

## EVALUATION OF PUBLIC ATTITUDE TO FOREST DRAINAGE AS CLIMATE CHANGE MITIGATION MEASURE

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**Abstract.** Nutrient-rich organic soils in forest lands are found mainly in naturally wet (*Dryopterioso-caricosa* and *Filipendulosa*) and drained (*Oxalidosa turf.mel.*) broadleaf dominated stands. These soils are one of the largest sources of greenhouse gas (GHG) emissions in Latvia, and according to the latest national GHG inventory report, GHG emissions from organic soils in Latvia in 2020 amounted to 6.1 million tons of CO<sub>2</sub> eq. from the land use, land use change and forestry sector. High GHG emissions from organic soils also point to considerable opportunities for climate change mitigation through improved forest management practices. The results of the sociological survey presented in this paper are part of a larger study that aims to provide forest managers with decision support tools, including carbon sequestration and GHG emission factors and modeling tools for planning climate change mitigation measures when managing forest stands with fertile organic soils. Purpose of the sociological analysis is to gather information about the readiness of the target group to implement the results of the research in practice. To find out the opinion of the target group, the preconditions for the implementation of climate change mitigation measures in forests on fertile organic soils were identified and a survey of target groups was conducted, involving 509 respondents from several Latvian cities and rural areas. The results of the survey show the attitude of the target groups towards forest drainage as one of the measures to mitigate climate change.

**Keywords:** drainage, organic soil, GHG emissions.

### Introduction

Studies performed so far comparing carbon (C) storage in drained forest organic soil (*Callunosa turf.mel.*, *Vacciniosa turf.mel.* and *Myrtillosa turf.mel.*) and control areas with unchanged moisture regime have shown that forest stands with drained soils are not a long-term source of greenhouse gas (GHG) emissions due to C sequestration in living biomass and soil C input by biomass mortality [1; 2]. The neutral effect of nutrient-poor organic forest soil drainage on GHG emissions is confirmed by the data obtained in the LIFE REstore study [2]. Soil as a source of GHG emissions is observed in broadleaf dominated forest stands with drained nutrient-rich organic soils (*Oxalidosa turf.mel.*) [1; 2]. Nutrient-rich organic soils in forest lands are found mainly in naturally wet (*Dryopterioso-caricosa* and *Filipendulosa*) and drained (*Oxalidosa turf.mel.*) broadleaf dominated stands [3].

Under the Land Use, Land Use Change and Forestry (LULUCF) Regulation, forestry is required to mitigate the effects of climate change by ensuring that GHG emissions from forestry do not exceed the reference level after 2020 [4]. Organic soils are one of the largest sources of GHG emissions in Latvia, and according to the latest national GHG inventory report, GHG emissions from organic soils of the LULUCF sector amounted to 6.1 million tons of CO<sub>2</sub> eq. in Latvia in 2020 [5].

High GHG emissions from organic soils also point to opportunities for climate change mitigation through improved forest management practices [1; 2]. According to the available results of studies conducted in Latvia [1; 2], due to improved C sequestration in biomass and consequently C input in soil by biomass mortality, drainage of organic soils in is one of the most effective climate change mitigation measures feasible implementable in forest management. It is recognized that the use of intensive forestry on part of the forested area in Sweden increases the production of forest biomass and enables an increased use of such biomass to mitigate climate change [4]. Most stakeholders see the future of the forest sector as linked to broader issues of climate mitigation and energy transition [6]. However, with increasing conflicting interests in forest ecology and forestry, the success of such a strategy depends on the public acceptance [4]. In Finland, nowadays commonly used and by general knowledge acceptable forest management practices such as drainage of organic soils, as well as clearcuts, fertilization, mechanized harvesting and construction of logging roads were criticized until late 1980's [7; 8]. Drainage is not listed as non-acceptable measure in Sweden [9]. Attitude and readiness of society to implement extensive forest soil drainage measures in Latvia is unknown. The results of the sociological survey presented in this paper are part of a larger study that aims to provide forest managers with decision support tools, including C sequestration and GHG emission factors and modeling tools for planning climate change mitigation measures when managing forest stands on nutrient-rich organic

soils. Survey results provide insight of forest owner and other respondent opinion on drainage of forest soil that support decision making of drainage related climate change mitigation measure implementation in forest management practice.

### Materials and methods

To find out the public attitude towards forest drainage as a measure to mitigate climate change, a sociological survey was conducted, involving respondents of different ages (from 18 to 69 years) who indicated their place of residence in several Latvian cities and rural areas. Respondents answered 22 questions. In total 509 respondents (52% women and 48% men) took part in the survey. The study compares the answers provided by the respondents divided into two groups. The first group consists of 93 respondents who own a forest (forest owners), while the second group consists of the remaining 416 respondents (other respondents).

### Results and discussion

Summarized results of the sociological survey show that 18% of respondents own forest property. 37% of all respondents indicated that forest property belongs to a family member, but 59% respondents indicated that forest property belongs to friends. Only 5% of respondents affirmed they plan to purchase forest property in the near future, while 5% respondents indicated that they have recently sold forest property. The majority or 73% of surveyed forest owners indicated that the forest owned is not characterized by drained forest soil, but 15% of forest owners could not answer whether the forest soil they own is drained.

According to the results of the survey, 76% of forest owners are informed that drainage measures considerably improve the course of forest growth, and the majority or 61% of other respondents also understand the importance of forest amelioration measures. When asked to describe the plants that typically grow in drained forest soils before the introduction of drainage measures, the majority or 58% of forest owners answered that they were plants typical for naturally wet forest, this opinion was shared by half (50%) of the respondents who do not own the forest. While 40% of forest owners answered that before the introduction of forest drainage measures, plants typical of the swamps grew in the drained forest soils, this opinion is also shared by 47% of other respondents.

According to the information available in the Latvia's National Inventory Report, organic soils are typical for 19% of Latvia's territory [10]. Based on the forest type [3] and according to the information provided by the National Forest Inventory, forest land characterized by organic soil amounts to 723 kha and 53% of these areas have been drained. Finding out the respondents' opinion on the proportion of drained naturally wet forests in Latvia, 25% of forest owners answered that, in their opinion, 3% of forests in Latvia that are characterized by naturally wet forest soil have been drained. The opinion of other respondents (24%) was different, indicating that the proportion of drained naturally wet forests could be around 5%.

The opinion of forest owners and other respondents on the main tasks of forest drainage in Latvia is similar, however, forest owners, in comparison with other respondents, emphasize certain tasks of forest drainage as more important. According to the answers of the respondents, the main tasks of forest drainage are mechanical lowering of the groundwater level and improvement of soil aeration, providing tree roots with a better supply of oxygen, as well as improving the availability of forest resources (Fig. 1). The coincidence of opinions is observed in the answers of forest owners (48%) and other respondents (48%), indicating that forest drainage measures in forests with naturally wet forest soils affect the biological value of the forest, creating new values.

There are differences of the opinion between forest owners and other respondents regarding forests with drained forest soils as a considerable source of GHG emissions in short term [1]. Many forest owners (42%) answered that forests with drained forest soils are not a considerable source of GHG, this opinion is shared by 29% of other respondents. While 42% of other respondents consider forests with drained forest soils as a considerable source of GHG emissions, and 37% of surveyed forest owners also agree with this opinion. Forests with drained soils as a periodical source of GHG (when CO<sub>2</sub> sequestration does not compensate for emissions) was indicated by 22% of forest owners and 29% of other respondents.

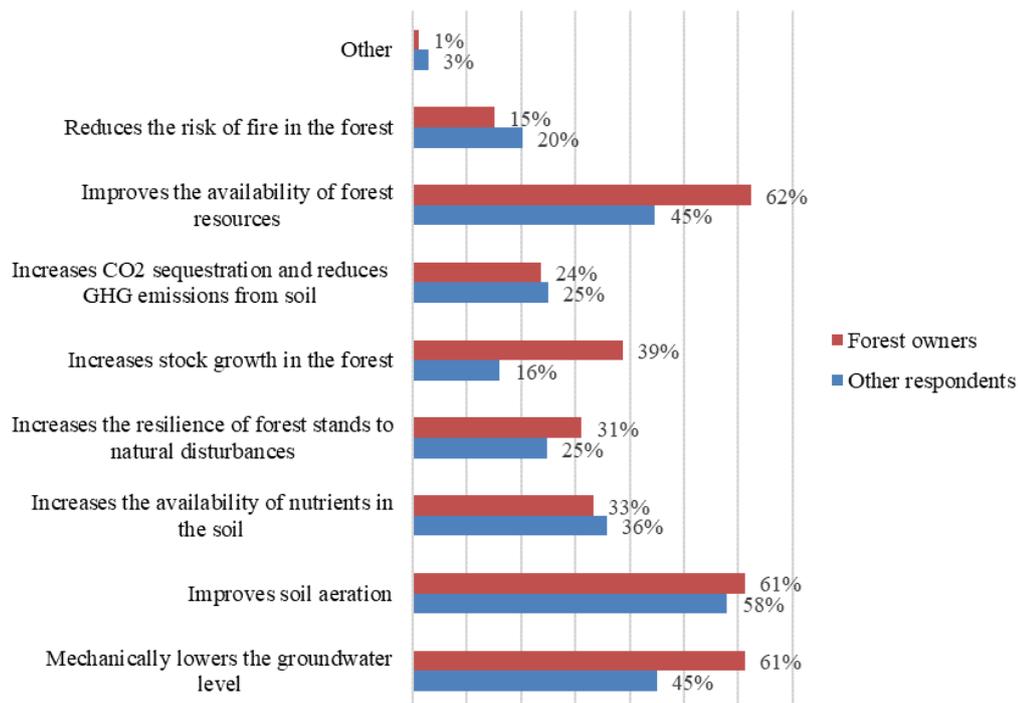


Fig. 1. Main tasks of forest drainage in Latvia

About half surveyed forest owners (44%) and 29% of other respondents do not consider forests with naturally wet soils as a considerable source of GHG emissions. Forests with naturally wet soils were identified as a considerable source of GHG emissions by 30% of forest owners and 33% of other respondents. Considerable share of other respondents (38%) and 26% of forest owners answered that forests with naturally wet soils are a considerable source of GHG emissions periodically when CO<sub>2</sub> sequestration does not compensate for emissions.

Differences of the opinion between forest owners and other respondents are also observed regarding the long-term (during the forest management cycle) impact of forest drainage measures on GHG emissions in forests with organic soils. The majority (53%) of forest owners answered that forest drainage measures reduce GHG emissions, which is shared by 38% of other respondents. In turn, 29% of surveyed forest owners and 36% of other respondents answered that forest drainage measures considerably increase GHG emissions. 18% of forest owners and 26% of other respondents answered that GHG emissions from forests with organic soils are not considerably affected by drainage measures in the long-term.

There is a risk that Latvia will have difficulties in meeting its climate change commitments in the (LULUCF) sector in 2025-2030 [4], respondents commented on possible actions in this situation. The majority of both forest owners (70%) and other respondents (63%) identified the implementation of measures to reduce GHG emissions in the short term without negative long-term consequences (increase of GHG emissions after 2050) as the best solution. The share of respondents (22% of forest owners and 12% of other respondents), who consider the implementation of measures in the LULUCF sector as a suitable solution, thus ensuring the reduction of GHG emissions in the short term, was comparatively lower. A minority of the respondents or 14% indicated the withdrawal from the European Union (EU) and the renunciation of the commitments that Latvia has undertaken to implement as one of the solutions to the problem. The least number of respondents (6% of forest owners and 3% of other respondents) supported the introduction of a new tax to offset expenses of buying emission allowances by the European Union Emission Trading System.

Forest drainage is one of the most effective and cheapest measures to reduce GHG emissions in forest management, 68% of forest owners and 71% of other respondents are not aware of this general knowledge. Only 28% of forest owners and 26% of other respondents answered that they are aware of the effectiveness of these measures and their impact on reducing GHG emissions in forest management.

In general, respondents support the installation of new forest drainage systems in organic soils to ensure that Latvia’s climate change commitments are met, only 12% of forest owners and 7% of other respondents are opposed to such a solution (Fig.2).

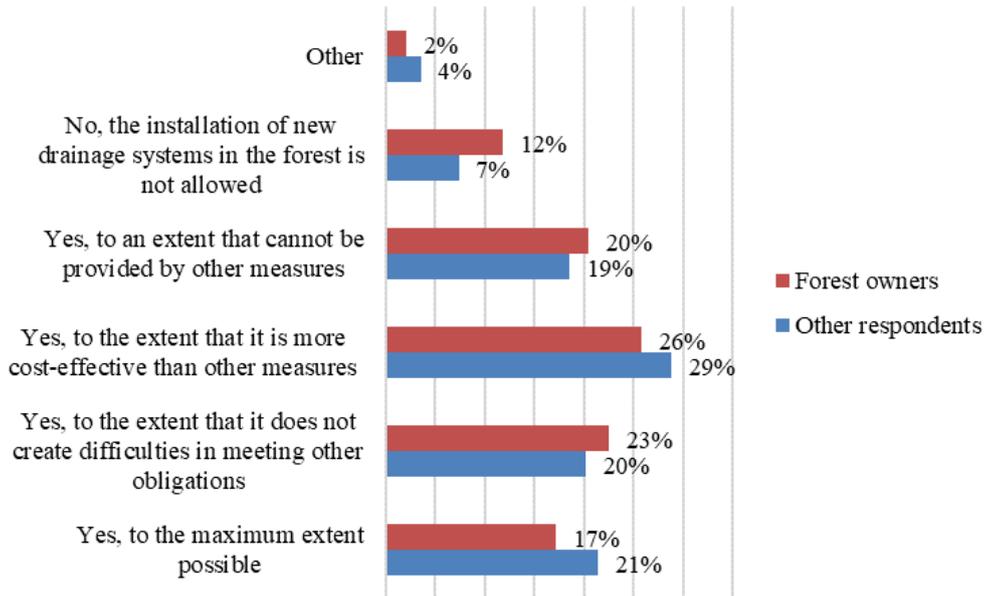


Fig. 2. Support for installation of new forest drainage systems in organic soils

The majority of respondents (74% of forest owners and 75% of other respondents) admitted that, although they do not support the installation of forest drainage systems, they are not willing to give up part of their income to compensate CO<sub>2</sub> emissions from naturally wet forest soils. Only 15% of forest owners and 17% of other respondents are ready to invest from 50-100 EUR per year to compensate for GHG emissions. The respondents also acknowledged that issues related to GHG emissions and offsets seem complicated due to a lack of knowledge and information to make an informed judgement.

Deterioration of forest drainage systems increases GHG emissions [2]. In general, the surveyed respondents support the restoration of forest drainage systems in forest areas with organic soils to prevent the increase of GHG emissions, only 8% of forest owners and 7% of other respondents are negative about such a solution (Fig. 3).

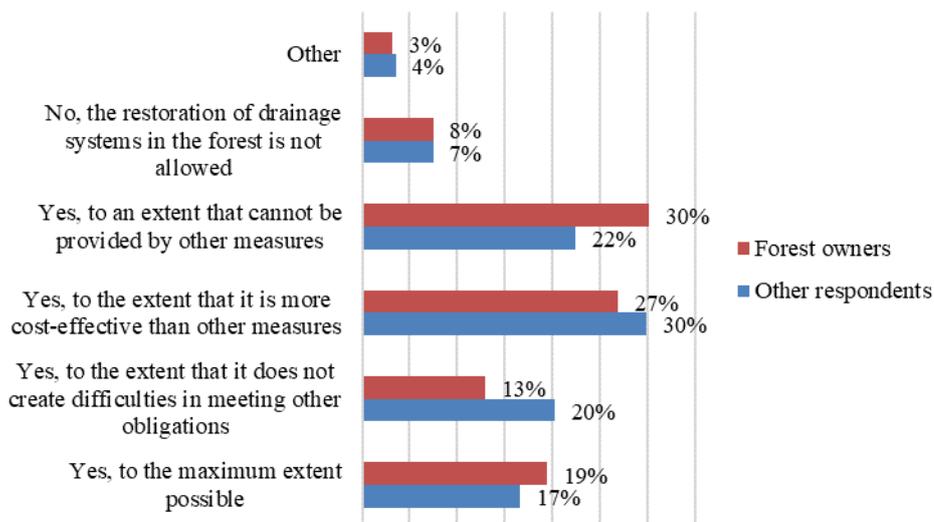


Fig. 3. Support for restoration of forest drainage systems in organic soils

Granting state support for the installation of new drainage systems in the forest is one of the solutions for the development of forest drainage systems. The majority of respondents answered that state support should be provided to the maximum extent possible (38% of forest owners and 36% of other respondents) only if alternative solutions for GHG emission reduction are more expensive (46% of forest owners and 38% of other respondents). While 20% of forest owners and 16% of other respondents answered that granting of state support for the installation of new drainage systems is not necessary. Results of the survey highlight issues that must be further studied by researchers to ensure a holistic approach in development of drainage systems: affordability with respect to the application of new technologies; procedures for integrated planning and management of irrigation and drainage systems; analysis to identify causes and effects constraining irrigation and drainage system performance; evapotranspiration and related calculation methods; estimation of crop water requirements; technologies for the design, construction and modernization of irrigation and drainage systems; strategies to improve irrigation and drainage system efficiency; environmental impacts of irrigation and drainage and measures for creating and maintaining sustainability; institutional strengthening, proper financial assessment, capacity building, training and education [11].

Wood ash makes it possible to further reduce GHG emissions in drained forest soils [12], but the distribution of wood ash involves additional costs. Most respondents (73% of forest owners and 60% of other respondents) answered that the state or ash producer should finance the use of ash in the forest, while 16% of forest owners and 27% of other respondents answered that the distribution of ash should be financed by the forest owner (Fig. 4). While in Sweden majority of the general public supports measures to increase forest growth, they oppose the use of intensive forestry practices such as cultivation of exotic tree species, clones, and forest fertilization. The acceptance of such practices is mainly influenced by the perceptions of their environmental consequences. Although views diverge over the use of novel tree species and the use of fertilization in Sweden [9], public acceptance is the highest for forest fertilization, whereas clone cultivation was the least accepted practice [4].

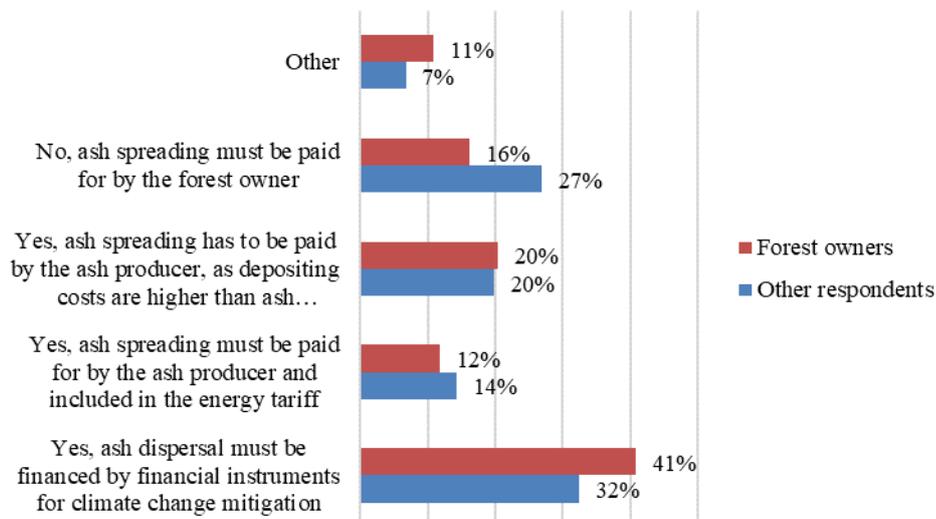


Fig. 4. Impact of land reclamation measures on the biological value of forests on naturally wet organic soils

### Conclusions

1. In general, the public (more than 82% of respondents) supports restoration and installation of forest drainage systems in organic soils to ensure the fulfilment of Latvia's climate change obligations.
2. The respondents (more than 70%) acknowledged that issues related to GHG emissions and their effects seem complicated due to a lack of knowledge and information available to express a reasoned opinion. The lack of sufficient information was pointed out by both forest owners and other respondents.
3. The survey shows that society (75% of respondents) is not ready to pay for CO<sub>2</sub> units if Latvia fails to meet its climate change commitments.

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