization, because this scenario presents the current stage (no changes). While, Option 1 is perceived as the best alternative to minimize risks, since a public-private partnership is the best way to stimulate the process.

The criterion “Coordination between managing bodies” is best satisfied by Option 3, where coordination by a separate state body is easier than across various stakeholders.

While, the “Availability of implementation tools” reveals an advantage for Option 3, since the state is likely to have greater instruments for planning and control, and more leverage to enforce the law, compared to other the alternatives.

In conclusion, Option 1 is less costly than Option 2 and 3. Additionally, when assessed against the other criteria, Option 1 outperformed Option 2 and 3 because it better satisfies the following: a reduction of soil erosion processes, increased agricultural yields, systemic efficiency, mitigated conflicts of interest, and risk minimization.

9. MONITORING AND EVALUATION PLAN

In order to track progress and evaluate the impact of the law, it is important to monitor how the objective indicators change over time. The indicators are divided into five categories based on the type of result:

I. indicators which reflect the availability of inputs to implement the draft law;
II. activities needed to achieve the objectives of the law based on the targets;
III. outputs - direct, immediate results associated with implementation of the law;
IV. outcome - the mid-term consequences;
V. impact - the long-term results, associated with the general objectives of the draft law.

Table 13: M&E plan

INDICATOR	FREQUENCY	RESPONSIBLE FOR MONITORING
Result I: Inputs		
• Budget allocation for the windbreak project implementation (break-down by central and municipal budgets)	Annual	MEPA, Agrarian Committee and MoF
Result II: Activities		
Operational objective 1. Define the legal basis for inventory and planning		
• The law on windbreaks and subsidiary legislation are adopted	Once	MEPA and Agrarian Committee
• The database with inventory information is created	Once / Upon request	NASP and MEPA
• The state program on windbreak planning	Once	MEPA
Operational objective 2. Define the legal basis for windbreak status		
• Number of decisions issued granting windbreak status to respective areas	Bi-annual / Annual	GoG and MEPA
Operational objective 3. Define the legal basis for windbreak registration		
• Amount of land registered as windbreak territory	Annual	Public Registry and MEPA
Operational objective 4. Define the legal basis for windbreak rehabilitation, planting and management		
• Number of projects and management plans developed	Bi-annual / Annual	Municipality and MEPA
Operational objective 5. Define the legal basis for windbreak utilization		
• Number of agreements between potential users and municipalities	Bi-annual / Annual	Municipality and MEPA
Operational objective 6. Define the legal basis for the execution of fines		
• Number of fines executed for various illegal activities	Annual	MEPA
Operational objective 7. Raise awareness regarding windbreaks		
• Number of awareness raising campaigns conducted	Annual	MEPA
Result III: Outputs		
Output level objective 1: Rehabilitation of windbreaks		
• Total rehabilitated area (ha)	Annual	Municipality and MEPA
Output level objective 2: Planting of windbreaks		
• Total planted area (ha)	Annual	Municipality and MEPA
Result IV: Outcome		
Outcome level objective 1: Proper management of windbreaks		
• Survival rate of planted trees in windbreaks (%)	Annual	Municipality and MEPA

• Damaged windbreak area (ha)	Annual	Municipality and MEPA
• Replanted area (ha)	Annual	Municipality and MEPA
Result V: Impact		
Specific objective 1. Reduced land erosion		
• Amount of eroded agricultural land due to severe winds (ha)	Annual	MEPA
Specific objective 2. Increased agricultural productivity		
• Productivity of crops due to windbreaks (kg/ha)	Annual	MEPA and GeoStat
General objective 3. Increased biodiversity		
• Number of species associated with windbreaks	Annual (starting from the Year 3 after planting)	MEPA
General objective 4. Decreased irrigation costs		
• Irrigation costs (GEL/ha)	Annual	MEPA

10. CONCLUSIONS AND RECOMMENDATIONS

This analysis identifies the need for the restoration of windbreaks, largely due to land erosion and the low productivity of agricultural crops. The absence of a legal basis for windbreak regulation ultimately leads to the destruction of windbreaks and the inability of interested parties to coordinate, and thus hampers potential energy directed towards windbreak rehabilitation, management and protection.

While the need for windbreaks is indisputable, there are still significant challenges associated with the implementation of the draft law. These challenges are equally present, to a relative degree, in all three of the options considered within the analysis. In addition, it is vital to consider the greatest challenge, the scarcity of state budget resources. This deficit can conceivably be addressed by attracting donor funds (e.g., the Global Environmental Fund) for windbreak management and rehabilitation.

The current problems of land registration (only approximately 30% of land is correctly registered) will undoubtedly negatively affect the implementation of the law on windbreaks. The parliament of Georgia, together with the government, is working on the systemic land registration project to be implemented throughout the country. This project is in the current state agenda, and windbreak registration is a recommended constituent part. Specifically, windbreaks, categorized as part of the land, should be registered alongside every plot of land, using a systematic land registration approach. This dynamic approach (land registration using GIS), including the registration of windbreaks, will save state expenditure and help avoid the many challenges this process faces, for instance, uncertainties of ownership, boundary disputes (overlapping), unlawful occupancy, the mixing of land categories, etc.

In order to achieve the objectives of the draft law, the following recommendations should be considered:

1. Development of incentive mechanisms for marginalized groups

Incentive mechanisms should be provided to farmers to motivate the planting and maintenance of windbreaks. Such incentives can be:

- **Land tax incentives:** Farmers might be exempt from land tax for areas under windbreaks. In addition, in order to motivate farmers to plant and maintain windbreaks, it is possible to offer farmers land tax exemption for limited period (e.g., 5 years) for their total land (National Center for Environmental Economics, 2001).
- **Cost-share incentives:** The provision of seedlings to farmers for the planting and rehabilitating of windbreaks must be free of charge or be executed through a co-financing scheme (which is considered in the draft law). However, farmers might also require seedlings for the replanting of windbreaks. Thus, it is necessary to learn from pilot projects to understand farmers' adoption behaviors. The government should be prepared to cover additional costs, except for seedlings, to ensure the effective implementation of the law, because the provision of seedlings may prove inadequate (Casey, Vickerman, Hummon, & Taylor, 2006) (National Center for Environmental Economics, 2001) (Parkhurst & Shogren, 2003);
- **Insurance incentives:** The mechanisms for insurance or reimbursement for damages from fires or other natural disasters must be considered (Casey, Vickerman, Hummon, & Taylor, 2006) (National Center for Environmental Economics, 2001);
- **Land easement incentives:** Farmers who agree to plant and maintain windbreaks might be favored in the renting/leasing of land from the state (Casey, Vickerman, Hummon, & Taylor, 2006) (Parkhurst & Shogren, 2003);
- **Grant incentives:** Farmers who agree to plant and maintain windbreaks might be chosen to receive benefits from state grants/co-financing programs (Casey, Vickerman, Hummon, & Taylor, 2006) (National Center for Environmental Economics, 2001) (Comerford & Binney, 2005) (Parkhurst & Shogren, 2003);
- **Facilitative incentives:** Farmers who agree to plant and maintain windbreaks might be chosen to receive benefits from educative and technical assistance programs (Casey, Vickerman, Hummon, & Taylor, 2006) (National Center for Environmental Economics, 2001) (Comerford & Binney, 2005) (Parkhurst & Shogren, 2003).

In addition to these incentives, there are certain other tools that can also be utilized. For example, during the development of windbreak cultivation technologies and methods, the potential benefit farmers' can obtain from windbreaks (e.g., cultivating almond, walnut and fruit trees within windbreaks) must be taken into consideration wherever possible (crucially, whether such trees can be used in windbreaks).

Furthermore, the utilization of resources from municipality-owned windbreaks, such as almond, walnut and fruit trees, the preparation of vineyard support materials (like acacia), or the use of old trees for wood, must be permissible for local small farmers and rural dwellers.

It is also possible to provide subsidies to particular groups of farmers. In East Georgia, wheat and barley farmers habitually use fire to clear their fields of harvest remains, therefore, state subsidies can be provided for farmers to hire machinery for the work. The maximum subsidy can be estimated at 70 GEL/ha- the difference between hiring a regular harvesting machine and a device that removes the harvest remnants. Given the scarcity of state resources, one must carefully consider this subsidy option: farmers create fires, not solely because they cannot afford the difference in cost, but because they use conflagration to fight diseases, consequently the provision of a subsidy will not have the desired effect and will result in wasted resources. Yet another issue is the size of wheat and barley farms, as fires are mostly initiated by large-scale farmers their subsidy might not be the best option for the state.

2. Protection of windbreaks from direct dangers

Protection from grazing. Damage to windbreaks from grazing occurs largely during the relocation of sheep and cattle, this is further conditioned by transportation routes, created from an insufficiency of resting places and a

lack of biomass on pastures. Nevertheless, a specific number of cattle and sheep remain in one location over the summer season. While, local herders frequently utilize windbreaks for resting and feeding cattle, especially during droughts.

For local **shepherds** and **cowherds**, alternatives should be provided for the grazing of their herds, this would minimize the utilization of windbreaks for grazing and resting. For such purposes, pastures must be allocated in the summer season for cattle, and special groves should be developed for the protection of animals during bad weather. Additional feed and rest sites should also be provided during migratory periods.

Alongside the incentives, it is important to improve the law enforcement process. Grazing in windbreaks must be prohibited, and the corresponding penalties must be issued, where such penalties should be given based on the extent of damage. Therefore, execution control must be strengthened and carried out by the state, for municipality-owned as well as privately owned windbreaks. Not only shepherds and cowherds, but farm owners should be, in some manner, obliged to take responsibility for the damage created by their herds and herders.

Livestock farmers as well as herders must be better-informed: their knowledge and awareness levels must be improved, and crucially they must be aware of their responsibilities in case of the damage or annihilation of windbreaks.

Protection from fires- Farmers burn their fields after harvest for two main reasons: (i) it is less costly to scour their land with fire than to pay to clear the land of its waste; and (ii) fire is an easy way to fight insects, pests and diseases. However, farmers are often unaware that fire damages the humus and the soil becomes less fertile, thus it reduces land productivity. Furthermore, air pollution from fires negatively affects human and animal health. Fires moreover destroy biodiversity on the surface of the land (including windbreaks).

Previously conducted studies have revealed that farmers will receive a greater benefit if, instead of burning their waste, they break it up with a chopper installed on their harvester, and the biomass then returns to the soil. To reinforce fire control, forcing penalties (based on the damage calculation), for burning harvest remnants, and properly executing the law will significantly reduce the destruction of windbreaks, in turn, this will ensure fertility and help restore soil productivity. The specific incentive mechanisms for crop farmers are:

- Stimulate farmers and harvesters to use choppers for harvesting by compensating the costs of the chopper:
    - Co-financing to purchase a harvester with a chopper;
    - If the harvester already has a chopper, stimulate farmers and harvesters to initiate it during harvesting (co-financing the harvesting costs for farmers or the salary of harvester drivers).
- The removal of biomass after harvesting must be financially rewarded:
    - Straw pallet production from the remaining biomass and their utilization must be further developed and promoted.
- The burning of harvest waste must be prohibited and corresponding penalty sanctions (based on the damage occurred) must be given and executed accordingly.

In order to execute the prohibition of burning biomass after harvest, it is important to conduct an awareness raising campaign for farmers. This campaign can be implemented by field rangers, municipal government representatives, MEPA's information-consultation centers, and the LEPL Agricultural Scientific Research Center, in cooperation with the Environmental Protection Supervision Department of MEPA.

Local self-governing bodies must be involved in the prevention of burning down windbreaks and they must execute control. Therefore, field rangers will be employed by the municipalities to control harvest fires (and to control the overgrazing and logging of windbreaks), and they will provide early warnings for dangerous of fires.

Protection from illegal logging- In order to avoid logging windbreaks, the most vulnerable rural dwellers (with social allowances), in locations where felling trees is allowable, should be given vouchers for wood.

3. Conducting information and awareness raising campaigns

The implementation of the law requires capable management, crucially identifying and illuminating the importance of windbreaks for soil fertility and for increasing the quantity and quality of harvests.

Farmers must be well-informed on the effectiveness of windbreaks. In the regions where wind erosion is prevalent, support for windbreak cultivation and maintenance, and the popularization of windbreaks, must be carried out by local municipalities, farmer unions and community leaders (Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ)., 2017).

Because of these factors, the role of RICCs is extremely important. The LEPL Agricultural Scientific-Research Center, in cooperation with private extension entities and farmer associations, must ensure the accurate portrayal of the importance of windbreaks through their informational and extension packages, also, by campaigning in the media.

Within their curricula, universities and professional education programs ought to elaborate upon and highlight the cultivation of windbreaks as an important means of soil protection and increased productivity. Additionally, information on good agricultural practices (e.g., returning biomass to the soil, rather than burning it) should be documented and disseminated among farmers. Moreover, awareness raising campaigns should be made available, including information about the stricter execution of fines.

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ANNEX

Table A2: A detailed summary of stakeholder consultations

Interview date	Respondents	Major points of discussion
Sept. 25	**Christian Goenner**, Project Manager, Integrated biodiversity management, South Caucasus, GIZ.	Mr. Goenner listed the following challenges regarding windbreaks: • Windbreaks ownership; • Division of responsibilities; • Poor law enforcement; • Farmers' low commitment and interest in taking care of windbreaks; • The role of the state due to a lack of farmers' motivation or interest. He also discussed the benefits of windbreaks. Those benefits include a 30% increase in yield (mostly for wheat); assistance in preventing soil erosion caused by winds and keeping moisture in the soil; preservation of biodiversity; and agroforestry related benefits. He moreover discussed the importance of introducing different types of soil cultivation methods (e.g., no tillage, biomass back to the soil), and crop rotation combined with windbreaks. The latter will increase the benefits of windbreaks even further. While windbreaks have numerous benefits, it is vital to consider the costs as well. The costs include windbreak inventory, planning, planting, maintenance, fencing, and monitoring. There are also alternative costs for farmers.
Oct. 8	**Iveri Akhalbedashvili,** Agrarian Committee Head.	Mr. Iveri Akhalbedashvili stated that everybody acknowledges the importance of windbreaks, however nobody wants to take responsibility for their management. In the initial version of the law, the ministry was supposed to support the NASP in an inventory process, but the ministry removed itself from that process during a revision stage. There are two versions of implementing the inventory: 1. NASP + outsourcing 2. NASP + its municipal agencies + an expert from the ministry 3. Ministry + outsourcing Option 2 was used in the Dedoplistskaro pilot, implemented by REC Caucasus. The Agrarian committee representatives believe that Option 2 is a sensible approach, because even if inventory is completed by NASP with outsourcing, there should be somebody receiving the report who is capable of judging the quality of the conducted inventory. If there is no competent person from the Ministry involved, then NASP should hire some expert to judge on the quality of the inventory report. The final consumer of the inventory report is the Ministry, and because of this, it is better for the Ministry to be involved right from the beginning. The current version of the draft is not final. Since the inventory in Dedoplistskaro needed 6 months, then the whole inventory process should take no more than 1-2 years. Due to the absence of windbreaks, 20-30% of yield is lost in Kvemo Kartli, and Shida Kartli. In those regions, wind is particularly harmful. Municipalities are in the best position to be responsible for local windbreaks, because the Ministry cannot manage windbreaks from Tbilisi. The reasons why municipalities should manage windbreaks: • Local representation; • Local beneficiaries; • They possess knowledge about local conditions;

		The involvement of farmers in the inventory is unrealistic. The committee believes that large-scale farmers are motivated to build windbreaks. If they will have some tax relief, this will motivate them further. There are several cases regarding ownership: • Registered windbreaks in private ownership – stay in private ownership according to the draft law; • State windbreaks transferred to municipal ownership; • Municipal ownership. Those windbreaks which are not registered as private property in the public registry should be transferred to the state. This decision to transfer windbreaks to individual ownership was made in order to ensure their protection by individuals. Individuals should have been registering windbreaksspecifically as windbreaks, but it is unclear if farmers have been doing so. There is no separate category of "windbreak", thus, it is not clear how windbreaks should be registered. The public registry does not include this category, because there is no law. The Agrarian committee representatives emphasized the importance of a literature review of international experiences regarding windbreaks.
Oct. 8	**Nino Chikovani,** MEPA - Office of Land Resources Protection / Department of Environment and Sustainable Agriculture.	Land degradation is the major focus of the department, and since wind erosion is a cause of land degradation, this department became a focal point for this issue. In initial version of the draft law, the responsibilities of the Ministry were not very clear and the Ministry itself added further responsibilities. The main responsibility of this division is to work on the registry, but the responsibilities of the whole department are not yet defined. The inventory is a function of NASP, though currently, the ministry does not know whether they need MEPA's support. The Agrarian committee believes MEPA should be involved in the inventory process, because there should be a description of state trees. This requires discussion, and it is possible for the Ministry to take this responsibility and support the process. While windbreaks are state property, Ms. Chikovani agrees that NASP would need the support of a specialist. Currently, NASP is also not able to compile the inventory itself, due to lack of resources, and they will need to outsource. NASP should be the recipient of the inventory results and should issue a normative document proving inventoried areas are windbreaks. Thus, NASP provides the results of the inventory to the government, so that they can issue windbreak status to the area. Registration should be completed by the Public Registry. Beyond which, NASP should provide the inventory results to MEPA, so that MEPA can develop a registry. The whole process starts with the development of a national program. It should include the inventory, registration and the overall vision. The development of the program requires time and resources. Along with the program, there should be an action plan developed. None of the documents have currently been developed, although there is a concept. The status of windbreaks should be approved by the government, because there are various types of stakeholders (e.g., private individuals), and it is better for the state to deal with them, although it is possible that the Ministry can also complete such tasks. New windbreaks are planted based on projects developed by private individuals or municipalities. One additional person, either in this department or in MEPA's agricultural research center, will be needed. The national program is to be developed with donor funding. MEPA representatives will most probably be involved in the development of the national

		program and the distribution of the program to other agencies. Currently, there is nobody in the ministry responsible for windbreaks. Municipalities requires additional human resources for planting, but a better option is outsourcing, which requires financial resources. Therefore, planting should be completed by municipalities, through outsourcing. The objective is to make sure that all windbreaks are either in private or municipal ownership, there should be no windbreaks in state ownership. Kakheti municipalities stated that they would prefer to have ownership. The benefits of windbreaks: • Humidity increase in soil; • Reduces losses from wind; • Increases productivity. Planting windbreaks might be the most challenging stage in the whole process.
Oct. 10	**Avtandil Sujashvili,** Agro-Forestry Expert.	There is an urgent need for the new law, as old windbreaks are being illegally logged or amortized. Windbreaks are important and essential to increase the productivity of crops. The choice of seedlings for planting windbreaks is not based on the type of municipality, rather the seedlings should be chosen according to: • Climate; • Soil; • Sea level. The other factors affecting the choice of species are, life expectancy and height. The number of seedlings is determined as follows: • Main windbreaks comprise of 4 lines and supportive windbreaks comprise of 2 lines; • Windbreaks can protect an area that is 15-20 times longer than its height. For example, if the height of trees in the windbreaks is 20 meters, then the area it protects is 300-400 meters. In the case of cereal crops, the protected area can be bigger still, while in case of fruit trees, the protected area is smaller. The inventory process describes the species in windbreaks, their conditions and needs for renovation. This process requires many human resources. The main obstacle for the law is likely the distribution of these responsibilities: • Monitoring; • Supervision; • Protection.
Oct. 11	**Kakha Potskhishvili,** Deputy Head of spacial planning department, Ministry of Regional Development and Inrastructurec (MRDI).	There is no agency responsible for windbreaks. There are only Soviet-period maps, including windbreak allocations. The status of the windbreaks should be defined and we should identify a responsible agency. There should be some incentive mechanisms for those farmers who will be affected by this law. Our ministry is an interested party, because we should not plan anything in windbreak areas, and we should work in coordination with each other. We should harmonize the sectoral interests.
Oct. 11	**Gizo Chelidze,** Department of Hydromelioration and Land Management,	The regulation of windbreaks is a crucial issues for us. There is no special unit in charge of windbreaks. The responsibilities should be defined clearly between the different stakeholders. Thus, this law will regulate these issues. The benefits of windbreaks are very important. If the land is irrigated and there is the windbreak in that area, the productivity increase is substantial. The state and donors

	MEPA.	spend a lot money on irrigation, and if wind destroys all the harvests, our effort becomes meaningless. Municipalities should be in charge of windbreaks because it will save money and effort. It will be easier for municipalities to monitor windbreaks. The control mechanisms are very difficult and money should be allocated for these tasks. The current supervision departments or municipalities do not have enough resources to be in control of such tasks. Large farmers might be interested in windbreaks, however it is very difficult to involve small farmers, as small farmers do not see the benefits of windbreaks.
Oct. 11	**Nino Kizikurashvili,** Project Manager, IFAD/AMMAR project.	Windbreaks have a protection function and the windbreak rehabilitation process is very important. GIZ has been working on this issue over recent years. There is no regulation regarding windbreaks. With GIZ funding, windbreaks were built in Dedoplistskaro, but there was no agency responsible for these windbreaks. We had the same problem, where we wanted to build windbreaks, but since there are no regulations regarding these issues, we did not implemented the projects. Implementing this law is very important for us and we are waiting for this law to be adopted. It is crucial to have responsible agencies defined by the law. The responsible agencies should carefully plan the process and at the same time they should take responsibility for the sustainability of the process. I do not think that the state should subsidize these costs. The state cannot subsidize everything. Though the state should be involved in the information campaign.
Oct. 12	**Amiran Kodiashvili,** GIZ Field Coordinator in Dedoplistskaro Municipality, GIZ Expert (Vashlovani NP Friends Assossiation (Dedoplistskaro).	Windbreaks are very important for cereal crops. Windbreaks have crucial importance for the Dedoplistskaro and Gardabani municipalities, where cereal production is very common. Cereals have a strategic importance in terms of food security, and currently Georgia is heavily dependent on imports from Russia. In Dedoplistskaro and Signagi, farmers burn straw and create a threat to windbreaks, while in other regions, straw is used for animal fodder. In Dedoplistskaro and Signagi, the demand for straw is very low, so the price is also low. Moreover, there is lack of techniques and appropriate machinery in Dedoplistskaro. If farmers do not manage to clean straw from their fields, they cannot plow their land. The fastest method to clean fields is to burn the straw. However, farmers do not realize that the productivity of the land decreases when the straw is burned. They also do not realize the importance of the environment and ecosystems. The biggest share of windbreaks do not belong to anyone, even the state has not registered them within its property. No one wants to take responsibility, but when it will be defined by the law everyone will be responsible for these tasks. This should not be the responsibility of the municipality alone, but the state should support it. Farmers should be able to have windbreaks in private ownership. Enforcement should be stricter.
Oct. 15	**Konstantine Tavzarashvili**, Mayor of Gori; **Giorgi Kapitashvili,** Gori Mayor's office, property management department;	Strong east-west winds are dominant from Variani to Shavshvebi (from Gori towards Tskhinvali). In this area, windbreaks were built in every 300-400 meters from Kaspi to Gori. On the other side (Gori's side), winds are not that severe. Without windbreaks, twice as many fertilizers are needed. The lack of electricity and gas in the 1990's, caused significant illegal logging of windbreaks. Currently, the regulation of the wood market and transportation of wood has stopped illegal logging, however, inter-village roads are not well-controlled and, to some extent, illegal logging still happens. After the privatization of land, farmers destroyed windbreaks and used them as arable land or for planting perennials. The challenges regarding windbreaks are:

	Zurab Jalagonia, Gori Mayor's office, Head of the spatial planning and infrastructure department; **Archil Giunashvili,** Gori Mayor's office, Head of the economic department; **Levan Mumladze,** RICC Shida Kartli (MEPA).	• Illegal logging; • Grazing due to limited pastures; • Fires. There is no department of agriculture in the municipality, so additional human capital would be needed to undertake new responsibilities. Mayoral representatives in the villages might be responsible for windbreaks, but these responsibilities require additional people. The current municipal budget does not have the resources to finance additional staff salaries or the required equipment. There are 30,000 farmers in the Gori municipality. Small farmers are the most problematic, as they hold 70-80% of agricultural land in the municipality and represent 90-95% of the total farmers in Gori. It is difficult to deal with individuals and, relatively, easier to deal with cooperatives/groups of farmers. Fencing is expensive, but very important. While, the environmental protection department has the ability to monitor and issue fines. It is very difficult to teach large numbers of farmers, but if 60% of farmers could understand the need for windbreaks, the results would be beneficial.
Oct. 15	**Mamuka Lomsadze,** Head of RICC Shida Kartli (MEPA); **Levan Masurashvili,** Shida Kartli Governor's office, project coordinator; **Levan Mumladze,** RICC Shida Kartli (MEPA).	Tubs for windbreak protection may be important in Europe, because rabbits and deer damage trees, but in Georgia, problem is with livestock, and tubs will not help avoid damage by livestock. The challenges related to windbreaks: • Inventorization/registration would be difficult because of overlapping plot borders; • Cleaning windbreak territories would be very costly (requiring special techniquess to remove tree roots). It would be very expensive. mechanization can help in cleaning, utilizing the correct techniques; • Waste utilization (where to pull, how to utilize, etc.); • Defending windbreaks against livestock; • Fencing would be necessary, though fining every cow owner would be difficult and cause a social complicate issues; • Burning corn fields is also problem, but less severe, and the case is the same for illegal logging. Planting trees is the easiest task. Preparing land/soil, maintaining, and defending windbreaks could be costly. There are no budget resources in the municipality.
Oct. 15	**Vano Vardanishvili,** Gori Municipality Sakrebulo member	The Mayor has representatives in every village that could be involved in windbreak rehabilitation and management. The management of windbreaks does not require too much money, but planting and maintenance require a vast budget. Thus, rehabilitation should be planned and implemented step-by-step. Large-scale farmers should be obliged to rehabilitate windbreaks, as for smaller farms, the government should motivate them by providing maintenance funds for 3-5 years. The municipality can establish a special entity, jointly managed by the municipality and MEPA. This entity should be responsible for every step of windbreak rehabilitation (e.g., planting, maintenance). Without a special entity, the plan would not work. Windbreaks could be later leased to large farms, taking on maintenance responsibilities.
Oct. 15	**Tengiz Kvlivishvili,** Kareli ICC (MEPA);	Only about 10% (50 ha) of windbreaks in the Kareli municipality are left. Registration of windbreaks is a crucial step to protect and then rehabilitate the land. Challenges related to windbreaks: • Grazing;

	Gocha Gogichashvili, Mayor's office, economic department; **Zaza Barbakadze,** Kareli ICC (MEPA); **Nugzar Dabrundashvili,** First deputy of the Mayor; **Giorgi Khatashvili,** Mayor's office, economic department; **Teimuraz Chagelishvili,** Mayoral representative; **Koba Nakhutsrishvili,** Head of the social committee; **Jumber Shubitidze,** Deputy Head of Sakrebulo.	• Windbreaks should be fenced, or each tree should have an individual oval fence, to protect from livestock; • Irrigation- after planting, trees require watering at least for a few years. Irrigation should be guaranteed. The municipality would require the creation of a special office (Samsakhuri) to take care of windbreaks. For which, the municipality does not have the necessary finances, thus transfers from the central budget should be increased. Windbreak rehabilitation should be obligatory for large-scale farmers, and for some compensation should be in place for smaller farms. High trees might shadow the land and small-scale farmers might be against windbreak plating and rehabilitation. In such cases, the farmers should be compensated (buy their land or offer compensation).
Oct. 15	**Gizo Gogichaishvili,** Head of the division of Agrometeorology; LEPL – National Environment Agency (NEA); **Lia Megrelidze,** Head of the Meteorological and Climatological Unit; LEPL – National Environment Agency (NEA).	Mr. Gogichaishvili highlighted that in order to implement the law, it is essential to have a land register (cadaster). There is no land management department or agency that supervises and governs land related issues. The Ministry of Economy or Ministry of Infrastructure and the Ministry of Justice should solve this problem. The main purpose of windbreaks is to protect soil from wind erosion. The result is to maintain soil fertility and protect crops. The purpose of windbreaks vary across the regions. For example, in West Georgia, windbreaks can decrease the vaporization of water from land. Windbreaks also decrease the strength of the wind. Windbreaks have a crucial importance for productivity. The land should be protected by the law on windbreaks, otherwise, it is impossible to protect windbreaks (as was the case after the collapse of the Soviet Union). The main challenge for implementing the draft law will be land registration. Furthermore, the protection and maintenance of windbreaks will be challenging. Incentives should be given to farmers to protect and maintain windbreaks.

Oct. 16	**Giorgi Pitskhelauri**, National Agency of State Property (NASP), Head of Department of Registering and Monitoring State Property.	The main problem is with windbreaks overlapping private land. We try to separate private land and windbreaks, and to register all windbreaks as private property. We need to change the configuration of the land, which is quite difficult. Our responsibility is to complete an inventory and register state properties. For this task, we need the mobilization of additional resources. A group of experts, with appropriate equipment, should visit the territories and create the inventory. For now, we do not have enough resources (financial or human) for this task. If the task is assigned to us, we need support (additional staff and equipment). It is very difficult to say what additional resources will be needed for the inventory. The cost varies a lot, depending on the size of the region and the windbreak. To define the cost ,it is very important to know the timeframe of the inventory process. The major issue is windbreaks overlapping private land.
Oct. 16	**Ekaterine Bendeliani,** Deputy Head; LEPL Environmental Information and Education Center (MEPA). **Irina Kutateladze,** Specialist; LEPL Environmental Information and Education Center (MEPA).	According to the Aarhus convention, public discussions and public participation are crucial in decision-making. People should have access to information. Our center works to provide environmental information, held by authorities, to the general public by organizing meetings and posting online. Before making any decisions, we always post the draft online to give people the opportunity to comment or send their remarks. Currently, information campaigns are extremely chaotic and disorganized. Therefore, everything should be planned in advance. Information can be spread through the following sources: • Social media; • Videos; • Meetings and discussions. The involvement of local municipalities is also very important. The relevant representatives should be trained to provide information to local people. Local and regional media also play an important role. The process of increasing awareness should be driven by the involvement of local media associations. Newspapers are an important source of information in municipalities. I should also mention the limited resources of our centers. If campaigns start simultaneously and cover whole country, then we will need more human resources. I do not only mean more employees, but more qualified employees who are trained to develop such campaigns.
Oct. 17	**Levan Silagava,** Wheat Producers' Association.	In general, wheat is one of the most vulnerable agricultural crops affected by strong winds. The price of wheat flour strongly depends on wheat production. If wheat production decreases, the price of wheat increases. Our association members should pay more for inputs, that in turn increase the price of wheat flour. Windbreaks will play an important role in the reduction of wind damage on wheat production.
Oct. 18	**Nani Goginashvili,** Head of the Department, MEPA/LEPL Scientific-Research Center for Agriculture / Agro-	There are no studies that explore the current status regarding windbreaks. The most important step in implementing the draft law will be inventorization. Around 80%, or more, of old windbreaks are amortized and need to be restored. In order to restore and plant windbreaks, firstly, the current condition and status of windbreaks should be identified. Farmers often ask us to help them plan windbreaks and choose the species of trees. We go to the territory, identify where windbreaks should be planted and offer advice to farmers on: • Which species to use; • Which scheme to use;

	Forestry Research Service.	• What protection/maintenance measures to take. The choice of species is determined based chiefly on the region. While, we categorize municipalities by the strength of wind. The process of implementation should be completed step-by-step. Planting can be started in East Georgia (better explored than West Georgia) and thereafter spread to West Georgia. Windbreaks can be a source of income if there are mixed fruit plants, like berries and nuts, within the land. For instance, mulberries not only provides fruit, but their leaves can be used in silk production. One of the main issue is the restoration of old windbreaks. It doubles the costs, as old trees must be removed from the roots and new ones must then be planted. The roots should also be disposed of, but where and how it is still a topic for discussion.
Oct. 19	**Nino Tkhilava,** Environment and Climate Change Department (MEPA).	The windbreak draft law is very important for Georgia, as strong winds are common in some regions of our country. Due to wind, sometimes farmers have to plant crops twice, as winds can remove the surface of the land. The most important issue in the law is inventorization and the choice of species to plant in the windbreaks. At this stage, we are trying to attract funds from the available resources (FAO, GEF). We want to do as many pilot projects as possible. I think the process should be done step-by-step. A feasibility study showed that Dedoplistskaro was the most vulnerable to winds, therefore, the pilot was started there. Planting the windbreaks should be started in the most vulnerable regions and then cover the whole country. But of course, windbreaks are part of climate adaptation measures. Implementing the draft law will also be very costly in terms of administrative costs, campaigns to increase the awareness, but it will have huge benefits in the long run.
Oct. 19	**Neli Korkotadze,** Head of Analytical Office, MEPA – Environmental Supervision Department.	Our department will be responsible for the execution of the draft law. Our department will levy a sanction when the law is violated. We do prevent, detect and suppress illegal activities. Under prevention we essentially mean that our crew is constantly patrolling the territories. This is not the same as monitoring, as we execute the law . When our crew detects illegal activity, they give fines to the offenders. Then, a protocol is drawn up on violence in the administrative law. We do not need new staff as our department completes the patrols. But of course, our responsibilities will be extended and that requires additional administrative and time resources. For instance, if we need to send our representatives to a trial. This, of course, requires additional administrative staff, but it will be difficult to prove the necessity of new staff. We can take the responsibility on executing the windbreak draft law, but it will be at the expense of other responsibilities: should we redistribute our time or our responsibilities. It will not be such a burden to ask for additional staff.
Oct. 19	**Ana Rukhadze,** RECC Expert (Environmental Policy and Biodiversity).	Windbreaks are very important; a lot of research studies confirm their importance. For instance: • a climate change adaptation measure; • prevent reduction of soil fertility; • a natural habitat for animals; • necessity of environment between agricultural lands to preserve biodiversity. In Georgia, they are particularly important in the eastern part of the country: • Shida Kartli: the absence of windbreaks has caused a significant reduction in soil fertility; unfortunately, there is no exact data on this, but interviews with farmers emphasized the severity of the problem (reduced soil fertility; significantly lower yields; farmers and experts compare it to Soviet times). Of course there are many other factors that contribute to reduced land productivity

		in Georgia, but the negative impact of missing windbreaks is obvious in Kvemo Kartli and Kakheti (Shiraki). I recommended to have the following procedures: • The first step should be compiling an inventory; • Afterwards, prioritize the regions that most need windbreaks; • In these regions, start the rehabilitation of windbreaks. Also, regulating and organizing an ownership structure of windbreaks is of utmost importance. One has to distinguish between small land owners (very small farmers) and significant land owners. • I recommended in regions/areas with many small land owners, windbreaks should be owned and managed by the municipalities; • In regions/areas where there are large-scale farmers, windbreaks can be privately owned. Perhaps we can provide owners some incentives (e.g., waiving of land taxes). The government should of course held with planting trees (seedlings are quite expensive), but farmers have to realize that windbreaks are beneficial.
Oct. 22	**Giorgi Kolbin,** Expert, GIZ.	Calculating only planting and maintenance costs is not enough and it is important to consider protection costs. Farmers and shepherds are the major problems for the protection of windbreaks. There should be some incentives created for farmers to stop fires. Marginalized groups who can hinder execution of the law: • Small farmers, whose land is in shadows of windbreaks; • Small, medium and large-scale wheat farmers who start fires to clean their land and fight disease; • Georgian and Azerbaijani shepherds who use fire to increase the amount of green grass for their sheep. They are often very young people, with a low level of education (most of them cannot read or write), who avoid contact with others and therefore are difficult to work with.
Oct. 22	**Malkhaz Merabishvili,** Deputy Mayor, Dedoplistskaro Municipality City Hall.	Windbreaks should be on the balance of the municipality, they would then be responsible for maintaining the land and also keeping farmers satisfied. The municipality has a cleaning service, and if necessary, finances are provided, they can undertake planting, maintenance and protection of windbreaks. The execution of fines is very poor weak. The environmental control department issues fines, but courts allows guilty parties to avoid payments (500 GEL). While large scale farmers are easier to communicate with, they are also the ones who make fires.
Oct. 23	**Lika Giorgadze**, Deputy Head, MEPA – Biodiversity and Forest Policy Department.	During windbreak rehabilitation and planting, it is important to consider that windbreaks with a width of over ten meters fall under National Forest Agency jurisdiction, classified as forests. If wide windbreaks are built, then they will be regulated by the forest code, though Ms. Giorgadze doubts that there is a need for such large windbreaks. Windbreaks positively affect and support biodiversity, which in turn has a positive impact on productivity. Ms. Giorgadze was involved in a cost-benefit analysis for farmers who use fire to clean their land and remove straw. This analysis revealed it is not that costly for a farmer to use machinery to remove straw or put it back into the land, but farmers are still not applying these techniques. Ms. Giorgadze has also discussed the availability of enterprises to use straw and hay to produce additional goods. These enterprises were previously available, but their current absence is a major issue, because farmers have no alternative for the straw,

		and they do not understand that it is harmful to use fire to clear their land. Fires reduce biodiversity in the land, thus, its productivity. There is a need for a complex approach, tackling only farmers' awareness will not resolve the problem, and there is a further need to develop other parts of the chain, such as companies buying straw and hay from farmers for additional production.
Oct. 23	**Revaz Bejanishvili**, Director, LEPL National Nursery.	Mr. Bejanishvili discussed the following issues: • Planting demonstration windbreaks in all regions would be recommended at the beginning; • Private nurseries in the regions should be strengthened and their seedlings should be purchased; • If the state orders seedlings with a pre-payment, the nurseries can provide about one million seedlings per year; • Fencing, watering, hoeing, and additional rangers would be necessary to attain successful results.
Oct. 23	**Natia Iordanishvili,** Deputy Head, LEPL National Forestry Agency.	Our agency is currently undergoing a very important period because of the forest code. There are many changes that we need to implement. Thus, in the future (in 5 years) if no unit is responsible for windbreaks, we might become involved. At this stage, we need financial and human recourses in order to be involved. Farmers should definitely be involved in this process. If the state provides seedlings to farmers, then farmers should be able to take care of windbreaks, as well as be responsible for other activities. Awareness raising campaigns are very important, but they need time to generate results. At present, financial incentives should be provided to farmers. It is also very important to improve the enforcement of fines.
Oct. 24	**Elene Shatberashvili,** ELKANA (Biological Farming Association).	Windbreak ownership should be organized case-by-case. Municipalities know the best situation, therefore a lot of functions should go to the municipalities. In terms of planning, it is important to consider the importance of awareness raising and information provision. It will be very difficult to convince farmers to participate in windbreak related projects. As such, it is very important that incentives are in place. A combination of command-type and incentive-type policies should be used. In particular, it will be difficult to have windbreaks in regions with many small farmers. In the case of farmers with 500 ha and more, it is clear that windbreaks should be planted with private costs. Other option like "private ownership (entirely)" ora special "dedicated unit" will not work. I am, in general, against the creation of new units (their effectiveness is much lower).
Oct. 25	**Kakha Artsivadze,** Biodiversity, Climate and Pastures Expert, NACRES (Centre for Biodiversity Research & Conservation).	The state should finance windbreaks in those areas where there is high public interest (windbreaks along the highways, forest shelters). If there is only private interest, the state should not be involved. All the activities: planting, buying seedlings, management, and protection, should be done by farmers because it is in their interest. Municipalities also have functions for which they are authorized, but these activities are not properly completed, due to a lack of financial and human resources.
Nov. 1		Mr.Gonashvili was particularly intesrted to know: • Who will be responsible caring for and protecting windbreaks? • What incentive farmers would receive to motivate them?

	Beka Gonashvili, Chairman, National Sheep Farming Association (+ Individual Farmer).	The literature might prove that there is a productivity increase, but there is no local experience to show farmers whether it is effective in Georgia. Mr. Gonashvili suggested using demo plots to research and analyze the results on "treatment" and "control" plots- one with and the other without windbreaks. There are still a few plots with windbreaks remaining and this lands could be used for research. The research results would help farmers to better understand the benefits of windbreaks (if there are any). After this, they would be much more motivated to plant and take care of windbreaks.
Nov. 5	**Lasha Meskhi,** Public Registry.	The main issue regarding the draft law is the responsibility of municipalities. Under the current conditions, municipalities will be obliged to take care of windbreaks, which implies that municipalities have to allocate financial resources for windbreak maintenance. Once the draft law is enforced, the change should be made in the Organic Law of Georgia Local Self-Government Code. If the land is registered, it will not be a problem to further register it as a windbreak, as long as the applicant has all the necessary documents. But if the land is not registered, the execution process will be difficult for municipalities. They should expropriate the land from farmers who exploit the resources. Such a practice was used when the highways were built. Overlapping with private land is also very serious problem, which could be solved through co-ownership of windbreaks.

Figure A1: Distribution of farmers' benefits, by years (mln. GEL), Option 1

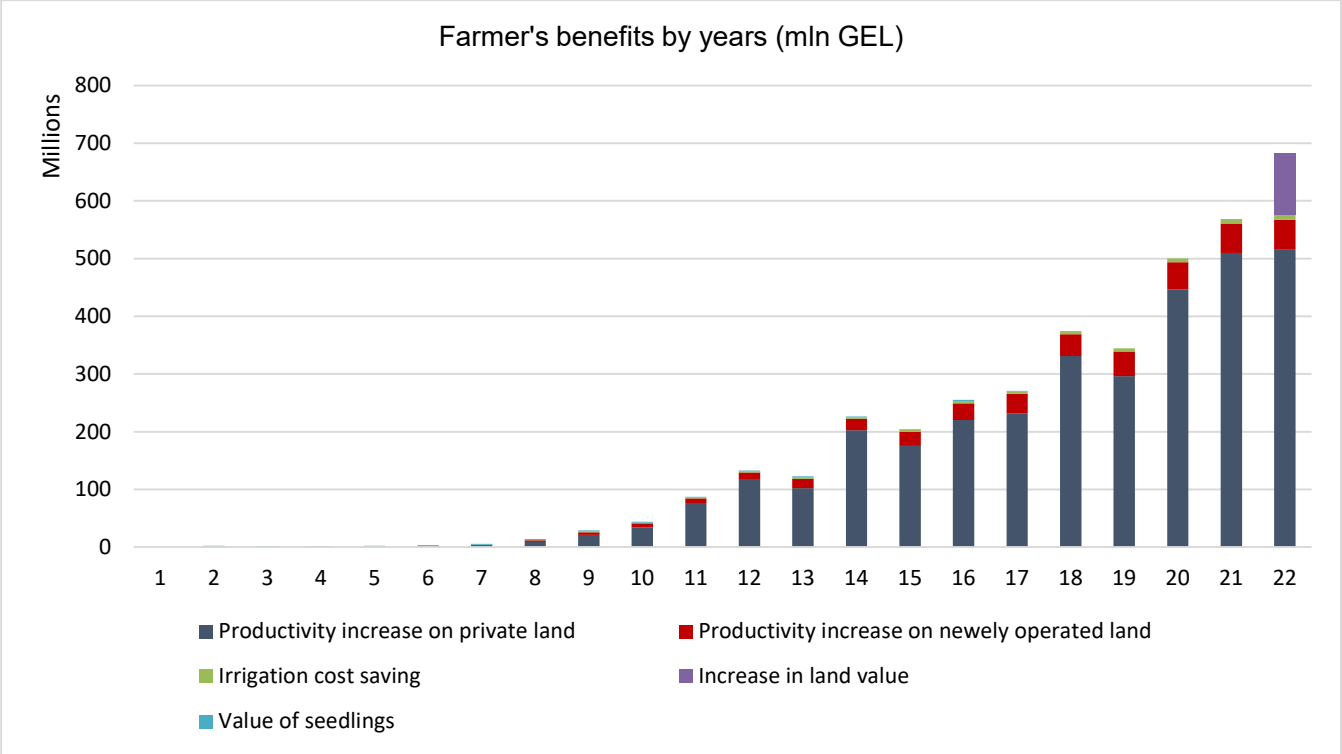

Figure A2: Distribution of municipalities' benefits, by years (mln GEL), Option 1

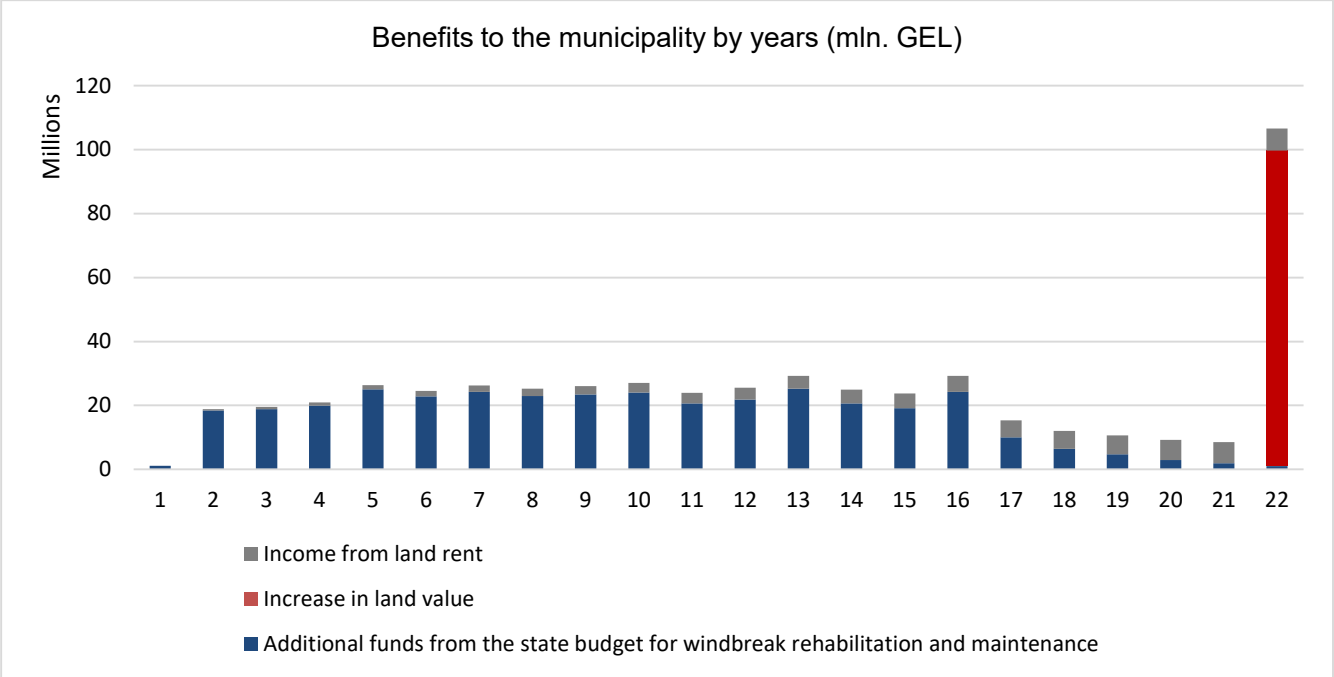

Figure A3: Distribution of benefits to the central government, by years (mln GEL), Option 1

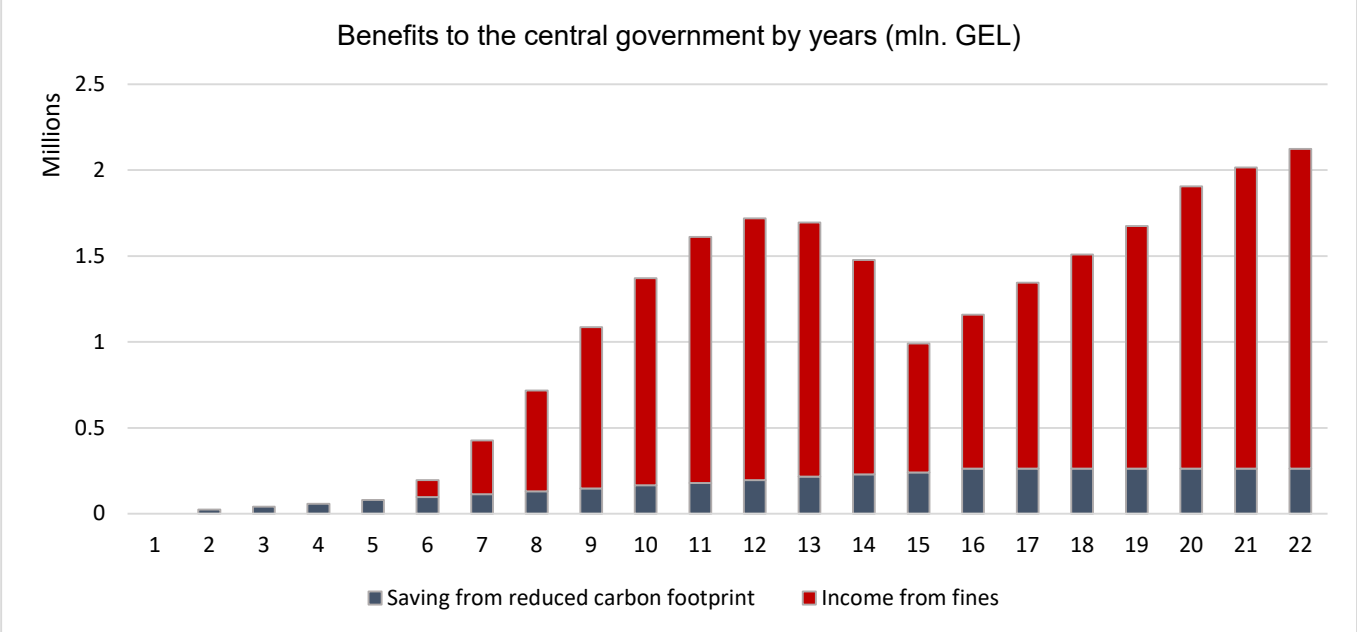

Figure A4: Distribution of farmers' costs, by years (mln GEL), Option 1

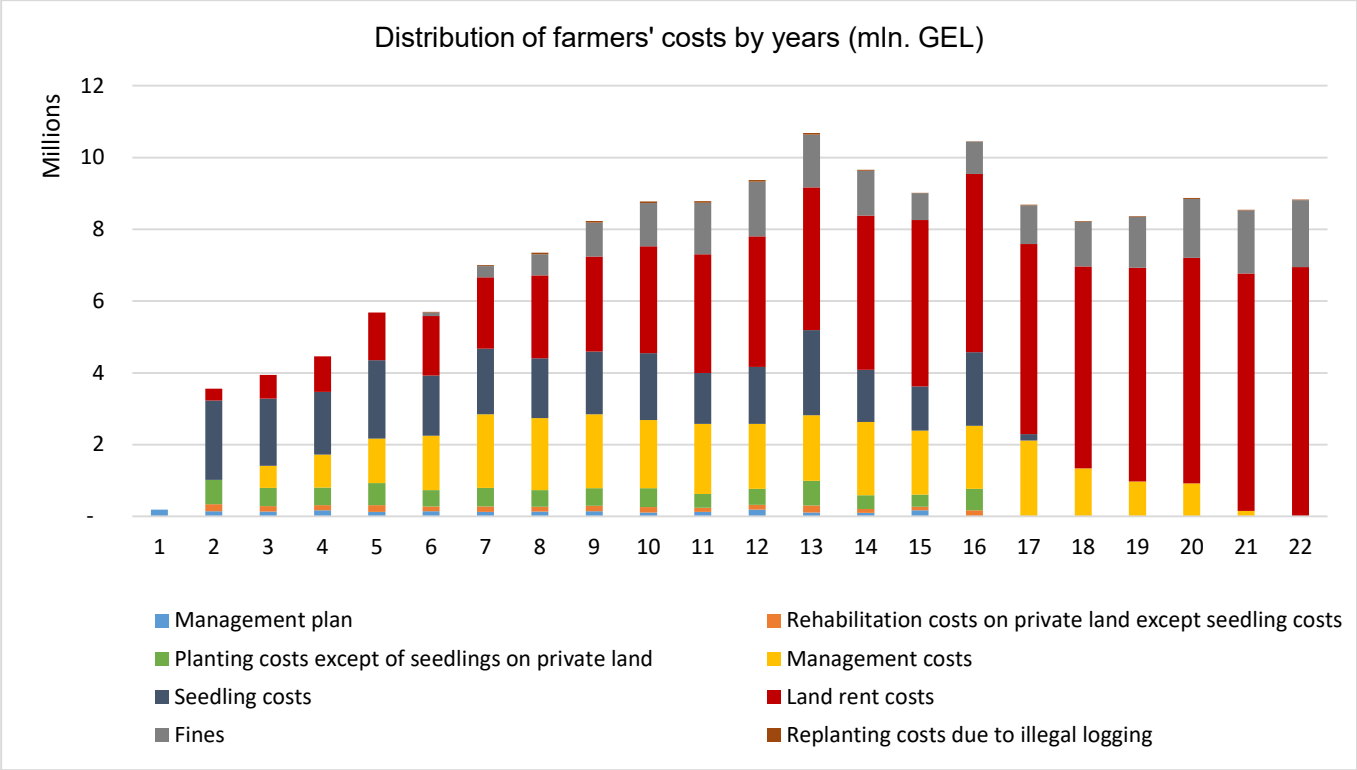

Figure A5: Distribution of municipalities' costs, by years (mln GEL), Option 1

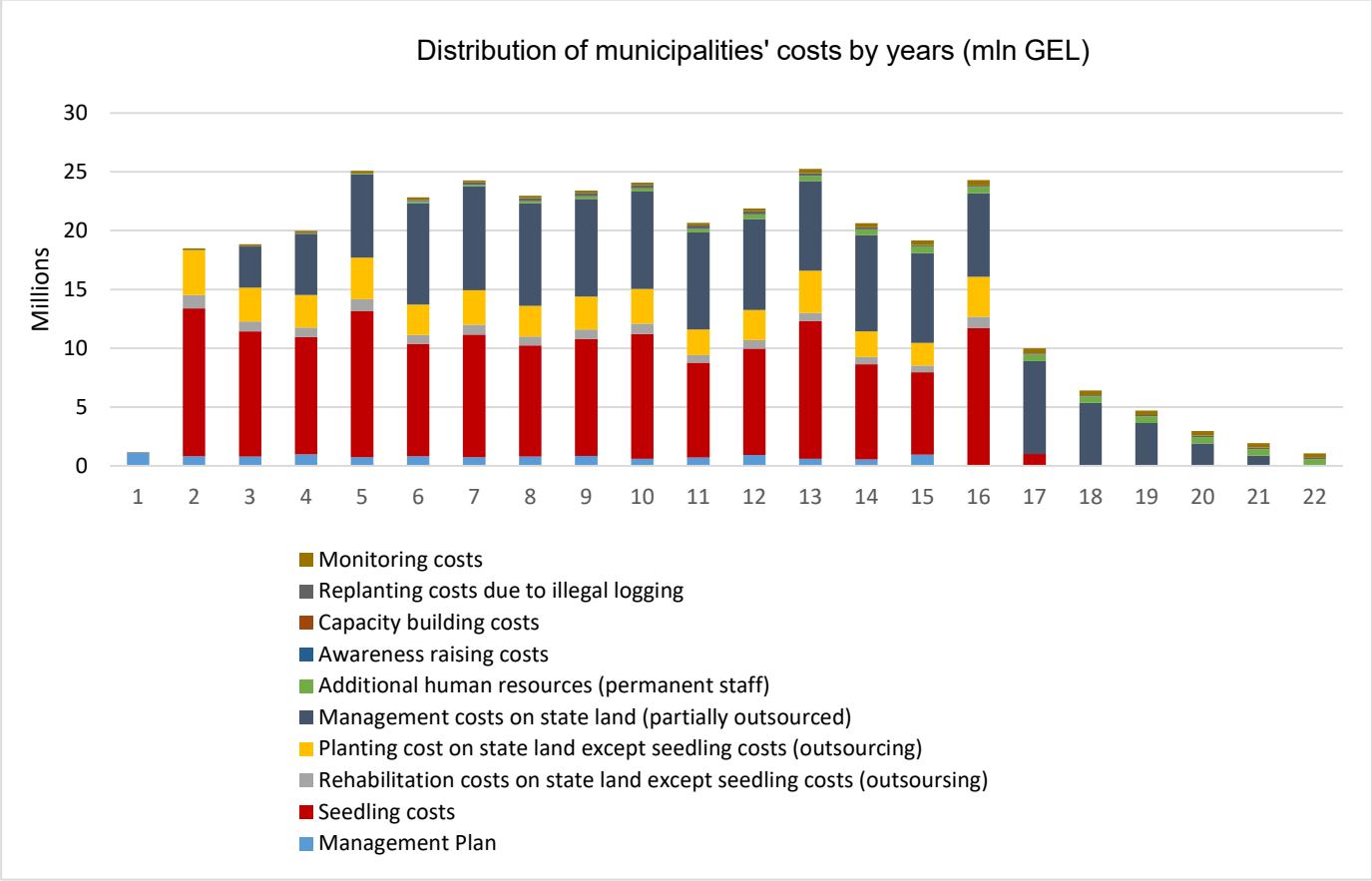

Figure A6: Distribution of the central government costs, by years (mln. GEL), Option 1

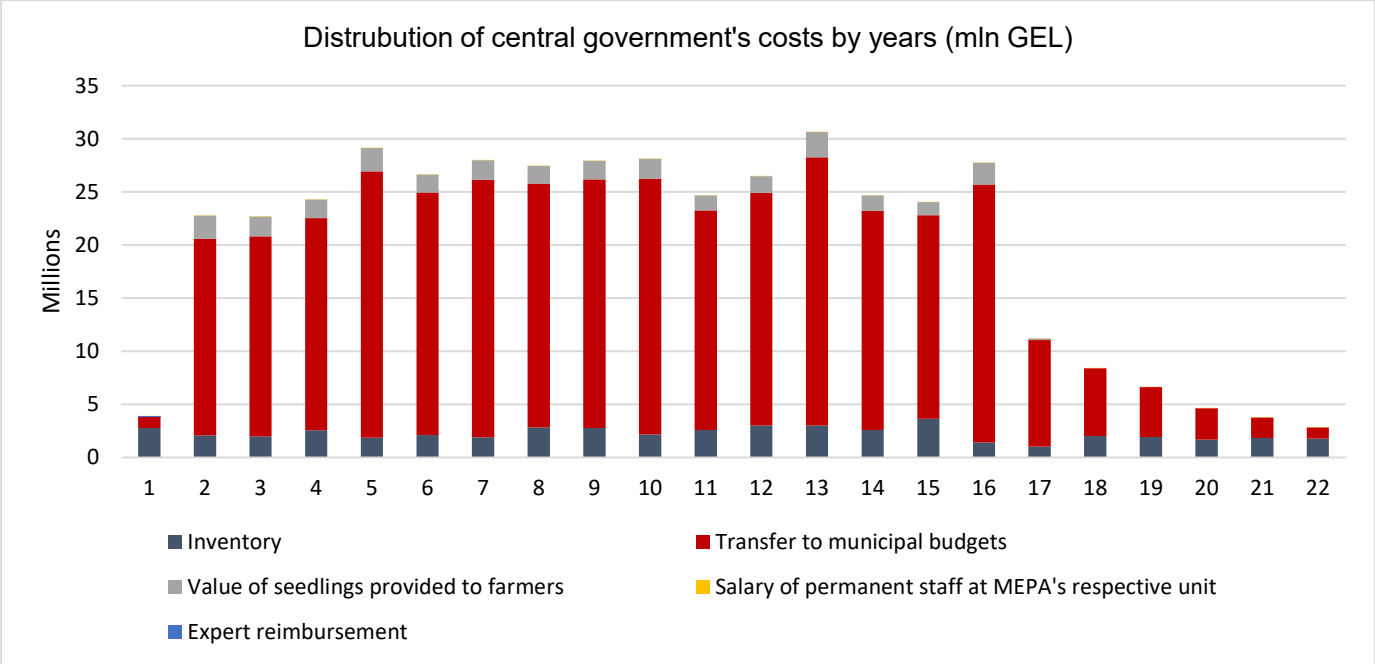

Table A3: The costs of 1 ha of windbreaks

Type of cost	Cost (GEL/ha)
Inventory	2,346
Management plan	1,080
Seedlings, including tubes	12,590
Planting/rehabilitation	4,786/5,619
Seedlings for replanting	1,133.1
Management (5 years)	11,258


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