

Recommendations for integrating climate change mitigation and adaptation measures into national forestry and climate policies and legislation

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1 Abstract

Key words: climate change, mitigation, adaptation, policies, systemic actions, measures

Policy recommendations created by the Forests for Future project were based on the results of forest development modelling and scenario creation, forest management planning guidelines, review of legislative frameworks, survey of 34 leading Slovenian forestry experts and decision-makers, and results of meetings with forest owners. These recommendations elaborate measures and adaptations that would facilitate the integration of mitigation and adaptation measures to climate change impacts into national forest and climate policy, legislation and forestry practice. The recommendations relate to the following areas:

- In forest management planning, it will be necessary to consistently implement all planned measures in forest management and hunting management plans. Planning will benefit from the establishment of cyclic LiDAR scanning. The process of approving forest management plans will need to be accelerated. The external professional and institutional environment will have to recognise the expertise of the materials, measures and policies performed and created by the forestry sector.
- The National Forest Programme, the Forest Law and other subsidiary acts require updating. Climate change mitigation and adaptation will need to be addressed in cross-sectoral cooperation. Bureaucratic procedures will have to be rationalised. The main forestry legislative acts will have to be synchronised with international standards and frameworks. Incentives for owners who manage forests in accordance with forest management plans should be considered.
- Optimization of planning, implementation and financing will be required in regeneration, tending and restoration management. Systems for the restoration of forests after natural disturbances will have to be further developed.
- Better forest protection will require professional and personnel reinforcement in the sectors of silviculture and forest protection.
- For better implementation of silvicultural, forest protection and research activities and measures, additional financing from existing and new national and international mechanisms will be required.
- Maintenance and improvement of the protective role of forest will require stable and adequate financing and maintaining the engineering title as part of forestry studies.
- In the field of research, it will also be necessary to ensure the stable financing of research activity. International cooperation and the inclusion of all stakeholders in the research process will ensure knowledge transfer, better results and better transfer into practice.
- Networking and communication between all stakeholders will be key for the initiation of more active forest management.
- For more sustainable use of wood and woody biomass, as well as the further development of the wood processing industry, it is recommended to adopt the document *Strategija umne rabe lesne biomase za energetske namene (Strategy for the smart use of woody biomass for energy purposes)*.
- We recommend the establishment of an expert advisory body for forestry that will help develop and coordinate political decisions regarding the impacts of climate change on the forest, promote integration and unity of the forestry sector and ensure stable political support for the sector.

2 Introduction

This text has been produced as part of the mandatory content of the EUKI project "Forests for Future", where in second output titled "Enhanced knowledge of forest management planners and forest policy makers on forest management optimisation regarding carbon sinks ", it is stipulated that recommendations for policy and political decision-makers, particularly in the fields of environment and forestry, must be made in order to integrate measures for mitigation and adaptation to the impacts of climate change in national forestry and climate legislation and policy.

The recommendations were based on (i) a review of existing international and domestic legislation and strategies, (ii) review of best practices (primarily manifested as legislative strategies at the Slovenian and international levels), (iii) opinions and proposals of leading experts in forestry, (iv) opinions of forest owners, and (v) suggestions and comments from participants of workshops held by regional units of the Slovenia Forestry Service. The draft recommendations were then discussed at a national training workshop (decision-makers and representatives of the main forestry and environmental institutions) and regional training workshop (forest management planners and other staff of Slovenia Forest Service - SFS). The received opinions and proposals were reconsidered and if needed incorporated into the final text.

The review of existing legislation, documents and strategies showed that much has already been done in this area in Slovenia. In certain areas, the legislation needs to be upgraded, which is acknowledged by both policy-makers and experts, and evident from some drafts of new legislation that are in preparation.

In order to obtain the widest possible range of opinions and suggestions on policy and legislation related to mitigation and adaptation to the impacts of climate change, an online survey was conducted. A wide range of the most competent forestry experts from different institutions and backgrounds responded with their personal views on the issues at stake. By analysing these opinions and proposals, we obtained an appropriate expert and legal basis for forming recommendations.

An important activity in the project is collaboration with forest owners in order to raise awareness about the importance of proper forest management in a changing climate. The activities were focused on owners of larger forest estates. Meetings or workshops were held with them to obtain their views on the issues at stake, and these views were also used in the formulation of recommendations.

Based on the above-mentioned steps, we prepared a draft text which was presented at a workshop attended by key decision-makers and stakeholders in Slovenian forestry. The proposals and opinions were later incorporated into the final text, which was further supplemented with opinions and suggestions received at workshops held by regional units of the Slovenia Forest Service.

3 Recommendations for the integration of measures for mitigation and adaption to the impacts of climate change

Previous activities led to the formation of the following chapters of recommendations:

1. Forest management planning
2. Updating legislation
3. Regeneration, tending and restoration of forests
4. Biodiversity conservation
5. Forest protection
6. Upgrading the financing of forestry measures
7. Protective function of forests
8. Education
9. Research
10. Mobilising forest management
11. Sustainable use of wood, wood processing industry, biomass

We would like to point out that several of the recommendations strongly overlap with the core forest management strategies, which are identified and further detailed in the Environmental Report for the 14 Regional Forest Management Plans for the period 2021–2030 (Original title: Okoljsko poročilo za 14 območnih gozdnogospodarskih načrtov za obdobje 2021–2030, hereafter referred as ER-RFMP). We therefore only list them in this document, without providing more detailed descriptions, as these are available in the aforementioned document.

3.1 Forest management planning

Forest management planning is the cornerstone of forest policy, and therefore proposals related to it are given priority. Despite the fact that forest management planning is closely related to the issue of the impact of climate change on the forest, it is necessary to provide certain guidelines and recommendations that should be incorporated into the planning system and, consequently, into forest policy and legislation.

Based on the suggestions made by the respondents, forestry policy should be upgraded to complement and upgrade the forest management planning system in the direction of dynamic measure adaptation, the development of measures leading to a tree composition adapted to climate change, appropriate regeneration planning, measures to increase the stability of stands, and proper preparation and, above all, comprehensive interpretation of all available data. There is a need for continuous review of current management concepts in areas where the impacts of climate change are expected to be most rapid and severe.

Forest management planning must be quantitatively based. This should make the best possible use of the results of scientific research supported by field data. Synergies should be created between operational and research work.

In addition to woody biomass, forest soils should also be taken into account in relation to carbon sinks. Further research is needed on forest soils, as the extent to which they provide a carbon sink is

not yet fully understood. Forest soils should also be considered as an important factor in carbon stocks, which is particularly important in the planning and implementation of forest works.

Mitigation and adaptation measures should be integrated as far as possible into forest development models. In this context, it is essential to set upper limits on the accumulation of wood stocks that will still ensure the sustainable provision of all forest functions. This would address the discrepancy between mitigation and adaptation measures, which can in certain cases have opposing effect, an example being measures that tend to accumulate wood stocks and those that relate to regeneration, thinning and tending.

We may add to this the proposals published in the article by Gučka et al. (2019): *"In the future, changes in planning should be considered holistically, with all changes in the concept of forest planning well thought out and justified by arguments and analyses. Changes are necessary but must be directed to those parts of the planning process that are time-consuming. It is necessary to incorporate 'innovations' and new technological possibilities (analysis of large databases, tools for automated data collection, control, and storage). The quality of data collection would benefit greatly from the re-establishment of LiDAR imagery or the establishment of cyclic LiDAR imagery of the surface of Slovenia and, in certain cases, the use of Sentinel satellite imagery. Changes in the design of forest management planning are possible only with changes in legal regulations."*

Recommendation: Establish cyclic LiDAR scanning with a point density sufficient to meet the needs of stand interpretation.

The decision-making process in forest management planning is important, but must follow general principles that ensure its effectiveness (Putsch et al., 2010). This process is cited for the implementation of forest adaptation to the impacts of climate change (Breznikar, 2019): *"In the implementation of adaptation, we must first encourage and ensure the commitment of all actors to change, thoroughly understand the issue of climate change and raise awareness among all stakeholders. We have to identify relevant stakeholders and collaborate with them, address uncertainties and investigate all possible impacts of climate change, identify important unresolved issues and a wide range of adaptation options, avoid misguided adaptation methods, prioritise adaptation options, change regulations and establish supportive structures. We also have to monitor and evaluate the progress of adaptation and update it as necessary based on new data."*

Recommendation: It is necessary to speed up and streamline the procedures regarding approval of forest management plans (hereafter referred as FMPs). In doing so, the external professional and institutional environment has to recognise the expert value of strategic and operational documents prepared by the forestry sector.

3.1.1 Forest and land use management

Suggestions made by respondents were also concerning the positioning of forest and forestry, particularly in the area of land use management, as it will be necessary to optimise space in terms of land use. Deforestation for agricultural purposes is not acceptable. Financial incentives for clearing overgrown areas should be maintained, but there should be no co-financing for converting forests to agricultural use. It is unacceptable to seek replacement land for construction on agricultural land in areas covered by forests. Existing urban area should be utilised instead. The option of the state providing a buyout of the forest should be considered through the perspective of possibilities and not obstacles.

Particular attention should be paid to the issue of forest use for recreational and tourism purposes. An appropriate approach to regulating the use of forest land for recreation and tourism development is to classify forest land for recreation and tourism, identify areas where horse riding and non-motorised cycling are possible on marked forest trails and other paths. Such classification was already foreseen in the National Forest Programme and the Forest Law, elaborated by the Slovenia Forest Service during the renewal of the regional forest management plans in 2012, and updated in 2022. The classification of the forest area for recreation and tourism should be fully taken into account when regulating use.

3.1.2 Forests and wildlife

The problem of the disturbed balance between forests and wildlife has been present for several decades, but in the context of climate change it has taken on an additional dimension. Without proper resolution of this issue, mitigation and adaptation measures are not imaginable, as the impact of wildlife on younger developmental phases, up to the pole stage, is so great that it leads to changes in tree composition and, to some extent, to a disrupted ratio between developmental stages. This consequently leads to time loss in the forest development process and, not least, to the loss of certain tree species. In other words, it has a strong impact on both adaptation and mitigation measures (e.g. tree species mixture).

More on this issue and measures to address it are provided in the ER-RFMP, where it is stated:

"It is necessary to improve the living and feeding conditions for wildlife species and to ensure adequate foraging capacity for game."

Recommendation: Comprehensive implementation of measures prescribed in forest management and hunting management plans.

3.2 Updating legislation

Slovenian forestry legislation already provides for the implementation and guidance of mitigation and adaptation measures to a large extent. On the positive side, both the political and professional spheres have started to react relatively quickly to the changing conditions caused by climate change. Thus, climate change is addressed in the Resolution on the National Forest Programme, the Operational Programme for the Implementation of the National Forest Programme 2017–2021, the Operational Programme for the Implementation of the National Forest Programme 2022–2026, and in particular the draft Regional Forest Management Plans 2021–2030 (RFMP 2021-2030), where forest management objectives and guidelines are closely linked to the issue of mitigation and adaptation to the impacts of climate change. Nevertheless, there is still some room for improvement in this area. The future is unpredictable, and there will need to be continuous adjustments of legislation and policy.

The key forestry documents are:

- The Forest Law
- Resolution on the National Forest Programme
- Operational Programme for the Implementation of the National Forest Programme 2017–2021,
- Operational Programme for the Implementation of the National Forest Programme 2022–2026,
- Regional Forest Management Plans for the period 2021–2030.

Recommendation: Climate change needs to be addressed holistically across all sectors affected by this issue. The process of updating legislation should, as much as possible, take place in the framework of the Forest Dialogue. The aim should also be to de-bureaucratise statutory procedures.

3.2.1 National Forest Programme

The National Forest Programme (hereafter referred as NFP) should be reviewed on how mitigation and adaptation to climate change impacts could be integrated into the individual objectives and targets. Indicators of climate change impacts and the results of measures should also be upgraded. It should be noted that many of the objectives and their targets already correspond to mitigation and adaptation policies, as reflected in the respondents' opinions, which explain their positive view of the given assessment. As an example of an objective that already takes adaptation and mitigation guidelines into account, we can cite Objective 1 in Chapter 5.3 of the National Forest Programme, which reads: "Ecosystem-based approach and sustainable development of forests in terms of their biodiversity and all their ecological, economic and social functions". This objective and the guidelines and indicators related to this objective completely comply with objectives related to climate change and are very relevant for mitigation and adaptation. However, there are certain chapters and objectives that should be updated, such as for example Chapter 6.3.2 Forests and Climate Change, where the content needs to be updated with new knowledge and up-to-date national as well as international guidelines.

Two documents should be mentioned as an integral part of the NFP, namely the Operational Programme for the Implementation of the National Forest Programme 2017–2021 of 2017 and the Operational Programme for the Implementation of the National Forest Programme 2022–2026. The particular is an extremely well prepared document that fully covers the issues at stake and is an excellent basis for the implementation of forestry policy in both the short and medium term.

Recommendation: The National Forest Programme should be reviewed and updated from the perspective of mitigation and adaptation to the impacts of climate change.

3.2.2 Forest Law

The main forestry law, the Forest Law (hereafter referred as FL), constitutes a general legislative framework for forest management and is the foundation for all subsidiary acts. Like the NFP, the FL should be reviewed to see where it is necessary to include amendments that specifically address climate change. The term "climate change" currently cannot be found in the FL. In addition to the

term “climate change”, the terms “mitigation and adaptation to the impacts of climate change” should be defined. If certain measures are found to be contrary to climate objectives, they should be reviewed, modified or removed.

Recommendation: The Forest Law and related subsidiary acts should be reviewed and updated from the perspective of mitigation and adaptation of forests to the impacts of climate change. The law should define the term “climate change” and the terms “climate change mitigation and adaptation”.

If the financing of mitigation and adaptation measures is to be upgraded and expanded, these mechanisms need to be defined in the Forest Law and subsidiary acts.

International commitments and rapidly changing European legislation also require the FL to be reviewed and amended. At present, the FL does not fully incorporate international or European regulations and needs to be adapted.

Recommendation: Adapt the Forest Law to international/European frameworks.

In the previous chapters, inactive management, failure to achieve the planned volume of harvesting and non-compliance with the guidelines of forest management plans have been highlighted in several places. In the light of these findings, one of the possible/suggested solutions is to amend the FL and the tax legislation in a way that would incentivise forest owners who manage their forests in accordance with forest management plans with the possibility of tax relief.

Recommendation: Incentives and tax benefits should be included in the Forest Law and tax legislation for private forest owners who manage their forests in accordance with FMPs.

3.3 Regeneration, tending and restoration of forests

3.3.1 Forest regeneration

The participatory process of formulating the recommendations highlighted the need to build on the regeneration measures that regulate tree composition in order to ensure adaptation to quickly changing conditions caused by climate change. Concrete guidelines are required to ensure the provision of suitable tree species for regeneration (including non-native species in areas where this is not prohibited), which would reduce future risks. The forestry sector needs to consider the extent to which natural regeneration is appropriate. The proportion of regeneration by planting should be determined and the further development of arboriculture should be ensured in this respect. More specifically, measures should be targeted at protective forests and forests in flood-prone areas.

In the context of core forest management strategies, the following guidelines for forest regeneration are set out in the ER-RFMP:

- Renewal is based on natural regeneration; where natural regeneration is hampered, regeneration by planting and seeding is used.
- Tree composition should be adapted to the growing conditions, taking into account anticipated climate change.
- The decision to use non-native tree species must respect the precautionary principle and be well thought out.

Recommendation: The process of forest regeneration management should enable the strategies prescribed in the forest management plans to be implemented. Regeneration should be as rapid as possible. The establishment of additional nurseries is necessary to provide sufficient seedlings of good quality that are suitable for the planting site.

3.3.2 Forest tending

It has been repeatedly emphasised that forest tending is a crucial environmental measure requiring a professional approach, as it is a highly specialised task. Tending not only covers forest management in a narrow sense, but is also important for guiding forest development in changing natural and social conditions, and therefore has a broader social significance. Proper and timely implementation of tending measures has a positive impact on all forest functions (Sever et al., 2022). Low realisation of planned tending measures can have long-term negative effects on the carbon sink, and, in particular, on the adaptation of forest stands to climate change. Realisation of tending decreased in the past, especially due to low implementation of planned silvicultural measures in private forests. The reason for this in private forests may be attributed to priority of restoration after large-scale natural disturbances, insufficient funds for co-financing, low percentage of co-financing of silvicultural measures, low timber prices, fragmented ownership and inexperienced owners whose economic wellbeing is not directly tied to the optimal development of their forests. Low implementation of silvicultural measures in state-owned forests originates from the period of concessions (previous management system in state-owned forests), which ended with the establishment of SiDG d.o.o. (State Forestry Company) in 2016. As a result of this change, implementation has greatly improved in recent years.

In the long term, the reduced realisation of silvicultural works may result in less stable stands, where tree composition is not adapted to the site or to climatic challenges. It also means lower wood stock and increments, lower tree quality and thus less carbon sequestration. In response to this, the regional forest management plans for period 2021–2030 define the minimum and optimum extent of silvicultural works. The minimum extent is strictly necessary to ensure the stability of the stands, while the optimum extent covers all works that would increase the stability and quality of the stands.

In the ER-RFMP, adaptation and mitigation measures are integrated into the guidelines for forest tending and regeneration. Specifically, in the context of the Core Strategies for Effective Forest Management, the following is stated in relation to tending for mitigation and adaptation:

- Forest tending and thinning should be intensified and actions should be directed towards strengthening forest stability and resilience to climate change.
- In forest stands that are highly vulnerable to the effects of climate change, the mechanical and biological stability of forests should be improved through intensive tending or gradual conversion.

Recommendation: The forest tending process should create an environment that allows the strategies prescribed in the forest management plans to be implemented. The level of co-funding for silvicultural works should be increased and the possibility of full funding of silvicultural works in private forests should be considered.

3.3.3 Forest restoration

Although the upgrade of procedures for responding to natural disasters in forests mainly falls under amendments of forestry legislation and would technically belong in Chapter 5.2, it is necessary to highlight the need for certain legislative adaptations that could contribute to faster and more effective execution of forest restoration procedures required in the event of a natural disturbance.



Figure 1: Consequences of a windthrow (photo: J. Beguš)

Restoration measures should be timely and performed quickly and to a high standard (Chapter 3.2.3.3.3c). Forest regeneration material should consist of appropriate tree species. The development of model for insuring forest management risks as a basis for the development of insurance products should be considered. There is an urgent need to set up local nurseries, establish teams/structures for emergency forest restoration (required for sanitary felling), and consider tax relief mechanisms and mechanisms for intervention purchases of timber.

In areas of increased risk, an adequate network of forest roads infrastructure should be prepared for a rapid response in the event of extreme weather events.

Recommendation: The system of procedures for responding to natural disasters in forests should be upgraded, and the possibility of insuring forest property should be considered.

3.4 Biodiversity conservation

The issues of forest biodiversity conservation and enhancement are further specified in the RFMP 2021–2030 and in the ER-RFMP. Slovenian forestry is well aware that biodiverse forests with a more favourable condition are more resilient to climate change and, as such, have a high potential for adaptation.

The fact is that in Slovenia the production of wood is no longer the sole objective of forest management. "New objectives related to important forest functions, such as the protection of forest lands and stands, biodiversity conservation, hydrology and recreation, are gaining in importance" (ER-RFMP, 2021). The link between preserving biodiversity and climate change is strongly emphasised in

the aforementioned documents: "*When directing the composition of tree species in forest stands, the key is to use a diverse and appropriate mixture of different tree species, provenances and genotypes based on expected climate change. It is also crucial to select tree species that are adapted to different growing conditions, to give priority to the use of native tree species and provenances, and to change the species composition by increasing the proportion of native species that are more adapted to expected climate change.*" This is particularly reflected in the emphasis on the importance of minority and fruit-bearing tree and shrub species. Here we cite some of the guidelines from these documents:

- Long-term adaptation of forest stands to climate change and reduction of areas with altered and severely modified stands, leading to greater stability and higher biodiversity
- Deliberate retention of dead woody biomass
- Maintaining as natural tree composition as possible

To this, we should add recommendations contained in other parts of this document which suggest that, in terms of biodiversity, efforts should also be made to promote the sustainable use of wood.

Recommendation: Measures prescribed in forest management and hunting management plans should be consistently implemented.

3.5 Forest protection

Forest protection is becoming increasingly important in the context of climate change. Its effective implementation requires an upgrade of the legal framework to ensure streamlined procedures for obtaining funding and eligibility for the allocation of funds and materials required for the execution of protective measures.

Consideration should be given to the process of identification and qualification of forests according to their susceptibility to the effects of climate change.

Stronger emphasis should be placed on forest fire risk management, as forest fires represent one of the disturbance agents that will have an increased role due to the effects of climate change (Braatz, 2012). Fires are not only becoming a threat to coastal Karst regions but to forests throughout Slovenia. All relevant services must be prepared and equipped to prevent the occurrence and negative effects of forest fires. Fire prevention plans must be reviewed and updated.



Figure 2: Protective forests are becoming increasingly important (photo: J. Beguš)

Adequate density of forest roads and skidding trails is extremely important for forest fire management, as it enables the use of firefighting vehicles. Adequate density of forest roads and skidding trails is also necessary for the implementation of other forest protection measures.

Protection against non-native invasive species and quarantine pests needs to be strengthened.

Effective implementation of forest protection measures, as well as forest tending, regeneration and restoration activities, requires an adequate density of forest transport infrastructure and adequately equipped forest contractors.

Recommendation: In the context of climate change, adapted silviculture and forest protection are of paramount importance. It is therefore urgent to strengthen the forest protection field covered by the public forestry service of the Slovenia Forest Service with additional expert personnel and other required resources. There is a need to transfer the latest professional and scientific knowledge into legislation and forestry practice.

3.6 Upgrading the financing of forestry measures

As shown in section 3.2.5 of this document, the prevailing view is that the available financial mechanisms are not sufficient to meet the needs for co-financing mitigation and adaptation measures. However, some also believe that the funds are sufficient, but that some reallocations are necessary¹. The presented amount of funds needed (ten-year needs) for regeneration, tending, forest protection and habitat conservation derives from the RFMP 2021-2030. As it is not possible to provide exact information regarding the amount of the resources that was available in the past periods, we used data from the Forest Investment Programme and the Forest Protection Programme for 2022 as an indication of the current ratio between required and available resources. In particular,

¹ We quote the opinion of a respondent: "In principle, there are enough funds, the question is whether we know the appropriate measures that would have the greatest adaptation or mitigation effects. It is certainly a process of continuous verification of the effects of climate change, finding suitable solutions, designing measures and only then designing suitable financial resources".

it is necessary to compare needs and actual possibilities in relation to certain planned measures. Table 1 shows that the minimum planned volume of tending, regeneration, protection and habitat conservation measures would require just under €115 million over ten years, while the optimum volume would require around €199 million. The difference is €84 million or €8.4 million per year².

Table 1: Estimated needs for planned measures in €1,000,000 for the minimum and optimal volume of implementation (source: Okoljsko poročilo, 2021).

	Minimum (ha)	Optimal (ha)	Minimum (€)	Optimal (€)	Difference (€)
Regeneration	20,483	40,805	19.0	37.9	18.9
Tending	74,244	132,458	68.9	122.9	54.0
Protection	115,252	158,156	22.3	30.6	8.3
Habitat conservation	23,970	38,690	4.6	7.5	2.8
Total			114.8	198.8	84.0

The required funding needs to be compared with the expected resources provided from the state budget, the Forest Fund, the European Agricultural Fund (Rural Development Programme – RDP) and the Climate Fund.

Table 2: Available resources from the integral budget of the Republic of Slovenia and Forest Fund per measure (budget item), compared to the funds required for full implementation of measures planned in the work programme (sum of measures planned in all forest management unit FMPs) (source: Program ..., 2022)

Investments in forests from the integral budget of the Republic of Slovenia by budget item	Required resources for measures planned in work programme (EUR)	Available resources (EUR)	Available resources by work programme (%)
141110 Regeneration of private forests	371,298	213,000	57
144110 Tending of private forests	1,463,872	380,600	26
224810 Regeneration of forests in burnt areas and restoration of forests damaged by storms	341,198	185,000	54
632610 Preventive forest protection	85,970	140,000	163
632710 Other protective measures in private forests	338,061	215,000	64
632810 Maintenance of wildlife habitats in private forests	71,702	50,000	70
632910 Fire protection in the Karst	451,675	150,000	33
633010 Seed and seedling production	17,000	6,000	35
255910 Enforcement of measures ordered by decision of the SFS	5,000	5,000	100
TOTAL state budget	3,145,776	1,344,600	43
547 Forest Fund	1,132,775	1,000,000	88
TOTAL	4,278,551	2,344,600	55

² Calculations were made according to the methodology for the preparation of a preliminary economic valuation of forest management, which was developed for the purpose of preparing the 2021–2030 regional plans.

The Investment Programme shows that the state budget and the Forest Fund provide 55% of the resources required for the full implementation of the work programme drawn up from the planned scope of measures in the FMPS of forest management units.

The full amount of RDP funds will be used. The work programme was prepared taking into account the available amount of funds in the RDP (Table 3).

Table 3: Co-financed value of planned silvicultural and protection measures under the 2014–2020 RDP scheme, sub-measure 8.4 – Works for elimination of damage and forest restoration (source: Program ..., 2022)

RDP 2014–2012 funds, sub-measure 8.4	Funds required by restoration plan (EUR)	Percentage of funds available according to work programme (%)
Tending of restored areas, regenerative stages and younger pole stage stands	207,599	100
Preparation of area for regeneration, regeneration by planting	273,745	100
Protection against wildlife in restored areas	320,114	100
Removal of fallen timber from protective forests	6,950	100
Preparation, construction and reconstruction of skidding trails	42,800	100
TOTAL	851,208	100

As in the case of RDP, forest road maintenance programmes are designed based on the expected amount of funding.

Table 4: Required and expected funds for forest road maintenance according to the Forest Road Maintenance Fee Regulation (source: Program ..., 2022)

Maintenance of forest roads	Funds required by work programme (EUR)	Expected resources (fees, budget, local government funds) (EUR)	Percentage of available funds according to work programme
Repair of forest roads in private forests	6,881,952	6,440,294	94
Repair of forest roads in state-owned forests	2,879,184	2,185,642	76
TOTAL	9,761,136	8,625,936	88

Recommendation: In general, the greatest needs for additional co-financing are related to forest tending and forest protection (especially protection against fires). In addition to these, funding should be obtained for research, protection against invasive species, treatment of quarantine pests, and for strengthening the protective function of the forest (not only for protective forests declared by the government).

Additional resources should be sought from the national budget, the Climate Fund and the European Agricultural Funding Mechanism. The Climate Fund should ensure that mitigation and adaptation measures are adequately represented in the allocation of these resources.

3.7 Protective function of forests

Forests with a strong protective function are becoming increasingly important. These forests need to be managed in a way that maintains or enhances their role. This is particularly important where there is a high likelihood of risks from gravitational natural hazards. There, the role of the forest must be maintained through adapted management methods, which often result in less favourable economic outputs. It is therefore necessary to co-finance works in such areas, a possible source of which could be resources available in the Common Agricultural Policy.

All relevant stakeholders (forest owners, contractors and professional forestry staff) need to be properly trained for the implementation of such measures.

The importance of forestry in flood management activities should be highlighted, with a particular focus on river basin management.

Recommendation: It is essential to find financial resources to maintain or increase the protective function of forests. In connection with forest construction (forest roads, stormwater management), every effort should be made to ensure that forestry retains its status as an engineering profession.



Figure 3: The preparation of a high stump as a measure to extend the protective role of the forest against falling stones (Photo: A. Grum)

3.8 Education

Education is understood as all activities that includes training, awareness-raising, counselling, informing, participation and capacity-building for their implementation. The aim is to raise awareness of what climate change is, how it impacts forest development, what the role of forests is in this interaction, how to manage forests in changing conditions, what financial mechanisms are available and what legal frameworks exist for this purpose.

It is necessary to address all important target groups, including:

- Forest owners, forest managers and forest workers
- The professional forestry community, distinguishing between the professionals working in practice and decision-makers
- Professionals from other disciplines
- The general public

The content of the activities should be tailored to each target group separately. All available information channels and all available training methods will have to be used.

Continuous education of all target groups should be encouraged, as mitigation and adaptation measures are long-term dynamic processes.

3.8.1 Forest owners, forest managers and forest workers

Forest owners, forest managers and forest contractors will need skills in the following areas: climate change in connection to forests, the difference between mitigation and adaptation, the possibilities of obtaining funding, the importance of forest management planning with an emphasis on climate change mitigation guidelines, biodiversity conservation issues, the rights and obligations of forest owners in this respect, the possibilities for participation in forest management processes, safe working in forests on steep slopes, measures to reduce gravitational natural hazards, and the importance of tending for timber quality.

In addition to the target group of "forest owners", the participants in the participatory processes expressed the need for continuous education and training of forest workers.

For this target group, the most appropriate forms of training would be workshops, lectures, courses, field demonstrations (we suggest the creation of a specific demonstration with a theoretical part and field practice or that this content is included in existing training courses, for example the course "Working Safely in Protective Forests"), personal contacts (especially in process of selection of trees for felling), the press, the media and social networks.

These trainings could be organised as a part of activities performed by public forestry service provided by the Slovenia Forest Service, as a part of educational activities performed under the Common Agricultural Policy and trainings that could be provided in the framework of various projects.

As an example of good practice, we cite the inclusion of content on climate change in relation to forests and the importance of forest management planning in training on safe working in forests under the measure "Knowledge Transfer and Information Activities" of the Rural Development Programme 2014–2020. More than 7300 participants have attended these training courses, so this number has also received this information.



Figure 4: Continuous training is essential to maintain the professional competence of forestry professionals (photo: A. Grum)

3.8.2 Professional forestry community

For the professional forestry community, the primary focus should be on the education of field professionals (i.e. those who present the first line in the field). The focus should not be placed just on the public forestry service, but on professionals participating in all levels of management, research, education and implementation, including decision-makers. This was also demonstrated by the results of the survey, which showed that it is also essential to disseminate knowledge to this segment of population.

The following topics should be communicated to the professional public: climate change in relation to forests, the difference between mitigation and adaptation, forest management planning guidelines, tools for monitoring carbon sinks, funding possibilities, legislative frameworks, and silviculture and forest protection guidelines.

Workshops, lectures, webinars and field demonstrations are suggested as the most appropriate forms of training. These should be carried out by the Slovenia Forest Service as part of in-house training, by scientific research institutions and also by relevant ministries.

Climate change issues should be integrated into forestry curricula or a new subject should be created to deal with forests in relation to climate change.

3.8.3 Professionals from other disciplines

As forests, and therefore forestry, become increasingly important in mitigating climate change, it is essential that trainings for professionals of other disciplines focuses on explaining the importance of forests and the problems that arise in relation to climate change.

3.8.4 General public

It is also essential to extend the issue of forests and climate change to all areas and levels of the general public. Information should be aimed at explaining the role of forests and should reach as wide a population as possible.



Figure 5: Demonstration of the impacts of climate change on forests to children at the "Forest, Water, Mill 2022" event (photo: H. Štravs)

3.9 Research

The research challenges are divided into the following issues: (1) identification of the content that would contribute to addressing the issue at hand, (2) the question of implementation and funding, and (3) the question of cooperation and transfer of knowledge into practice. Let us stress at this point the need for at least two-way communication between the stakeholders in the process.

In terms of **content**, the research should cover the themes that were also proposed in the survey, namely:

- Carbon sequestration management approaches
- Adaptation potential of key native tree species and stands to climate change
- Forest development models and associated scenarios
- Methods of restoration of degraded forests
- Conservation of forest microclimates and soils
- Optimum levels of wood stock accumulation
- Forest regeneration methods, with an emphasis on the suitability of tree species
- Experiments with new ecotypes and species, assisting migration, provenance experiments
- Variants of the recommended adaptation measures
- New possibilities for the use of tree species currently less desirable for the industry.

Research should receive **funding** from a various resources, both established as well as newly developed/utilised. The Climate Fund would represent a viable source of research funding. Much can be also done through international projects. Examples of good practice include "Forests for Future", NewFor, GreeRisk4ALPs, Life SySTEMIC and many more. However, at this point we must also mention the observation from one of the participants in the survey that points out *"the lack of support and understanding from decision-makers, i.e. those providing funding, for promotion of project calls and projects related to climate change mitigation and adaptation in forestry"*.

Recommendation: Regulate the research funding system by using the resources available in Slovenia and by encouraging participation in international projects.

It is certain that a large part of the **implementation** of research will fall on research institutions, in the case of forestry on the Slovenian Forestry Institute and the Department of Forestry and Renewable Forest Resources. However, the Slovenia Forest Service is and will continue to be heavily involved in research, both as a participating partner as well as an independent research body. It is also essential to involve forest owners in the research process, especially those with larger estates (e.g. for provenance testing), as well as forest managers and, last but not least, forest contractors. This is the only way to ensure that the **transfer of knowledge into practice** is successful.

Recommendation: Involve all stakeholders in forestry in research processes and thus ensure that knowledge, information and experience are adequately transferred between the actors involved in the process.

It should also be noted that integration with other disciplines and other environments (countries) is already taking place in the framework of international project cooperation. This approach has so far produced excellent results, is essential for maintaining this condition and will encourage this type of cooperation in the future.

Recommendation: Encourage participation in international projects that enable the acquisition of new knowledge, the exchange of knowledge and also the promotion of Slovenian forestry doctrine abroad.

3.10 Mobilising forest management

Several factors clearly indicate the need to activate small-scale management of private forest estates, e.g. the implementation of planned harvesting and planned forest management measures. This was highlighted in the responses of survey participants and participants in the workshops. More active management could be achieved in a number of ways, most of which have already been mentioned in the previous sections. In particular, we should focus on the following approaches:

- Education and awareness raising
- Active participation
- Financial and legal incentives
- Appropriate legislation
- Networking among forest owners

The main role in promoting private forest management lies with the Slovenia Forest Service, but this task is unlikely to be carried out successfully without the cooperation of the relevant ministry, the forest inspectorate, the Chamber of Agriculture and Forestry and forest owners' associations.

Recommendation: Involve all stakeholders in the activation of private forest estate management who could contribute to better implementation of the measures planned by forest management plans.

3.11 More sustainable use of wood, wood processing industry, biomass

Respondents identified the more sustainable use of wood as one of the most pressing problems in climate change mitigation, which is evident from some of the received opinions such as following: *"The wood processing industry is not keeping pace with the actual potential of Slovenian forests, especially in terms of the structure of forest wood assortments. Wood should replace other materials, but increased harvesting would have an impact on sinks, and therefore balance needs to be found between use of wood and the carbon sink in the forest. Ageing forests will provide lower quality timber to the market, but will also reduce the sink capacity of forests. New uses of wood, especially broadleaves, need to be ensured in order to help long-term storage"*.

However, a review of the literature and legislation has shown that much has already been done in this area in Slovenia, and that fears of falling far behind are unfounded. Some of the documents and activities that to some extent promote the development of timber processing chains in Slovenia, and thus increased domestic timber use, are:

- The "Wood is Beautiful" Action Plan to increase the competitiveness of the forest-wood chain in Slovenia by 2020
- The "Wood is Beautiful" Action Plan to increase the competitiveness of the forest-wood chain in Slovenia by 2030 (under preparation)
- Rural Development Programme 2014–2020 and Common Agricultural Policy Strategic Plan 2023–2027
- Slovenian Industrial Strategy 2021–2030
- Slovenian Smart Specialisation Strategy: <https://www.gov.si/assets/vladne-sluzbe/SVRK/S4-Slovenska-strategija-pametne-specializacije/Slovenska-strategija-pametne-specializacije.pdf>
- Roadmap for the transition to a circular economy in Slovenia
- Projects promoting innovative ideas in the field of wood mobilisation, e.g. the ROSEWOOD project: <https://rosewood-network.eu/>;
- Research Programme P4-0430 The forest-wood chain and climate change: transition to a circular economy.

To give an example: the importance of forests and forest-wood chains for wood use in terms of climate change mitigation and also in terms of respondents' comments is recognised and described in the document **"A signpost of the transition to a circular economy in Slovenia"**, produced in 2018 (Godina Košir et al., 2018). The **Forest Value Chains** section describes the forest and wood value chains and includes *"all stages of maintenance, production, processing, transport, sale of wood, waste management, wood products, broader field of nanotechnology, tourism and construction (including complex buildings)"*. Wood is seen as *"one of the most 'circular' materials, and the*

integrated management of forest value chains includes many opportunities for innovation in the field of materials." The industry also points out that it is mainly small and medium enterprises that need help and encouragement in developing projects and in joining European calls. There is a lack of integration between them and larger systems, communication is not effective enough and promotional activities are weak. Opportunities highlighted include timber construction, buildings as 'material banks', revitalisation of the furniture industry, re-use of wood and repair of wood products, involvement in green public procurement, and the cascading use of woody biomass and wood as an energy source.

Recommendation: Wood biomass is a specific issue in wood use. Its efficient use is well defined in the draft document 'Strategija umne rabe lesne biomase za energetske namene' (Strategy for the smart use of woody biomass for energy purposes). We propose the adoption of the document.



Figure 6: Wood is a traditional source of energy (photo: J. Beguš)

4 Forestry opportunities

In conclusion, most participants in the process of creating this text have expressed a clear position that the forest will contribute significantly to coping with climate change. **However, participants from all forms of collaboration have, in the process of preparing this text, pointed out that the role of forests and forestry in policy and public is not sufficiently visible.** This is true, for example, if we consider that the Council for Development in Agriculture, Forestry and Food, established in 2019 as an advisory body to the Ministry of Agriculture, Forestry and Food, only has one member from the Slovenian Forestry Institute among its 26 members (https://www.gov.si/assets/ministrstva/MKGP/POSVETOVALNA-TELESA/SVET-ZA-RAZVOJ/2019-2024/sklep_clani.pdf). This is certainly insufficient for the strategic content being discussed, including climate change, the role of forests in relation to climate change, knowledge transfer and sustainable forestry. It also shows a somewhat neglected attitude towards the forestry profession (ICGF, 2019). Another such example is in the text "Strategic Plan for the Common Agricultural Policy 2023–2027 for Slovenia," where forestry is only briefly represented as a sector, despite the fact that forests provide one of the biggest carbon sinks (ICGF 2021).

Respondents expressed the need for a consultative body at the national level to work on forestry. They also suggested strengthening inter-ministerial, inter-institutional and inter-sectoral cooperation.

Recommendation: An expert advisory body should be established in Slovenia with the task of assisting policy decisions related to the impacts of climate change on forests, both on the national and international level. Existing consultative bodies already working in this direction should be complemented with new members that would ensure adequate representation of forestry with all stakeholders. Inter-ministerial, inter-institutional and inter-sectoral cooperation should be strengthened.

Above all, it must be made clear to others that forests are not an infinite reserve of resources. It is impossible to expect the full economic viability of all measures planned in forests. It should be made clear that forestry as a profession has the competences that will ensure the provision of appropriate solutions in the future.

Recommendation: When positioning the forestry profession in the professional and political environment, at least the following aspects should be considered: (1) the forestry sector should strive for unity when presenting itself externally (an expert advisory body would contribute to this goal) and (2) the reliable and strong support of political decision-makers is essential for the implementation of the required adaptations of forest management.

It should be reiterated that mitigation and adaptation activities are **an ongoing task, a dynamic process** involving all stakeholders at all levels of the forest management system.

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