*Environmental and Climate Technologies*
2023, vol. 27, no. 1, pp. 195–211
https://doi.org/10.2478/rtuect-2023-0015
*https://content.sciendo.com*

# Evaluating the Effectiveness of Agricultural and Forestry Policies in Achieving Environmental Goals Through Policy Documents

Lauma BALODE[1*], Dagnija BLUMBERGA[2]

[1,2]*Institute of Energy Systems and Environment, Riga Technical University, Āzenes street 12/1, Riga, LV-1048, Latvia*

***Abstract* – To achieve the climate targets set by 2030 and become climate neutral by 2050, each Member State must develop a National Energy and Climate Plan (hereinafter NECP) containing practical and effective measures to achieve the targets. The research sought a connection between the measures or action lines in the Latvian NECP related to agriculture and forestry, the European Green Deal goals and related strategies. The effectiveness of the agricultural and forestry measures defined in the Latvian NECP was evaluated by defining appropriate indicators, an expert survey and a composite sustainability index. The results show that the effectiveness of agricultural and forestry measures is most influenced by quality, financing, and specificity factors. The lowest-scoring measures were specific measures whose impacts cannot be measured and are not explicitly mentioned in the European Green Deal. Therefore, the description of the measures should be more detailed, with specific activities, indicators to be achieved, and amounts and funding sources planned for each activity.**

***Keywords* – Agricultural policies; composite sustainability index; forestry policies; National Energy and Climate plan.**

## 1. INTRODUCTION

Many European Union environmental policies have been developed and integrated simultaneously to strengthen the European Green Deal and achieve its goals. To achieve European Green Deal goals [1], [2] new policies and strategies are being developed [3] that identify directions and actions to preserve biodiversity, reduce greenhouse gas emissions, or improve resource efficiency [2]–[5]. The role of the bioeconomy in the Green Deal is covered in several ways, including biodiversity conservation and carbon reduction measures in the Biodiversity Strategy for the European Union [6], the Farm to Fork Strategy [7]. the European Union Forestry Strategy, and the Circular Economy [8], [9]. At the same time, solutions are sought for the efficient consumption and production of resources and the preservation of biodiversity without exceeding the capacity to use resources [1], [2], [10]. Coinciding with the publication of the European Green Deal, the European Commission published the Biodiversity Strategy 2030, which is one of the policy documents associated with the European Green Deal [10]. One of the main goals and objectives of the strategy is to protect ecosystems and restore natural values by 2030 and 2050. Concerning agriculture, the Biodiversity Strategy defines the restoration of arable land ecosystems in agriculture and the

* Corresponding author.
E-mail address: lauma.balode_2@rtu.lv

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restoration of biodiversity as one of the priority areas. The objectives of the strategy are consistent with and complementary to the priorities of the Farm to Fork Strategy, as they have a more direct link to food security and sustainable production [9]–[11]. Food production is the sector that causes various types of environmental pollution, including soil degradation, water, air, biodiversity degradation, and climate change, which need to be addressed to reduce the overall environmental impact of agriculture [12] in the processes of food cultivation, producing, and usage [6]. To improve the sustainability of food production and the food system as a whole, the European Commission has developed the Farm to Fork strategy, which is also part of the European Green Deal [1], [2], [10], [13]. The strategy emphasizes not only the importance of food security and safe food, but also the importance of sustainable food production in building the economy [3]. The Farm to fork strategy for the countries of the European Union sets out the recommendations that should be taken into account when developing and implementing measures at the national level to increase sustainability in the food industry [3], [8]. The Farm to Fork strategy's main objectives are to reduce the entire food chain's environmental impact at the European Union level, promote sustainable resource use, and provide safe, affordable food [8], [13]. The strategy sets targets for 2030 that determine the reduction of the use of pesticides in food production in the European Union by introducing a series of specific additional measures and revising regulations so that the use of chemical pesticides can be reduced by 50 % within the specified period [14]. In addition to reducing the use of pesticides, the strategy also aims to reduce the use of fertilizers in agriculture by 20 % by 2030. Considering the objectives set out in the Fertilizer Use Reduction Strategy, the European Commission has highlighted the role of precision fertilization in ensuring sustainable agriculture and reducing fertilizer use [8], [15]–[17].

In addition to ensuring sustainable agriculture, it is also necessary to promote sustainable forest management and mitigate climate change by sequestering $CO_2$, by defining appropriate measures and actions. One of the planned solutions to improve forestry policy is the New European Forest Strategy [13] and its integration into the national plans of the Member States of the European Union [10]. The main goals of the new Forest Strategy concern measures and actions to conserve and restore European forests while maintaining biodiversity and increasing $CO_2$ absorption, reducing the frequency of forest fires and efficient forest management [5], [13], [16]. Promoting the development of a sustainable bioeconomy can help to achieve the goals defined in the European Green Deal in the following key areas: 1) it would help improve the environment and ecosystems and preserve biodiversity; 2) promote the transition from fossil energy to bioresources, including the creation of value-added products from bioresources; 3) thereby increase economic prosperity and create new jobs [10], [13]. In Latvia, agriculture and forestry are on the list of activities that, together with households, account for a significant share of greenhouse gas emissions [18], [19]. Agriculture is the second largest sector in terms of emissions [15]. According to 2017 data, agricultural soils accounted for 60.8 % of greenhouse gas emissions, and 31.2 % were from fermentation processes in animal intestines across the agricultural sector. Projections show that the volume of agricultural emissions could increase by 30.1 %. The largest increase in emissions is predicted for emissions from agricultural soils and from animal fermentation processes. The projections show that emissions from agricultural soils will account for about 58.9 %, while emissions from the fermentation of cattle intestines will account for 32.5 %. In addition, methane emissions from agricultural manure could increase by 36.9 % by 2030 compared to 2017 data [20]. In Latvia, one of the specific problems in agriculture is that the number of poultry and livestock kept has increased in recent years, and with it the activity of the digestive processes of farm animals and the amount of greenhouse gas emissions they produce. Each Member State of the European Union is required to prepare a National Energy

and Climate Plan and set achievable measures and policies to achieve the European Green Deal targets. According to the NECP, to achieve the plan goal, it is necessary to reduce unsustainable resource consumption (fossil fuels) by facilitating the transition to using renewable energy resources. Several action directions and sub-measures have been identified for developing agriculture and forestry in the Latvian NECP until 2030. Promoting sustainable forest management and integrating climate change mitigation measures is necessary to ensure sustainable agriculture. Therefore, it is necessary to simultaneously assess the directions of action and specific measures related to agriculture and forestry. Also, in the NECP, the directions related to agriculture and forestry are combined, and it would be correct to evaluate these directions together. Action line eight includes measures to reduce greenhouse gas emissions and promote resource efficiency in the agricultural sector, in contrast action line nine focuses on measures to reduce greenhouse gas emissions and promote carbon sequestration [21]. while promoting sustainable resource use. These action lines and the measures under them were used in the study, and some horizontal measures related to agriculture or forestry were included [20].

Although the Latvian NECP identifies several directions and sub-measures to achieve the set 2030 targets, including developing the agricultural and forestry sectors, some of these measures cannot quantify the impact, according to the European Commission's assessment [22]. It is unclear which measures would be the most important and how the measures were measured or achieved. This study aims to analyse and evaluate the effectiveness of agricultural and forestry measures in the NECP of Latvia. The evaluation of individual measures is based on the indicator approach. This study applies the policy effectiveness evaluation methodology to determine which are the most important measures that should be implemented in forestry and agriculture and whether the priority measures are also consistent with the priorities of the European Green Deal [3], [20], [23].

## 2. METHODOLOGY

### *2.1. Approach to the Study*

Two methods have been chosen to identify and literature review the Composite sustainability index. The Composite sustainability index [24] was used to evaluate the policy's effectiveness. The methodology includes (Fig. 1):

1. The selection of specific policies and actions related to forestry and agriculture is based on the goals and objectives;
2. Identification of indicators to evaluate specific policies;
3. Development of an expert questionnaire to assess the relevance of each indicator and rank actions according to their relevance.
4. Normalization of indicator scores;
5. The weighting of the indicators;
6. Aggregation of indicators into Composite sustainability index [25]–[27].

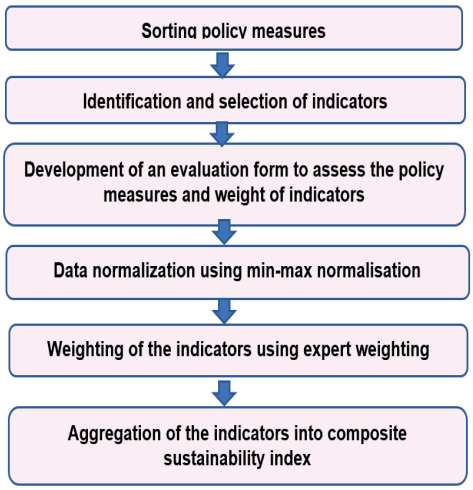


Fig. 1. Model for the evaluation of policies and measures [28].

### *2.2. Construction of the Composite sustainability index*

The Composite sustainability index can be used instead of the method 'The Technique for Order of Preference by Similarity to Ideal Solution' of multicriteria analysis [26]. The composite sustainability index is used in various studies, including the analysis of multiple environmental policies and aspects of long-term assessment. With the help of the sustainability index, the results clearly show the ranking and the most important aspects and factors influencing the result, thus already offering the possibility to analyse the causes further. Collecting and categorising indicators according to the selected indicators makes it possible to obtain a sustainability index that identifies which indicators affect the system the most and which affect it the least. The Composite sustainability index can be used in decision-making processes to determine which solutions have the highest value in a given case [17], [18], [28]. The compilation of indicators in the sustainability index is reliable and meaningful if clear assumptions are made [29].

### *2.3. Sorting policy measures*

First, from Latvia's NECP Annex Four, policy measures and actions were selected specifically for the sustainable use of resources in forestry and agriculture and for reducing GHG emissions Annex 4 of the Latvian NECP [20] defines packages of measures covering several directions of action in the relevant sectors – horizontal measures and specific directions related only to certain actions. The study includes horizontal measures and action directions for agricultural and forestry activities [20]. All action directions, horizontal measures related to agriculture and forestry, and the set targets to be achieved by 2030 were initially selected from Annex 4 of the Latvian NECP (Table 1) [2]. Subsequently, from all directions of action and already concrete measures, it is already analysed in more detail whether the identified measures can be analysed using the six identified indicators for impact analysis. For further analysis, policies are selected that provide practical measures to achieve the goals and where the descriptions of the measures contain information that can be used to conduct an indicator-based analysis using an expert survey [20].

The NECP includes a common section on agriculture, land use, and forestry (4.12. Agriculture, Land Use, and Forestry). Although agriculture and forestry account for a large share of emissions, the amount of information in the plan is smaller than in other sectors such as household, transport

and industry. In the European Green Deal and the Biodiversity Strategy, forests and sustainable forestry are essential for climate regulation and achieving climate neutrality by 2050 [20].

### *2.3.1. Description of the specific agriculture and forestry actions*

H.14 develop research programmes to stimulate research needs to achieve energy and climate goals. One of the highly rated environmental measures relates to support for environmental research programs to meet established climate goals and to encourage the development and use of new innovative technologies and products. Horizontal measure H.14 provides for the continuation, expansion, and promotion of the activities of national research programs, the promotion of market-oriented research, and the promotion of national research projects with a practical orientation.

- *8.1. Promote and support the exact use of mineral manure.* It is expected that conditions will be developed to apply the measure to target farms (achievable indicators - the measure has been implemented in 37.5 % of wheat and rapeseed areas managed by cluster 2 farms (intensive grain farming farms).
- *8.2. Promote Fertilisation Planning*. One of the agricultural policies that scored high in the long-term index assessment was the promotion of fertilizer planning to reduce emissions generated in agriculture. In Annex 4 of the Latvian NECP, the list of measures and achievable indicators stipulates that regulations will be developed for mixed, medium-sized farms with grazing, which account for 25.4 % of the total number of farms in the country, and the list of measures also stipulates that the promotion of manure planning in 2030. As a result, 27 % of agricultural land in these farms will be implemented.
- *8.4. Organic dairy stock farming* – to reduce emissions caused by dairy farming. The event's activities envisage that the regulations will be developed so that in 2020 they account for 17 % of the total number of dairy cows, in 2025, 21 % of the number of cows in organic dairy farming and in 2030 already, 22 %. Similarly, the overall achievable indicators of the measures specify that ammonia emissions from dairy farming will be reduced by 4 %.
- *8.5. Facilitate ration planning (planning feed rations)*. The action plan provides for the development of conditions for applying the measure in the target farms, including 31 408 dairy cows.
- *8.7. Improving the maintenance of amelioration systems in agricultural lands, thereby reducing indirect runoff*. The course of action envisages that conditions will be developed to apply the set of measures to all farm groups, covering 100 thousand ha.
- *8.8. Improve the inclusion of taw winter in the crop rotation to promote nitrogen removal.* The course of action foresees that the conditions will be developed in order to apply the measure to target farms, covering a total of 172.331 thousand ha (clusters 1, 2 and 3, which together make up about 26 % of all farms in Latvia and occupy about 70 % of the total agricultural land).
- *8.10. Supporting and promoting wider use of passer in cereal crops* – The action plan provides that using a passer increases carbon sequestration (application of the measure on 17.5 thousand ha of agricultural land) (achievable indicators - the increase in carbon yield increases carbon accumulation in the soil by 7 tons $ha^{-1}$).
- *8.11.* The course of action envisages that conditions will be developed to ensure that green fallow is established before winter sowing, which increases carbon sequestration (100,858 ha of agricultural land). Achievable indicators - the increase in carbon yield contributes to soil carbon accumulation by 7 tons $ha^{-1}$.

- *8.12. Support the development of innovative technologies to promote resource efficiency, reduce greenhouse gas emissions, and increase $CO_2$ emissions in agriculture.* The action envisages that support is provided for the implementation of research, technology development, and demonstration projects to improve resource efficiency, reduce greenhouse gas emissions/increase carbon sequestration in agriculture, and support the development of new technologies and innovative solutions (legislation and support programs have been developed).
- *9.3. Promoting the development of forests and the quality of the crop in naturally overgrown areas*. Implementation is planned for 10 thousand ha during the year. Implementation is planned for 10 thousand ha during the year.
- *9.4. Encourage the replacement of unproductive low-carbon forest stands.* The operation is planned to be carried out in 10 thousand ha during the year.
- *9.6. Encourage young-adult felling*. The action plan envisages 120 thousand young adults being felled by 2030.
- 9.8. *Encourage recultivation of historically used peat harvesting sites by selecting the most appropriate type of recultivation.* The direction of action requires that guidelines have been developed to ensure a comprehensive assessment of areas for decision-making and development of action plans for the recultivation of areas. Within the framework of the Common Agricultural Policy, the establishment of perennial plantations (a total of 18 thousand ha) was supported.
- *9.9. Promoting wood use in construction*. According to the framework of the action direction, it is planned to launch at least one promotion program to stimulate the use of wood in construction by 2030.
- *9.10. Promote the cascade principle in the use of wood and biomaterials*. According to the Latvian NECP in Annex 4, preparing legal acts and developing at least one support program for applying the cascade principle of measures on wood-related products are foreseen. However, detailed information on related activities under the action plan was not provided.
- 9.12. *Promote support for innovative technologies, development of technologies and innovative solutions to promote greenhouse gas reduction/carbon sequestration in forestry and resource efficiency.* The package of measures envisions promoting cooperation between state and local government institutions, educational institutions, and enterprises to develop new innovative technological solutions for sequestering $CO_2$ from forestry and improving resource use efficiency. The stated performance indicator is the funding program.
- *12.1. Improve public knowledge, awareness, and awareness of climate change mitigation, use of RES, and resource efficiency*. At least once a year, information campaigns are conducted on: ways to reduce daily resource consumption, the importance and necessity of RES and its contribution and benefits to the economy, society, nature and the climate, the principles of socially responsible use of RES [20].

TABLE 1. DESCRIPTION OF THE ACTIONS IN NECP [20]

| **Action lines related to agriculture and forestry measures** | **Measures or action lines related to agriculture and forestry** |
|---|---|
| Horizontal measures | 8.10 Supporting and promoting wider use of passer in cereal crops |
| H.5 Promoting the production of biogas and the use of biomethane biomethane | 8.11 Support and promote the establishment of green fallow before winter crops |
| H.14 Develop research programmes to promote and stimulate research for achieving energy and climate goals. | 8.12 Support the development of innovative technologies to promote resource efficiency, reduce greenhouse gas emissions, and increase $CO_2$ emissions in agriculture. Support the development of innovative technologies and solutions to promote resource efficiency, reduce greenhouse gas emissions, and increase carbon sequestration in agricultural activities. |
| 8. Direction of action. Efficient use of resources and reduction of GHG emissions in agriculture | 9. Direction of action. Sustainable use of resources and reduction of greenhouse gas emissions and increase of $CO_2$ reduction in land use, land use change and forestry. |
| 8.1 Promote and support the exact use of mineral manure | 9.3 Promoting the development of forests and the quality of the crop in naturally overgrown areas |
| 8.2 Promote Fertilisation Planning | 9.4 Encourage the replacement of unproductive low-carbon forest stands |
| 8.3 Directly promoting and supporting the incorporation of organic fertiliser into the soil | 9.6 Encourage young-adult felling |
| 8.4 Organic dairy stock farming (emission-reducing dairy farming) | 9.8 Encourage recultivation of historically used peat harvesting sites by selecting the most appropriate type of recultivation |
| 8.5 Facilitate ration planning | 9.9 Promote the use of wood in construction |
| 8.7 Improving the maintenance of amelioration systems in agricultural lands, thereby reducing indirect runoff | 9.10 Promote the use of the cascade principle in the use of wood and biomaterials |
| 8.8 Improve the inclusion of tawwinter in the crop rotation to promote nitrogen removal | 9.12 Promote and support innovative technologies and solutions to promote greenhouse gas reduction/carbon sequestration in forestry, resource efficiency |
| 12.1. Improve public knowledge, awareness, and awareness of climate change mitigation, use of RES, and resource efficiency | |

### *2.4. Identifying Indicators for Performance Assessment*

To create a representative composite sustainability index, it is essential that the selected indicators characterize the problems of the respective system and that the selected indicators allow for mutual comparison of the effectiveness of different policy measures, which is the aim of this study. Therefore, the indicators were selected considering the indicators used in the policy evaluation and individual indicators from the Better Regulation Program. Better Regulation Regulatory Policy The OECD indicators are rated as one of the most effective indicators of policy regulation and management that can be used as tools for decision-making and policy analysis [30]. Therefore, in addition to the indicators included in Better Regulation, the study also used some success and failure factors to characterize the success or failure of measures. The study selected one of the indicators from the success factors of the ODYSSEE-MURE project for the implementation of successful energy efficiency measures. However, this indicator can also be used to analyse other environmental policy measures. Based on the analysis of the scientific literature and the amount of information on

policies in Annex 4 of the Latvian NECP, six indicators were identified that can be used to characterize the effectiveness of the policies. The indicator i1, possible adverse side effects, describe whether and which negative or positive side effects will occur during the implementation of the specific policy or bundle of policies and whether adverse effects have already been consciously identified. The side effect analysis is also a preliminary identification and assessment of risks associated with the implementation of specific policy actions [31] indicator i2 transparency [32] – Transparency is an indicator that characterizes the transparency of specific measures at the definition and implementation stages. i3 Objectivity – the indicator shows whether the specific policy measure or approach will allow achieving the set climate targets following the Latvian NECP. i4 Specificity – the indicator characterizes whether the specific measures and the plan for their implementation are described correctly and understandably and whether only general and unspecific tasks are set. i5 – the quality of the policy measures [30]. The indicator describes whether the policy measures, the procedure is described understandably and whether the policy measure is realistically feasible according to the given description i6 Financing – the indicator describes whether the amount of financing and the sources of financing for the specific action are clearly stated (Table 2).

TABLE 2. DESCRIPTION OF THE INDICATORS

| No. | Indicator | Explanation of the indicator |
|---|---|---|
| i1 | Possible negative side effects [28], [33], [34] | The possible adverse side effects of the specific measure are excluded (e.g., no indirect support for the use of fossil fuels in agriculture is created and no additional energy consumption is promoted, no additional resource consumption is used), the policy measure complies with the principles of climate neutrality, efficient use of resources for policy measures or the direction of action the result does not contradict the defined environmental and climate goals. |
| i2 | Transparency [28], [32] | Lobby influence has been eliminated (positive or negative side pressure). The potential influence of the lobby (influencing policy - action or inaction to influence decision-making in favour of specific individuals or groups, various political interests, and private and public interests) has been identified and eliminated. |
| i3 | Objectivity [28], [32] | Identified policies or action lines are based on achieving climate change objectives according to the documents listed in the higher-level hierarchy. A policy measure or line of action is objectively determined and its choice is justified following the defined objectives and the tasks to be achieved. |
| i4 | Specificity [28], [32] | The information provided about the policy action is not generic and is described in detail, the description and mission of the action or course of action are consistent with the defined objectives. The policy action plan defines expected measurable outcomes. If necessary, the policy action or course of action is laid out for changes in a way that allows flexibility to make changes to the plan. |
| i5 | Quality [28], [32] | The policy measure or line of action and the expected results are described understandably and realistically. A policy measure or specific action line will ensure the long-term sustainability of the goals set (e.g., specific greenhouse gas emission reductions, energy savings, transition to RES), or the results will not be limited to a single measure, but will contribute to a positive chain reaction and overarching goals. |
| i6 | Funding [28], [32] | Clear sources of funding for policies or a specific course of action are identified and funding is provided to implement appropriate actions. Funding is provided for the implementation of actions that contribute to the reduction of greenhouse gas emissions following established goals to be achieved within a specified period. |

Each indicator is evaluated according to a severity scale. The indicators were scored on a scale of one to five, with a score of one representing very poor performance and a score of five representing very good performance that impacts the success of the policy. The assessment was conducted by nine experts in environment and agriculture.

### *2.5. Data Normalization*

When creating a complex composite sustainability index, the data must first be normalized for mutual comparison of measures and indicators. To compare and compile indicators, the data must first be normalized. To standardise the indicators, the min-max method, used in sustainability studies, was used for normalization. The Min-max normalization method was used for normalisation, which is also used in environmental decision-making and policy analysis. This method presents the results on a scale of [0;1]. The indicators selected for the study were normalized using Eq. (1).

$$I_{N,ij}^{+} = \frac{I_{\text{act},ji}^{+} - I_{\text{min},ji}^{+}}{I_{\text{max},ji}^{+} - I_{\text{min},ji}^{+}}, \tag{1}$$

where

$I^{+}_{N,i}$ Normalized indicator;
$I^{+}_{\text{act},i}$ The actual value of indicator;
$I^{-}_{\text{min},i}$ Minimum value of an indicator;
$I^{+}_{\text{max},i}$ Maximum value of an indicator;
$i$ Specific indicator [27].

### *2.6. The weighting of the indicators*

To create the composite sustainability index, it is necessary to determine the importance of the indicators in comparison with other indicators and evaluate each indicator's weight. Special completion forms were prepared and the experts were asked to rate the six indicators mentioned above according to their importance, which was expressed in %. The forms were filled so that the total score of the indicators was 100 %, e.g., Possible side effects 30 %, Transparency, 20 %, Objectivity 10 %, Specificity, 5 %, Quality, 20 %, Funding 15 %. In the forms, scoring is done by filling in the " boxes" and indicating the corresponding percentage score for each indicator. To determine the weight of each indicator, it is possible to use expert interviews to determine the weight of the indicators or assign the same weight to each indicator so that the total weight of the indicators is one. An expert weighting technique was used in this study. Simultaneously with the assessment of the measures themselves, nine experts with extensive knowledge of bioeconomy policy and the agricultural sector were asked to assess the significance % of the indicators described above, based on the indicator approach. The experts have experience in research on bioeconomy, climate and environmental sustainability. The expert survey form was accompanied by an additional table in which each of the six indicators was given a percentage score, so that the total sum of the indicators was 100 %. In this study, the weighting of the indicators was done by expert survey, and the results were also compared with the exact weighting. The overall performance index is calculated for each indicator based on the cumulative amounts with their respective weights. The composite sustainability index is calculated as the total sum of all indicators, according to Eq. (2) [27].

### *2.7. Aggregation of indicators in to Composite sustainability index*

The sum of all indicators results in the final Composite Sustainability Index, which can be used for further comparisons.

$$I_{CSI} = \sum_{j}^{n} W_j \cdot I_i, \quad (2)$$

where

$I_{CSI}$ is a composite sustainability index;

$W_j$ the impact weight of indicators determined from the expert surveys (calculated in %) [27], [35];

$I_i$ the normalized value of an indicator.

## 3. Results and Discussion

### *3.1 Evaluation of policy impact*

The highest score in the composite sustainability index got policy action direction *12.1. Improving public knowledge, awareness, and understanding of climate change mitigation, RES use, and resource efficiency* (score 0.77). On the other hand, the lowest scores in the Composite sustainability index got actions *8.11. Supporting and promoting the installation of green fallow before winter crops* (0.58), *8.10. Supporting and promoting wider use of passer in cereal crops* (0.57), *9.9. Promoting wood use in construction* (0.55).

The direction of action *12.1 Improving public knowledge, awareness, and understanding of climate change mitigation, RES use, and resource efficiency* (0.77) – at the national level, there are no long-term measures to educate the public about solutions for efficient resource use [18]. A sub-priority of the European Green Deal is to promote even broader knowledge transfer, education and involvement of even broader social groups in environmental decision-making. To achieve the set goals in environmental education, the European Commission has developed a set of competencies that include recommendations and best practices and examples that promote an understanding of how to integrate environmental education and climate issues into educational programs [36]. To implement the goals defined in the Farm to Fork Strategy, the involvement of all food system stakeholders, including society, is essential. The implementation of the adopted measures should consider the needs of the people and the regional characteristics, while also considering the interests of producers [14]. Based on the data in the assessment of experts, the direction of action: *9.10. Promote the cascade principle in the use of wood and biomaterials also received a high index* (0.71). Detailed information on related activities under the Action Plan was not provided. It is expected that the sources of funding will come from both the state budget and the European Structural Funds, and it is not specified how much funding will be needed to implement the planned activities [18]. One of the environmental policy documents related to the priority directions of the European Green Deal and their implementation in the field of forestry and carbon sequestration is the European Union New Forest Strategy and the cascade principle for wood is one of the main priorities. The European New Forest Strategy for 2030 states that the amount of wood used should be used as much as possible to obtain higher value-added products or raw materials by expanding its use following the basic principles of the circular economy and the cascade principle [17]. *8.5. Facilitate ration planning (planning feed rations)* (0.71) – specific financial requirements for individual activities are not specified. However, the financial needs for the development of conditions and their implementation (the achievable indicator is 10 % in the first group and 50 % in the third and fourth groups) amount to 4.7 million EUR, with both private and European Union structural funds indicated as sources of funding. From the given description, it is necessary to clarify what part of the funding amount is required for the development of regulations and what part is required for

the achievement of the established indicators. However, the evaluation of the measures proposed for this action is quantitatively measurable, and in the medium term could measure progress towards the goals set for 2030. *H.14 Develop research programmes to stimulate research needs to achieve energy and climate goals* (0.71) – one of the highly rated environmental measures refers to the promotion of environmental research programs to achieve the set climate goals and to promote the development and use of new innovative technologies and products. Similar to the other measures and action directions, the funding required for each activity or direction is not allocated here, but the total funding for the implementation of the package of measures is reported to be around 280 million euros. Several sources are indicated for financing the package of measures, including private funds and the state budget. In the description, there is a lack of concreteness regarding the tasks to be fulfilled to promote research programs, as well as achievable, measurable indicators that would make it possible to evaluate progress and determine whether and for how long the set goals are being achieved and whether they need to be revised [18]. In line with the NECP itself, the vision defined in the plan includes measures to promote support programs and increase export capacity through support to distributors and to develop new innovative technologies and innovations that promote the commercialization of research results. NECP indicates in the section on research that both practical research programs with commercialization, technology transfer centres, and centres of excellence on decarbonization issues should be created. In line with the European Green Deal, closer collaboration between universities, research institutions and companies in the field of climate change, future nutrition and sustainable energy use will be further promoted [35]. *8.2. Promote Fertilisation Planning* (0.70) – one of the agricultural policies that scored highly in the long-term index assessment was the promotion of fertilizer planning to reduce emissions generated in agriculture. Although clearly stated achievable indicators, the measure lacks a specific implementation plan for how the indicator will be achieved – implementation of fertilizer planning in 27 % of affected farms. The level of funding is not broken down by activities or periods only the funding for the entire package of measures is indicated. The package of measures to promote fertilizer planning in Latvia was rightly proposed because one of the most important problems of Latvian agriculture is the excessive use of mineral fertilizers. The promotion of fertilizer planning is in line with the agricultural goals set out in both the Green Deal and the Common Agricultural Policy, which calls for a reduction in the use of fertilizers. Fertilizer planning and more prudent use of fertilizers are the measures that make it possible to improve the balance between emissions generated by agriculture and overall emissions [9]. *8.4. Organic dairy stock farming – to reduce emissions caused by dairy farming* (0.70). Compared to the other measures described, this set provides specific, achievable indicators to be achieved in each period. This provides an opportunity to measure progress against the plan or revise the measures and targets for 2030 [10]. In Latvia, organic dairy farming is an open niche and regionally suitable, as there are many dairy farms in Latvia. However, the livestock of the farms is small, so organic livestock production is possible. The package of measures is reasonably chosen and solves a current problem in Latvia while showing a potential solution that can help reduce and regulate emissions caused by livestock farming while developing the direction of organic dairy farming. The European Green Deal requires that precision agriculture and organic farming be included and developed in national energy and climate plans and other national environmental documents for agriculture and forestry. The European Green Deal requires all European member states to increase the area used for organic farming. Therefore, the measure proposed in the Latvian NECP will promote progress and fulfilment of this goal [6]. *9.12. Promote support for innovative technologies, development of technologies and innovative solutions to promote greenhouse gas*

*reduction/carbon sequestration in forestry, and resource efficiency* (0.68) – although the measures include several actions and activities that could be stated as achievable and measurable indicators, the stated performance indicator is the funding program. Both the European Structural Fund, private funds and the state budget are indicated for the implementation of these actions by 2030, but the total funding of the actions is unknown. It is not clear from the given description whether the implementation of the listed tasks will be done through the creation of funding programs. The objectives of the New Forest Strategy developed by the European Commission have been incorporated into the European Green Deal, and measures to promote carbon sequestration in forests have been identified as one of the priority directions for achieving climate neutrality goals. However, no quantitatively measurable, achievable indicators have been established to monitor and measure the progress of the proposed actions, the additional actions and the measures needed to achieve the targets. Based on the results, the following action directions received the lowest score in the composite sustainability index: *8.11. Supporting and promoting the installation of green fallow before winter crops* (0.58). This course of action of the agricultural sector was given one of the lowest scores in the sustainability Index. No funding was indicated for the implementation of the course of action and the achievement of the defined indicator, not even close to the required amount, indicating that the sources of funding will be the European Union Structural Funds, the state budget and private financing. The measures are rather general, and the NECP 2030 also needs to explain why this direction of the measures is essential and how important they are compared to the other measures, nor does it clearly state the planned funding and funding sources. *8.10 Supporting and promoting wider use of passer in cereal crops* (0.57). The second lowest score in the sustainability index was given to the Agriculture sector action line: Support and promote wider Use of passers in cereal crops. Similar to the previous action line, this action line does not even give an approximate amount of funding required. The funding sources are European Union structural funds, private funds, and funds from the state budget. Neither the description of the action plan nor the Latvian NECP itself describes or otherwise explains why the specific action is essential and what conditions should be developed. Moreover, it is not explained how monitoring should be carried out to ensure that the established indicator is achieved. *9.9. Promoting wood use in construction* (0.55): The action direction to promote wood in construction received the lowest score on the sustainability index. Under the action direction, it is planned to establish at least one incentive program to promote the use of wood in construction by 2030. The total amount needed or the approximate amount of funding is not specified in this case, and the national budget, European structural funds, and private funds are also mentioned as sources of funding. The new European Union Forestry Strategy described above identifies promoting the use of wood in construction as one of the most crucial carbon sequestration solutions. The forestry strategy emphasizes that it is possible to reduce climate change both by sequestering $CO_2$ and accumulating carbon in wood and replacing fossil-origin materials with wood, including wood construction, furniture, and household items as higher value-added and $CO_2$-neutral products [17]. Therefore, in the case of Latvia, more attention should be paid to promoting carbon sequestration through the use of wood in higher value-added wood products to reduce the amount of wood used for energy production and achieve the set climate neutrality targets in 2050. Also, from the New Forestry Strategy of the Union of European Member States, European priorities should currently refer to the more sustainable use of wood materials, including wood used in construction and demolition – reuse and recycling [15]; see Fig. 2 and Table 3.

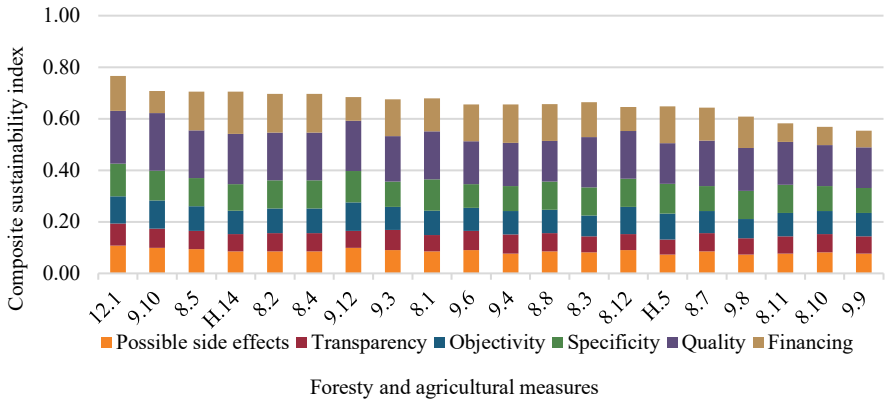


Fig. 2. Composite sustainability index of agriculture and forestry policy.

TABLE 3. AGRICULTURAL AND FORESTRY MEASURES FROM NECP [20]

| | |
|---|---|
| 12.1 | Improve public knowledge, awareness, and awareness of climate change mitigation, use of RES, and resource efficiency |
| 9.10 | Promote the use of the cascade principle in the use of wood and biomaterials |
| 8.5 | Facilitate feed ration planning |
| H.14 | Develop research programmes to promote and stimulate research for achieving energy and climate goals. |
| 8.2 | Promote Fertilisation Planning |
| 8.4 | Organic dairy stock farming (emission-reducing dairy farming) |
| 9.12 | Promote support for innovative technologies and solutions to promote greenhouse gas reduction/carbon sequestration in forestry, resource efficiency |
| 9.3 | Promote forest development and crop quality in naturally overgrown areas |
| 8.1 | Encourage and support the accurate use of mineral fertilisers |
| 9.6 | Encourage young-adult felling |
| 9.4 | Promote the replacement of unproductive, low-carbon forest stands |
| 8.8 | Improve the inclusion of taw winter in crop rotation to promote nitrogen removal |
| 8.3 | Directly promoting and supporting the incorporation of organic fertiliser into the soil (transporting liquid vehicles using hose systems or casks and using injectors in the soil) |
| 8.12 | Promote support for the development of innovative technologies and solutions to promote resource efficiency and reduce greenhouse gas/carbon emissions from agriculture |
| H.5 | Promoting the production of biogas and biomethane and the use of biomethane |
| 8.7 | Improving the maintenance of amelioration systems in agricultural lands, thereby reducing indirect FROM runoff |
| 9.8 | Encourage recultivation of historically used peat harvesting sites by selecting the most appropriate type of recultivation |
| 8.11 | Supporting and promoting the installation of green fallow before winter crops |
| 8.10 | Supporting and promoting wider use of passer in cereal crops |
| 9.9 | Promoting wood use in construction |

### *3.2. Importance of the indicators*

Regarding the importance of each indicator, indicators such as funding and quality were the most important. The weights determined by the expert evaluation were also compared for the weights where each indicator was equally important (Fig. 3). The results showed no significant differences in the distribution – it is equally possible to use the same weighting method and the weights from an expert survey.

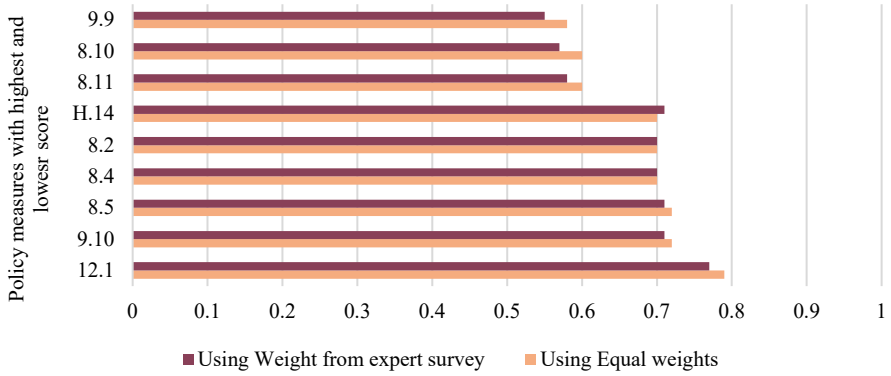


Fig. 3. Comparison of weight from the expert survey and equal weight.

### *3.3. Revision of the established agricultural and forestry measures*

According to Chapter 8 of the Latvian NECP, the first progress report on the impact of the measures defined in the NECP must be submitted to the European Commission by March 2023, including a more detailed assessment of the impact of the measures on the reduction of greenhouse gas emissions and energy consumption, and the definition of specific achievable indicators [18]. Each horizontal measure and course of action in the NECP Annex should include a detailed description of the specific measure and achievable targets. In addition, a measurable target achievement indicator should be provided for each defined action, not just the target achievement indicator for the entire course of action. For each of the action areas included in the NECP, objective and verifiable indicators should be defined that can be monitored to verify at an earlier stage whether progress is being made towards the goals set or whether the action in question needs to be revised to avoid partial or total non-compliance with the plan at the end of its implementation. The indicators to be achieved must be expressed in numbers (quantitative and qualitative indicators to be achieved by 2030), all responsible institutions and co-responsible institutions must be indicated, all necessary funding (including monitoring activities); additional funding sources.

### *3.4. Limitations of using the composite sustainability index method*

One of the study's identified limitations is that more objective results could be expected if more indicators were used. The indicators were selected based on the scientific literature and the minimum amount of information available for each horizontal measure and action line in the NECP. In such a case, if the policy planning documents contain more detailed information on policy objectives, achievable indicators, monitoring, and required funding, other indicators not included could be proposed for evaluation. Expert ratings were compared with the same weighting for each indicator. With a larger group of experts, the weighting of the indicators would be more different, and the result would be more objective. To create an evidence-based

and reliable sustainability index that shows the sustainability of each measure, the raw data and the availability of the data are most important. In this case, the data were more descriptive. Therefore, indicators such as quality were chosen to indicate how detailed and precise the course of action was described.

## 4. CONCLUSIONS

The study shows what actions are essential to achieve the goals of the NECP. The actions with the greatest impact were *12.1. Improving public knowledge, awareness, and understanding of climate change mitigation, use of RES and resource efficiency*, and *9.10. Promoting the cascade principle in using wood and biomaterials, facilitating feed ration planning, developing research programs, and promoting fertilizer planning*. These measures coincide with the goals of the Green Deal. European Forestry Strategy, as one of the binding documents of the European Green Deal, identifies the promotion of the cascade principle in using wood as one of the priorities. Measures 8.10 and 8.11 with the lowest score are specific and need to explain why these measures are essential and clearly state the proposed funding and funding sources. The lowest-scoring actions are specific actions whose impacts cannot be measured and are not explicitly mentioned as relevant in the European Green Deal. The description of the policy measures should be more detailed, with specific activities, indicators to be achieved, and amounts and funding sources planned for each activity. According to the experts, indicators such as funding and quality were the most important. The deadline for the implementation of most measures extends to the end of 2030, which does not allow for an objective assessment of the implementation of the measures based on achievable indicators. The plan should introduce indicators to be achieved in the middle phase and at the end of the planning period from the beginning, to be able to evaluate the progress in achieving the objectives or to re-evaluate the established achievable indicators in the middle phase and determine whether the established actions have not lost their relevance. Several of the action lines are similar, and it would be possible to combine them into one action line, e.g., reforestation. The action lines and specific measures are fragmented in agriculture and forestry and lack a common framework. Several actions can be combined and complemented. The sustainability index method can be used to analyse local, regional, national, and international policy planning plans and strategies. Using the composite sustainability index, it is possible to determine how to avoid failing to meet established goals by identifying impeding factors as early as possible in the planning process. It is also possible to assess whether the defined actions will achieve the defined indicators and whether reviewing and detailing the defined action directions is necessary.

## ACKNOWLEDGEMENT

This work has been supported by the European Social Fund within the project No 8.2.2.0/20/I/008 “Strengthening of PhD students and academic personnel of Riga Technical University and BA School of Business and Finance in the strategic fields of specialization”.

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